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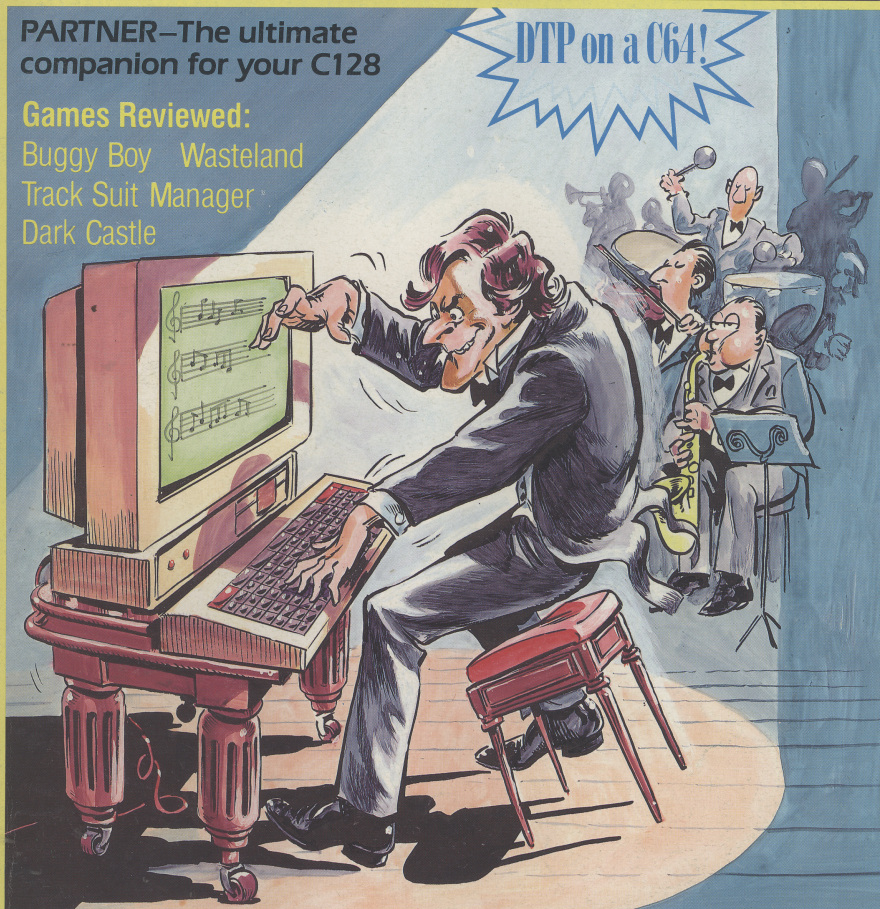

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WHAT THE REVIEWERS SAID

"I'm stunned, amazed and totally impressed. This is easily the best value for money cartridge. The cartridge king!

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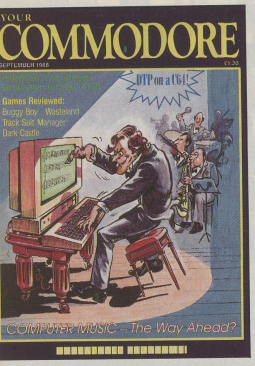

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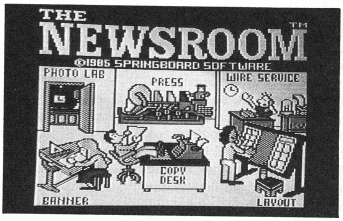
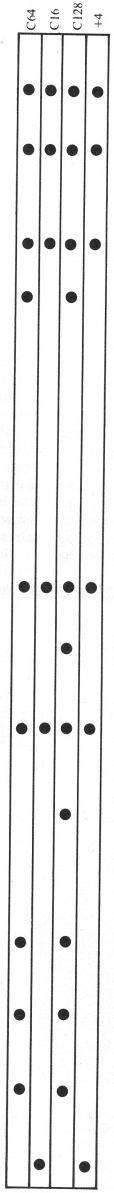
REGULARS

	C64	C16	C128	+4
Data Statements	●	●	●	●
Games Update	●		●	●
Competition				
Track Suit Manager	●		●	
Constructing A Compiler	●		●	
Wasteland	●		●	
Software For Sale	●	●	●	●
Dark Castle	●		●	
Buggy Boy	●		●	
Bards Tale III	●		●	
Making Music	●		●	





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FAST Action

AT CLACTON Magistrates Court, The Federation Against Software Theft scored one of its greatest victories in its fight against piracy. Jeffrey Batty, the proprietor of the Clacton-based Orion Software, was fined £4,500 for operating a mail order software lending library which principally relied on a stock of 3000 pirated titles.

Last year, on the 28th October, FAST's enforcement co-ordinator, Bob Hay, was assisted by Peter Korwen of Essex Trading Standards joined a police raid on Batty's home which resulted in the confiscation of the pirated stock. Although Batty had only been operating for nine months, the profit from Orion's nationwide mail order business was estimated at over £6,000.

Despite a warning six months before his arrest, Batty continued to operate his professionally organised library and, in sentencing Batty to pay a fine of £4,400 with £100 costs, the chairman of the bench commended Batty on his enterprise but emphasised that such an illegal business could not be condoned.

The case highlights the dilemma facing the software industry in the light of current legislation being passed through parliament. A proposed ammendment to the Copyright, Design and Patents Bill has had a clause re-introduced which will mean that a levy is charged on all blank audio tapes which would effectively legalise home taping of audio material. Although the new levy would recoup handsome returns for the record and musicassette industry, the software industry will be left out in the cold.

From the tape user's viewpoint, the fact that a levy had been paid could lead to the misconception that any form of home taping would be within the law. The effect would then be that greater revenue would be lost to the already blighted software houses.

Roger Tuckett, chairman of FAST sees the new Bill as being a serious threat to the work of the Federation, "We have been very pleased with the progress of the Bill so far which has gone a long way to protect the copyright interests of the UK software industry. Although a levy would, in some way, compensate the music industry for loss of copyright through home taping, it would undermine FAST's efforts to protect intellectual property and to prevent illegal copying in all forms. It would undoubtedly lead to increased software piracy and consequently represent a significant loss of income for the UK computer software industry.

We therefore support the Government in opposing the re-introduction of a blank tape levy."

The tape levy proposal has survived the second reading of the Bill and FAST will be using the recent case in Clacton to support their argument that the levy should be all-embracing or dropped from the Bill altogether.

Star Gains Prince's Trust

Dr William Smith receives the first Welsh LC-10 from T.Takahashi, Star's Managing Director

STAR MICRONIC'S first British-made LC-10 printer was presented to Dr William Smith, Executive of Prince's Trust Events, at the recent PC User Show. The Trust, whose patron is the Prince of Wales, will use the LC-10 to help its efforts in raising money for charity. The printer was deemed a particularly suitable gift because Star's new production line is based at the Tafernaubach Industrial Estate in Tradegar.

The new production line is dedicated to the production of LC-10's for Star's British, French and German subsidiaries but future development will increase the monthly output from 10,000 to 30,000 by the end of the year. This will mean expanding the present workforce in an area of the country which badly needs the extra jobs.

The LC-10 has been introduced as a replacement for the NL-10 printer and offers a multifont printing capability for £229.

Touchline: *Star Micronics, Craven House, 40 Uxbridge Road, Ealing, London W5 2BS.* ***Tel:*** *01-579 2259.*

Destiny's Star Tracks

DESTINY SOFTWARE'S next game, Diamond, includes a free single by a 'newly emerging' band, The Company She Keeps. The cassette features two tracks by the band, entitled What She Wants and Express Interest.

Destiny's managing director, Francis Lee, sees a healthy future in promoting music and software together in this way. "Promoting music through software seems an ideal way of letting people access music they perhaps otherwise would never hear", comments Lee.

We agree – what better way to promote new bands and give the punters something for nothing at the same time! Could this become a new trend? Write your comments on a five pound note...

Touchline: *Destiny Software, Lamerton House, 23 High Street, Ealing, London W5 5DF.* ***Tel:*** *01-567 6677.*

PC Showtime

THE SCENE IS SET for the annual industry scrumdown at the Personal Computer Show, formerly the PCW Show. Each year brings new products, new record attendances and new controversies. One thing is guaranteed, there's never a dull moment.

The Show is rather like a carnival parade, with each company trying to outdo the others by covering more and more space with imaginatively designed, decorative stands. In the past we've witnessed strippers, near punch-ups, programmer defections, showtime romances and enough intrigue to keep a soap opera going for years.

Behind the glitzy appeal of the home computing hall, there's the more serious Business Hall which last year attracted 48,000 of the Show's 80,000 visitors. The Show attracts exhibitors from all over the world and last year it was given media coverage in 22 countries.

Don't let the new name put you off, the PC Show does have a bias towards IBM compatibles but this is mainly confined to the business section. In the Main Hall you will still find US Gold, Gremlin, Telecomsoft, Mastertronic and all the other big names in the games field. In addition, Commodore will be taking their stand with the emphasis being laid on the promised big announcements for the Amiga and the Commodore 64.

The venue has been changed this year from Olympia to the larger facilities at Earl's Court. The dates for your diary are 14-18th September for trade and 16-18th visitors.

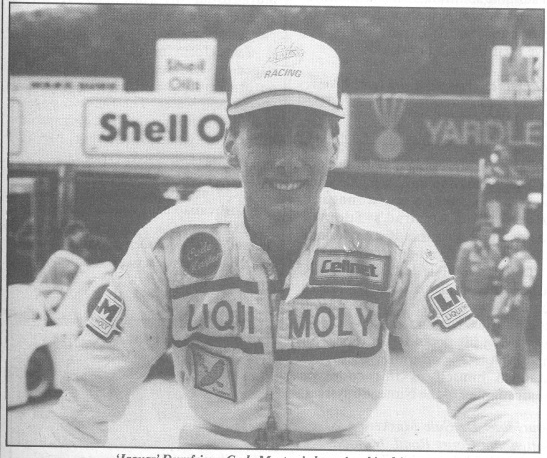
Touchline: *The Ticket Office, The Personal Computer Show, 11 Manchester Square, London W1M 5AB.* ***Tel:*** *(0203) 470075.*

No Simulation

The recent Le Mans victory for the British Jaguar XJR 9LM team provided Code Masters with yet another reason to celebrate – the winning team included the Code Masters' sponsored racing driver Johnny Dumfries. With co-drivers Jan Lammer and Andy Wallace, the team not only knocked Porsche off the top slot but also gained Jaguar its first Le Mans 24 Hour Race win in 30 years.

The success adds extra charisma to Code Master's current project, Johnny Dumfries' World Championship, which is scheduled for release this autumn.

Touchline: *Code Masters Software, Lower Farm House, Stoneythorpe, Southam, Warks. CV33 ODL.* ***Tel:*** *(0926) 814 132.*



'Jaguar' Dumfries – Code Masters' championship driver

RPS Get CBM OK

COMMODORE UK have followed the example of the West German Division by licensing RPS to produce the Commodore branded 5.25 and 3.5 inch diskettes.

Dean Barrett, UK marketing manager for Commodore, explains, "The evidence from our involvement in West Germany is impressive and we are convinced that this agreement will guarantee the highest quality product for our users and, importantly, provide total support for our dealers."

The disks will be manufactured at the RPS factory in Albi, France and distributed over here by SJB Disks. On this subject, Ivor Norkett, business manager at RPS, stated, "We have selected SJB Disks to distribute Commodore diskettes on an exclusive basis because it is a highly successful operation dedicated solely to the supply and marketing of computer media and can provide a total support package to Commodore dealers."

Touchline: *RPS, High Street, Houghton Regis, Bedfordshire LU5 5QL.* ***Tel:*** *(0582) 867222.*

DATA STATEMENTS

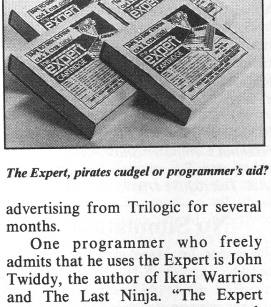
Expert Pirates?

TRILOGIC ARE currently running an anti anti-piracy league attack in defence of the Expert cartridge. The assault is based around the fact that, while publicly condemning the use of the Expert, they privately condone its use by accepting programs written with the Expert's aid.

Graham Kelly, Trilogic's joint managing director, describes the cartridge as a programmer's aid rather than a weapon in the piracy war. In the absence of training schemes, programmers must learn their craft by fair means or foul. Authors of books or magazine articles learn their trade by studying the techniques and devices of other authors. This means reading and dissecting published works in the same way as the Expert allows the programmer to read and dissect the code routines which constitute the best of British software.

While condemning the illegal uses of the Expert, Kelly's argument hinges on the claim that, although the cartridge can be used for illegal copying, the piracy factor is beside the point. Copying of cassette originated material is achieved as easily with a dual cassette deck as it is with the Expert. If the cartridge was withdrawn from the market, the piracy subculture would not be affected in the slightest.

Some companies such as Durell and Future Concepts even acknowledge Trilogic's product on the cassette inlay cards, while at least one member of the anti-piracy lobby used the threat of withdrawing its large advertising revenue to force a Commodore magazine to refuse



The Expert, pirates cudgel or programmer's aid?

advertising from Trilogic for several months.

One programmer who freely admits that he uses the Expert is John Twiddy, the author of Ikari Warriors and The Last Ninja. "The Expert cartridge enables me to program much faster," he says, "Without Expert, Last Ninja would have taken me a lot longer to program and would not have appeared on the shelves until many months later."

Kelly encapsulates the Trilogic argument by stating, "It is with reason that our main product is called 'Expert'. Any person who uses their Commodore for serious purposes would probably acknowledge that, in their expert opinion, Expert is an essential tool."

The controversy will, no doubt, rage on but surely the argument has no suitable solution. Just as a hammer is a tool of construction as well as of destruction, so the Expert and its kin have their light and dark sides.

***Touchline:** Trilogic, Unit 1, 253 New Works Road, Bradford BD12 0QP.* ***Tel:** (0274) 691115.*

Amiga Companion?

THE NINTENDO games console may become the natural companion to the Commodore Amiga, according to Luther De Gale of De Gale Marketing. At under £100, the machine offers a relatively inexpensive way to keep the kids amused while their parents get down to the more serious applications of the Amiga.

Another factor to support De Gale's claim is the Nintendo licensing system which tightly controls the quality and range of Nintendo products. In theory, this means that many of the games designed or converted for the machine will not be available for the Amiga. With sales of the Spectrum dipping lower, De Gale sees the Nintendo as a natural successor to Amstrad's adopted machine and also sees it as a serious threat to the Commodore 64.

Luther De Gale left Konami UK earlier this year to head his own company with backing from coin-op moguls, Electrocoin, and he is now busy using his detailed knowledge of the Japanese computer sector to establish himself as this country's major supplier of the Nintendo system.

***Touchline:** De Gale Marketing, 81 Tottenham Court Road, London W1A 1EY.* ***Tel:** 01-637 5735.*

Peace In Our Time

TELECOMSOFT AND HEWSON have at last decided to bury the hatchet over the Morpheus and Magnetron controversy. Their differences were 'amicably reconciled' ending the threat of interminable court hearings.

The situation blew up on the eve of last year's PCW Show when Graftgold decided to desert Hewson in favour of Telecomsoft. This left Andrew Hewson with a rather sorry looking stand organised around the theme of the two forthcoming releases on the Rainbird label.

Since neither company cares to comment on the situation it's not known if they've just decided to kiss and make up or whether they made a verbal agreement in used pound notes.

***Touchline:** Hewson, What argument?, Severed, Lincs. Telecomsoft, Andrew who?, Contentment, near Bliss.*

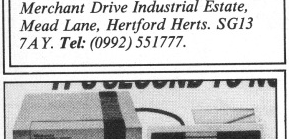
Green Listings

ENVIRONMENTALISTS MAY be interested to hear that Zweckform now produces a pastel green printout paper produced from recycled paper. This provides a warmer alternative to the more usual off-white paper which Zweckform have been marketing in the past.

Zweckform produces its recycled paper to help conserve the Earth's natural resources by saving trees, energy and water. The finished paper is equivalent in quality to comparable grades of wood-free paper but is slightly less expensive.

1000 sheets of either colour paper is priced at £10.87 and the off-white is also available in quantities of 500 for £5.98.

***Touchline:** Zweckform UK, Merchant Drive Industrial Estate, Mead Lane, Hertford Herts. SG13 7AY.* ***Tel:** (0992) 551777.*



The Nintendo system, successor to the 64?

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computer game.

You've seen the posters featuring a leopard skin clad, whip wielding Corrinne Russell, alias *Vixen*, now you can play the she-wolf in Martech's latest game. The game is supported by some rather dubious assumptions such as the dinosaurs which still rule the planet of Granath. The sole human survivor is Vixen, a girl brought up by foxes that possess magic powers, that a whip can fell a dinosaur and the Vixen can turn into a fox and back into her human form complete with jewellery, lipstick, nail varnish and hair style. If you believe that lot then you'll probably think this is a good game, that politicians always tell the truth and hype makes a game worth buying.

If you're looking to be a hero then why not step into the sandals of *Hercules, Slayer of the Damned* in Gremlin's

Games Update

TV game shows, board games, coin-op conversions, wargames and budget releases combine to form this month's new game releases

The latest TV game show to be released by Domark in their TV Games Series is *Every Second Counts* in which three couples compete through true or false questions to gain seconds of time. The winners of this section then use their clock in the final game to build up a high score.

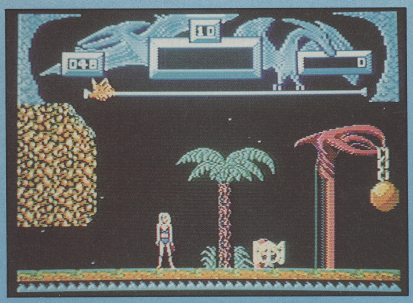
The game follows the Paul Daniels show quite closely, even down to the bonus rounds where you get ten seconds to answer a question. If you answer it in one you collect ten seconds and probably the lead.

In the final you must provide four, five, six then seven correct answers within the time set by your clock. Unfortunately, there aren't any prizes to be won; instead you must be satisfied with setting a high score. In the words of the quiz master. "You'll like it, but not a lot!".

Deluxe Monopoly is Leisure Genius' second attempt to simulate the world's greatest board game and is a vast improvement. Now you can actually see the board, the pieces and through a window at the bottom of the screen you can get details of the properties as you move over them.

A command bar at the top of the screen allows you to build houses and hotels, check who owns what, claim rent from players who land on your land, quit or save the game, check the player's cash levels, offer a trade or throw the dice to move.

The only problem that I could find with this good but floored computer version is that computer opponents will continue to offer you ridiculous trades even after you've turned them down countless times. Deals in which you are offered a pointless property for one that would make up a set for your computer opponent and you have to pay some money for the privilege. This simply slows the game down but shouldn't put off Monopolites looking for a



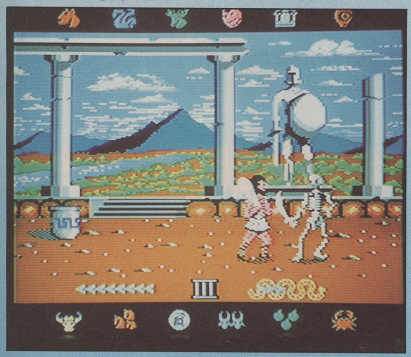
latest offering. Hands up all those that think that a combat game featuring the labours of Hercules would have him battling heroically against the Nenean Lion, Hydra, Cretan bull and others in a twelve part game. Well you'd be wrong as these massive creatures and tasks are reduced to smokey icons that must be collected while Hercules fights a series of skeletons!

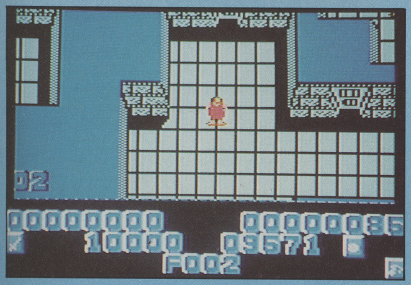
Grandslam's *Flintstones* was first released on the Amiga and has now appeared on the C64 and features you as Fred. You want to go bowling with Barney but Wilma has other ideas and as the game begins you must paint the living room wall while babysitting for Pebbles. After this disappointing start, what have we done to deserve another painter program, the game picks up with a reasonable bowling simulation and then falters again when

you attempt to rescue Pebbles who has wandered off and was last seen on a high girder on the local building site!

Another disappointing game was the C64 version of *Shackled*, US Gold's Data East Gauntlet clone. The object of the game is to enter a mysterious castle and free your comrades that are held prisoner.

The dungeon levels appear in an almost top down format whereas the characters and their gaolers would be more at home in a sideways scrolling game. The resulting display combined with a scrolling routine that ensures that you can't see where you're going results in a game that's almost impossible to play.





US Gold's *Desolator* is a conversion of the Sega coin-op game Halls of Kairos in which you must punch and kick your way through the castle of Kairos to rescue the infants held behind mysterious mirrors. Throughout your quest your path is blocked by Kairos' henchmen as well as mines and giant rolling barrels.

Cassette owners can at last explore the magical world of the *Bard's Tale* and send parties of adventurers to delve into the mysteries that lie in and below the town of Skara Brae. It's a town trapped by an eternal winter spell cast by the evil Wizard Mangar.

Armed with a few magical songs the Bard is ready to take on all comers as long as he has the help of a couple of fighters, a thief to find secret doors and at least one of the four types of magic user, conjurer, magician, sorcerer and wizard. The game features 128 different monsters waiting to chomp you, a 3D town to explore, 16 levels of dungeons and 85 different spells to wield. A must for roleplayers. Disk users should turn to page 35 to catch up on the latest installment, *Bard's Tale III: The Thief of Fate*.

SSI's *Shiloh* is a fascinating struggle that recreates the first real test for General Grant as his 45,000 men were caught by the Tennessee river in a surprise attack by General Johnston's Confederate forces.

In a three level battle you can build up your wargaming experience from the joystick controlled beginners game to the advanced level that includes additional rules and details that cover the actual leaders themselves, morale of untried troops and the gunboats Lexington and Tyler.

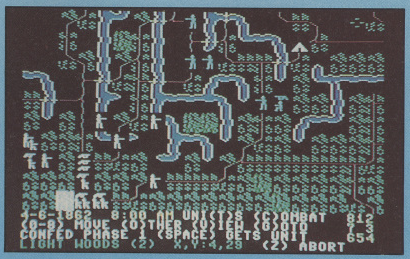
To help out a would-be general, you can display the units either as standard wargame symbols or as icons showing infantry, cavalry and artillery, swap between a large scale scrolling battlefield and to help you with your combat orders pressing a single key highlights everything in that unit's field of vision.

Once you've mastered the basic game you can customise Shiloh by adding hidden movement and restricting ammo and the efficiency of either side, so it will remain a challenge.

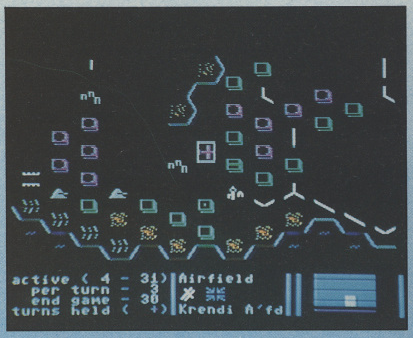
SSG, the Australian wargamers has signed a deal with Electronic Arts which means that games such as Decisive Battles of the American Civil War, Halls of Montezuma and now recently Rommel are available from EA for about half the former import price.

For just £18.95 the player will get a game disk containing on average six scenarios, a 72 page manual, colour scenario maps, labels for your save game disks and cards that guide you through the game's menus.

The first batch of releases include *Decisive Battles of the American Civil War* (volume I), the naval wargame *Carriers at War*, *Europe Ablaze* which simulates the five year struggle for air superiority in World War II, six battles that describe the history of the US Marines from Mexico in 1860's to WWII island assaults in *Halls of Montezuma* and now *Rommel*.



Rommel uses the menu driven Battlefront game system and recreates seven of Rommel's great battles in the deserts of North Africa and an eighth hypothetical invasion of Malta. The computer can take either side in a battle that is fought for key objectives such as towns, hills and airfields that are worth victory points for each turn you hold them. Unlike other wargames where you must move every single unit *Rommel* and other SSG titles gives you realistic control as you simply assign objectives to the regiments in your

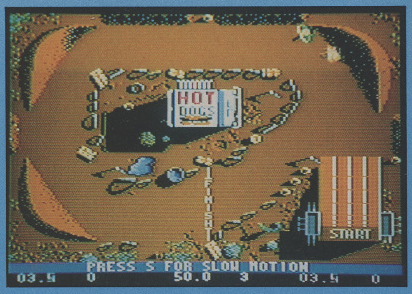


divisions leaving the computer sub commanders to do the ground work.

This still leaves you with plenty to do from assigning objectives to reserves and air support to defining whether a unit will probe, assault, defend or exploit when in attack.

BUDGET SOFTWARE

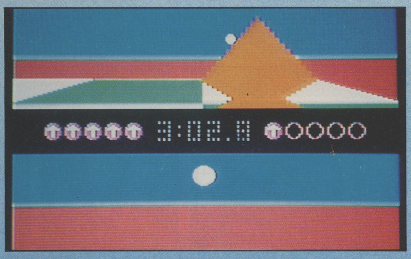
Code Masters has once again upped the stakes in the budget software battle by releasing the first in a range of budget games on disk. The first release is the tape based classic *BMX Simulator* now available on disk for only £2.99! Seven courses packed full of ramps, bumps and bike busting barriers wait to challenge one or two BMX bikers.



Beach-Head, the multi-stage action game that started a whole trend in software has been reissued as part of Mastertronic's Americana label. One or two players can take on the dictator's forces through a series of battles from an aerial assault on your fleet, a gun battle with enemy ships, a land battle as your tanks hit the beaches and then a final conflict as you attempt to destroy his fortress before he gets you.

Ballblazer is quite simply one of the best future sports games you will ever play. It was one of the first Lucasfilm games released in the UK by Activision and is now part of Mastertronic's Riccochet label.

Each player controls a rotofoil that hurtles around the arena attempting to shoot the plasmorb ball into the opposing goal that moves across the base line. The action is fast and furious and so the game includes up to nine



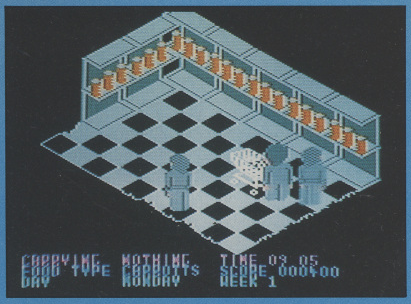
droid opponents in case you haven't a human who can stand the pace.

Super Trolley is the game designed by Andrew Collett, programmed by Icon Design and published by Mastertronic all as the result of Andrew's letter to Jim'll Fix It. In the game you are a general dogsbody in a supermarket and must wheel your trolley around the shop to collect the goods to restock the shelves while avoiding the customers. Hit too many and you'll be sacked.

Poltergeist is the latest 'blast everything that moves' game from Code Masters that plays like a cross between Scramble and Nemesis and based on an incredibly tacky scenario claiming the existence of haunted planets that must be cleared by your Exocist ship. Still it provides good shoot 'em-up value for only £1.99, but don't expect anything original.

Finally, *Droids* (Mastertronic MAD) features the Star Wars Droids C3P0 and R2D2 in a puzzle solving sideways scrolling adventure. They've been captured by the Fromms (painful) and must now escape through your skill in controlling C3P0 and R2D2's ability to plug in and control the Fromm's computer systems.

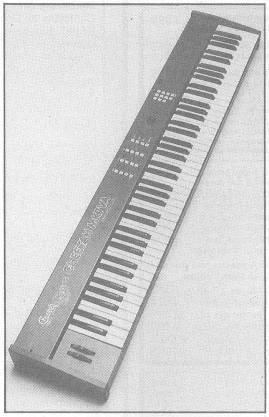
Tony Hetherington



Music with Midi

Getting to grips with MIDI

By Darrin Williamson



We've all heard and probably used the term MIDI in an everyday context. It has become the buzzword of the 80s for small but perfectly formed pieces of electrical hardware (e.g. Midi Hi-Fi). MIDI has a second meaning in musical circles in that it represents a musical processing protocol for the majority of electronic musical instruments currently under manufacture.

Understanding MIDI

MIDI stands for Musical Instrument Digital Interface and was co-invented by the head honchos at Roland, Yamaha and Sequential Circuits. This represents an astonishing achievement in consumer electronics. Not for technical reasons but purely because it's one of the few instances in history where Japanese, European and American electronics manufacturers have sat down and agreed to a single set of standards in which everyone conforms to (pretty remarkable, I trust you'll agree!).

The MIDI Concept

So MIDI is actually a two part concept; firstly it is a communications language and secondly an interface which interprets and converts the codes into musical output.

The MIDI protocol consists of 16 independent channels which can best be explained as being similar to transmission and reception on a C.B. radio. A MIDI interface transmits numbers; information about what note or notes have been hit and what characteristics (duration, velocity, volumes, etc) these notes have. This data can then be sent to any or all of the 16 MIDI channels.

Therefore you can route, say, a bass line to a specific sound unit by setting your input device to transmit on, for instance channel 10 and set the device you wish to respond to the same channel. Then only one device will "play" the bass line, rather like a CBer talking on a specific line frequency. If, however you wanted to send one musical phrase to a whole multitude of synths then you can either set all your output devices to the same receive channel or set your input device to transmit on all channels (AKA "Omni mode").

This may sound a bit complicated but it's just the same principle as if you had linked two Commodores together with a comms package. Hitting the letter A on one micro would reproduce the same letter on the receiving machine. It's not the actual letter that has travelled down the lead but the ASCII number that represents that letter which both machines understand. Likewise with MIDI, if you link two synths together in much the same way playing middle C on one will result in the other responding with the same note. Again the sound hasn't been transferred but a numerical representation (in this instant E60) of it that anything MIDI equipped will interpret correctly.

Getting into MIDI

So what basics do you need for MIDI? Firstly you need something to generate the codes. The obvious choice is some form of synthesiser as this will not only give you the keyboard input you require but access to some playback sounds when the composition is complete. When choosing a synth you really need one with as many performance controls on it as possible (e.g. pitchbend, modulation, after touch etc), and some form of touch sensitivity as most sequencers accept sensitivity and performance data as do most sound modules these days.

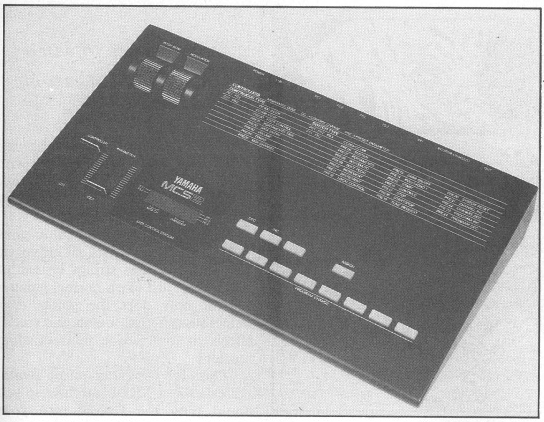
Ideally the synth should also be equipped with MIDI mode 4, otherwise known as "mono mode". This allows you to assign a different sound to a different MIDI channel thus giving the illusion of having up to 16 synths depending on how polyphonic the keyboard is, e.g. if the synth is eight voice polyphonic (eight notes can sound at the same time) so if you assign a separate sound to a separate channel the maximum number of sounds you will be able to extract from that machine is eight.

The most cost effective synths around come from Casio. Most economic is the CZ-101 which now retails for around £200 (provided you shop around) or the CZ-230S which is non-programmable but offers built in drum patterns. Both units have pitch band wheels but non touch-sensitive small keyboards which will inhibit those of you (like me!) with big paws. Pricewise you can spend as much or as little as you want. Thanks to keen competition, an extra £100 will get you extra valuable benefits.

You're so Masterful!

Alternatively you could opt for a MIDI master keyboard, which has all the performance features of a top-of-the-range synth without the voices. You may be wondering what the point of that would be. It depends on how complex your set-up is likely to be.

If, for instance your system is likely to consist of several sound modules (keyboardless synths) then you will be able to control each module more efficiently as most master keyboards allow you to route different MIDI channels and map them onto different areas of the keyboard. For instance, you could split the keyboard so that the bottom octave was sent to a synth running a bass sound, the middle two octaves driving a string sound on a different MIDI channel to a different module and so on. Once your keyboard split points are configured the way you want them, you can then



store the whole thing as a memory patch that can be recalled at a later date.

As with synthesisers you can spend virtually any amount of money on a mother keyboard. The best value range in the category comes from Cheetah Marketing (best known for producing add-ons for a certain rubbery keyed micro). Prices start from £200 for the basic model rising to £400 for the seven octave, touch sensitive, weighted keys and three programmable split points. Personally I would recommend the mid-priced model in the range, the MK5V which offers five octaves of touch sensitive keys and both pitch bend and modulation wheels. This models goes for about £275.

Another up and coming use of computers and MIDI is that of voice editing. Most synths are quite tricky to alter sounds on. Largely due to the unfriendly front panels on most synths. Therefore a more comprehensive front end can be displayed on screen, sounds can be edited on screen and sent back to the synth.

Furthermore, once you've started building up libraries of sounds they can be stored database style onto tape or disk which is much more reliable than synths internal save to tape to routines, not to mention quicker (yes folks there is something slower than a 1541!).

So, to sum up, it seems clear that there's an awful lot of things you can do with the combination of MIDI and your computer. They say there's a best selling novel in all of us so maybe there's a number one single in there too. Perhaps the current level of technology is high enough to extract talent from everyone.

Choose your Weapon

All well and good if you know your way around the ivories but that's of no use if you play something else instead. Fortunately there are also a number of alternatives in the shape of MIDI equipped guitars (from Roland and Casio), basses (from Roland), drum pads (from Roland, Casio, Yamaha and Simmons) and wind instruments (from Akai and Yamaha). All these products do much the same sort of job in as much as they all convert a musical action (pluck of a string, press of a key) into those all important MIDI codes.

There are even units that take a vocal input and convert them into MIDI codes. Syco Systems have developed a pitch tracker although you will be looking at paying thousands of pounds rather than hundreds for one of those. More within our price bracket is the Korg Voice Processor which is the MIDI equivalent of a Vocoder which allows you to talk or sing through notes played from a MIDI sound source which can produce some interesting effects. Anne Dudley of the Art of Noise swears by them.

So we've established that pretty much whatever instrument you feel comfortable with you can start unleasing MIDI codes into an unsuspecting Commodore. What do you mean big deal? Perhaps you haven't heard just what sort of things with a computer and a MIDI interface.

Computer Control

What could be better at gathering in numbers, storing them and, where required manipulation of numbers than a computer, particularly one as spiffing as a Commodore – right kids?

First thing you need here is some form of MIDI Interface – a box that converts MIDI signal into a form which a computer can understand and then change them back again. Sequencing has been the main use of computers in music for both home users and studio professionals alike. Performer/Producers like Stock, Aitkin and Waterman wouldn't create the songs they do without a little help from a micro here and there.

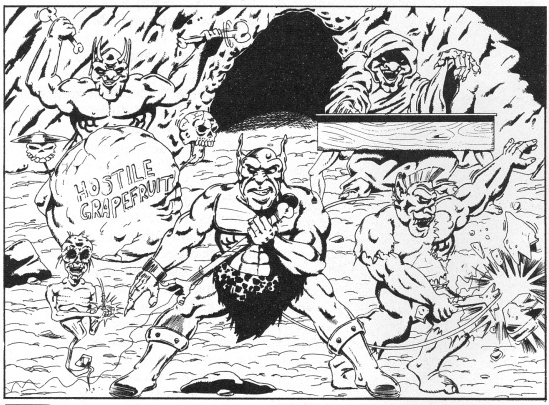
The term 'sequencing' is a little misleading these days as it stems back from the days when 8K was state of the art and sequencers could only remember a few notes and repeat them. Nowadays the term "MIDI Recorder" is more apt as whole songs can be entered and played back in much the same way as you would record and play a tape machine.

However Sequencers score over tape in that you can edit individual notes in or out and because the sounds aren't actually recorded (just their MIDI representations), mucho tweaking can be done once a song is recording.

Released at the British Music Fair was the Casio DH-100 digital horn which looks like a toy saxaphone but is in fact a MIDI controller that has the same fingering as that of a recorder, making it ideal for kids. In addition to the MIDI control you also have access to six preset sounds (sax, flute, trumpet, oboe, clarinet and synth-reed). At £99 r.r.p. you can't go wrong really.

However multi-keyboard specialists Farfisa have come up with a unit called Midimic which, put simply is a microphone with MIDI out as opposed to audio out. So if you can hum or whistle electronic sound source via MIDI. Furthermore Midimic has a line input on it which will allow you to hook it up to an acoustic instrument. All this for just £199.

For contact names and addresses refer to 'Beyond the Sequencer' pp. 51



Become a

MIDI Rock Star

Your chance to win a Casio DG-20 electronic guitar

To celebrate this special music issue we've teamed up with Casio and are giving one lucky reader the chance to own their very own DG-20 electronic guitar.

The DG-20 electronic guitar gives you all the flexibility of an electronic keyboard but uses strings instead of piano keys, just like a normal guitar.

Not only does the guitar offer numerous different sounds and special effects, it even has a built in drum machine.

Plus, for computer music freaks, there's even a MIDI interface so you could plug the DG-20 into your computer.

How to Enter

Study the two cartoons on this page; there are a number of differences between them. Once you have decided how many differences there are, complete the entry coupon and send it to the editorial address (see coupon). Write the number of differences that you have found on the back of the envelope. If you don't your entry will not be accepted.

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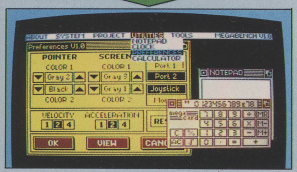

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WINDOWS

THE FINAL CARTRIDGE III

The high-resolution bit mapped windows are selected from a menu bar. An unlimited number of windows can be open on the screen at the time. The windows can be freely moved on the screen.

The following windows are already implemented in ROM:

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Selects: mouse port, joystick port, mouse speed, screen colours, pointer colours, keyboard click, keyboard speed.

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Complete simulation of a LCD-Calculator. Input either with mouse, joystick or keyboard. The numeric key-pad of the C128 can be used in C64-mode.

NOTE PAD
Easy to use wordprocessor with proportional characters enables you to store and print small notes, letters, etc.

DIRECTORY WINDOWS
Enables you to open directories from different disks and drives, sort and print directories.

DISK WINDOWS
Load, Run, Rename, Validate, Scratch, Initialize, Fast format disks.

TAPE WINDOW
Activates fast and normal modes.

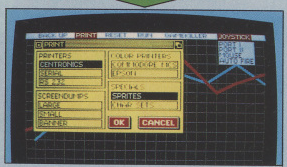
PRINTER WINDOWS
Select different printers, such as Commodore serial, Centronics, RS 232, Colour printers.

REQUESTER WINDOWS

DISC BASED USER WINDOWS

CLOCK
Real Time Clock, with Alarm.

FREEZER MENU



THE FINAL CARTRIDGE III

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Freezer options include:

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SCREENDUMPS
● Full A4 printing ● Variable printsize ● Colour printing ● Sprite printing ● Reverse printing ● Colour changes.

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Does not reside in memory.
Functions include:
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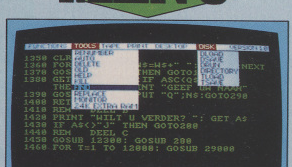

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Music Composer

Let your musical creativity run riot with this offering for the C64

By J. Oshry

Everyone knows that the Commodore 64 has an amazing sound chip. However, if you want to program music, it is very cumbersome to POKE all the correct values into correct registers. This program will come to your rescue! You can enter your music with the minimum of fuss with musical knowledge.

When you first run the program, there will be a slight delay while it initialises itself. You will then see a screen which has a keyboard on it, and the current note, octave, length and voice. On the right hand side of the screen are brief instructions on which keys to use. We'll go through each command, so that you can use the program effectively and easily.

Producing

To obtain a note, you have to press a key from the first row of letters beneath the keyboard. The note which you will produce will be in the second row of letters. The note is then stored in the computer's memory.

Changing The Length of Notes

To change the length of a note, you have to stress either the ',' key to decrease the length, or '.' to increase the length:

128	=	1/16 note
256	=	1/8 note
512	=	1/4 note
1024	=	1/2 note
1536	=	1/2 +1/4 note
2048	=	whole note

Obviously you can create other lengths if you wish.

Changing the Octave and Voice

To change the octave, press the ':' key to decrease by one octave, and the ';' key to increase the octave. If you have finished entering a voice, then press the 'F1' key to get into command mode. Then use the CRSR down key to descend the reversed bar. When it is covering the command 'NEXT VOICE', press the RETURN key. You can then begin entering the next voice.

To save your music, you must enter command mode and go to the 'LOAD MUSIC' or 'SAVE MUSIC' options. You will then be prompted for a file-name, and if you are using tape or disk, the music will then be saved or loaded onto the appropriate device. (To enter a pause, press the SPACE bar – the length of the pause wil be the current length shown on the screen.)

Changing the ADSR

To change the attack, decay, sustain or release, go to the appropriate option in the 2ND MODE. Once you have pressed RETURN when the reversed bar is covering the appropriate option, you will be asked initially what voice you would like to change. You will then be prompted to enter the attack, decay, sustain or release. After that, you will go back to the main screen.

Changing the Tempo

You can not only play your musical piece at one speed. If you would like a slower or faster tempo, enter the 2ND MODE. You will then be given a list of the different speeds that you can have. Press the appropriate key to obtain the appropriate tempo.

To delete a note, just enter command MODE, and press RETURN. The last note entered will then be deleted.

Frequency Display

If you want to display the frequencies of the notes already entered, go into 2ND MODE, and press RETURN. You will then be asked if you will be using screen or printer for output. The frequencies will then be displayed with the length of the note.

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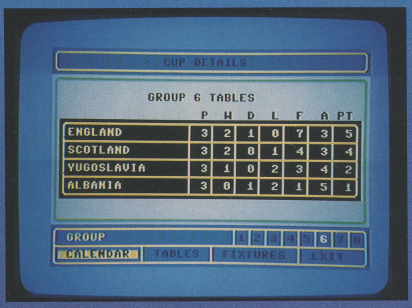
If you're disappointed by England's dismal performance in the recent European Championships and think that you could do better as the man in charge then start practising those cliches as you load in Goliath's Track Suit Manager.

As the game begins the headlines in the Daily Scrag and Sporting Knife greet your arrival with enthusiasm but if you don't start producing the goods they'll be on your back. The task ahead is far from easy with the first qualifying match for the European Championships just a few months away. If you survive, the World Cup follows shortly after.

Once the game has loaded the C64 draws the teams for the European Championship qualifiers that are thankfully split over the years giving you some time to play a few friendlies, scout on the opposition and try out the mass of goalkeepers, defenders, midfielders and forwards at your disposal.



Track Suit Manager

To help you choose your squad you can read a report on each player which rates a variety of abilities from tackling to shooting, heading to passing and confidence and fitness. Goalkeepers are evaluated on their reactions, handling, how well they deal with crosses and the accuracy of their kicks.

Unfortunately, you can only select a player if his club will release him so be prepared to lose Lineker or Shilton at the last minute and be ready with appropriate back up players to fill in where required. Once you've selected a 22 man squad it's time to try them out in either a friendly or perhaps a tour. Either can easily be arranged and for a real test you could take on Argentina, Brazil, Columbia and Uruguay on a South American tour.

Before each game you must obviously select the team that will play but also how they will play. Will they play attacking football, possession football, a sweeper system, offside trap 4-4-2 or 4-3-3 formation, short or long passing and zone or man-to-man marking. You can then scout the opposition to find out how they play and who are the danger men. Then to give you almost absolute control you can give each individual player instructions about whether to stay up or back and decide who should take corners and penalties. You can even decide who they mark. For example, if you're playing Argentina you may decide it's worth keeping Robson back to help out with the defence and telling him and Butcher to mark Maradonna.

Once the match begins a small diagram of the pitch shows the general position of the ball and text descriptions describe the play. For example, Shilton kicks the ball out to McMahon, McMahon passes to Robson, back to Butcher, long pass forward to Beardsley, Beardsley shoots..., inches wide.

If you want to speed up the action you simply press the cursor keys. If you press them often enough you can end a half in under five seconds.

Halftime gives you the chance to adjust the tactics to either hold onto a lead or chase or go for goals, you can even put on two substitutions but you can do this at any time.

Although the result is important, especially to the newspaper headline writers, as Manager you must look at the game to see who's playing well and ask yourself, is the defence holding out, is the midfield helping put and then pushing forward to help the attack and are you scoring goals? Then when you've worked out what's wrong who are you going to change to put it right, bearing in mind an injury, sending off or a club not prepared to release a key player can spoil the best of plans.

When you reach the start of the qualifiers the pressure quickly builds up as you realise this game counts. Now you must decide whether you go with experience (a half fit Brian Robson) or try out a younger star (Gascoigne) who's shown a lot of promise. Luckily, there is at least a month's gap between matches, often longer so there might be time to put things right if you get off to a bad start.

The finals in June bring their own problems. You can take a squad of 22 players and that's all so if you start picking up injuries or bookings you could head for trouble just when you don't need it as you come across stronger sides. Whatever the outcome the World Cup qualifiers begin almost as soon as you return only this time with more groups and a bigger finals stage.

Track Suit Manager is one of the best football games I have played and certainly highlights the problems facing a national team manager. You have so many players to choose from, so few matches to get it right and then tough opposition to play and if you don't do well the press are waiting for you when you get back home. **T.H.**

Touchline:
Title: *Track Suit Manager.* ***Supplier:*** *Goliath Games, 46 Locking Road, Weston-Super-Mare, Avon BS23 3DN.* ***Tel:*** *0934 22538.* ***Price:*** *£9.95 + 50p post & packing.*

Constructing a

In the last couple of installments we have looked at the basic operation of the compiler system and defined the FCL language – now it's down to the real work – the source editor program – EDIT.

By Steve Carrie

EDIT is a small BASIC machine code loader program which slithtly alters the operation of the C64's resident line editor. Normally, a line of text is scanned after the return key has been pressed to see if it contains any valid BASIC keywords. If any are found, they are replaced by a single byte token values which represent the particular keyword found. This is similar to the operation of our compiler's lexical analyser. The tokens will be recognised by the execution routines in the machine's BASIC interpreter and the required action carried out.

Because we do not want the interpreter to perform this action, we must replace the normal interpreter routine that inputs a line of text with our own. Fortunately, Commodore has provided us with an easy means of doing this by defining RAM-based vectors used by the interpreter. Don't worry too much about how this edit program works because it isn't really all that important here. Just type in the BASIC loader program (Program 1) and RUN it (save it first of course!).

The machine code will be placed into the cassette buffer, the vectors POKEed with new values, a sign-on message displayed and the BASIC loader NEWed. Whatever you do, don't try to edit a BASIC program with this installed as any new lines entered will not be tokenised by BASIC and any existing lines LISTed will produce strange results. Use EDIT only for preparing source code for the compiler!

Structure of program lines

This description if equally valid for both EDITed program lines and normal BASIC lines. In order for the interpreter's editor to easily manipulate lines in memory, the designers of Commodore BASIC made use of special bytes called **line link bytes**. These link bytes contain the address of the next line's link bytes. Should these link bytes contain zero, then the end of the program has been

Fig 1 structure of a BASIC/EDIT line in memory

```
0    11   1h   nl   nh   (tokenised text)                    0
     11   1h   nl   nh   (tokenised text)                    0
     ..................
     0    0                        (end of the file)
```

11,1h link address low/high
nl,nh line number low/high

reached. The full structure of a typical program is shown in Fig. 1.

The first zero is not actually part of the program itself but is used by the interpreter to mark the start position of BASIC text in memory. The zero at the end of the line is the interpreter's end-of-line marker. As you can see, the link bytes point to the next line and the end of the file is marked by two zero link bytes. The COMPILE subroutine which reads in a line of source text makes use of the various bytes to correctly GET a program line.

The COMPILE program

COMPILE is arguably the most important program of the system. It is the program which reads the language text written by the programmer and converts it into a set of pseudo code strings which are used by the code generator, CODEGEN to produce the program assembler source. COMPILE is approximately 1000 lines long and is as neat and tidy as Commodore V2 BASIC will allow (i.e. as few GOTOs as possible...).

There is a comprehensive error checking facility with in excess of twenty possible error conditions, all of which are listed later. COMPILE will scan the entire file, reporting any errors if and when it finds them. The program operates on a maximum of four disk files at any one time. It has been designed to be extend able to a certain extent though, to be honest, it's not all that easy! It operates in approximately 23K of memory leaving some 15K for its variables. The various sections of the program are detailed below;

Main control section the segment from line 10 to line 380 controls the operation of the compiler. From here, the system initialisation phase is called (line 10) and all subsequent phases eventually return to here. Lines 100 to 190 comprise the main loop which reads in the data and processes it line by line. Lines 230 to 360 report any problems during compilation and line 370 calls up the code generator only when no errors have been reported.

Initialisation phase the subroutines "error messages"; 450 to 910, "initialise"; 980 to 1160, "define functions"; 1230 to 1360, "read in keyword table"; 1430 to 1720 and "get filenames"; 1790 to 1870 comprise the

Fig. 2 — reserved words and symbols with token values

STATEMENTS

Array Element	Token	Symbol	Array Element	Token	Symbol
00	128	end	01	129var	
02	130	int	03	131	string
04	132	array	05	133	bset
06	134	wset	07	135	loop
08	136	endloop	09	137	while
10	138	when	11	139	if
12	140	endif	13	141	else
14	142	charout	15	143	fopen
16	144	begin	17	145	fclose
18	146	for	19	147	input
20	148	output	21	149	write
22	150	read	23	151	subroutine
24	152	return	25	153	call
26	154	external	27	155	forward
28	156	cls	29	157	wait
30	158	halt	31	159	syscall

OPERATORS

Array Element	Token	Symbol	Array Element	Token	Symbol
32	160	or	33	161	xor
34	162	and	35	163	not
36	164	=	37	165	< >
38	166	<=	39	167	>=
40	168	<	41	169	>
42	170	+	43	171	-
44	172	*	45	173	/
46	1774	++	47	175	--

FUNCTIONS

Array Element	Token	Symbol	Array Element	Token	Symbol
48	176	byte	49	177	word
50	178	len	51	179	char
52	180	str	53	181	asci
54	182	stop	55	183	key
56	184	charin	57	185	left
58	186	right	59	187	mid
60	188	sysfn	61	189	iostat
62	190	dstat	63	191	derr

As the line is processed, a sequence of pseudocode is written to the string OC$ for later disk output. The legality (syntax) and meaning (semantics) are thus checked by this large series of subroutines.

initialisation phase. The keyword table contains the list of reserved language elements. Most of functions defined in "define functions" are used mainly during lexical analysis to check character types. The subroutine "initialise" is the main one which makes calls to all of the others after setting up arrays, etc.

File I/O a number of subroutines provide the disk file I/0 facilities. These are "open disk files"; 1940 to 2010, "write data files"; 2080 to 2340, "read line from disk file"; 2410 to 2490 and "write to file"; 2560 to 2570. The "open disk files" routine is called at the beginning of compilation to open the work files. The "read" and "write to file" routines are used to input data from the source file and write data to the pseudocode file respectively while "write data files" is called after compilation to write the symbol and literal data files.

Lexical Analysis the first major phase in compilation is performed by "split line" and "tokenise line". The first of these breaks the line up into segments in the array L$(), the original source text being held in IL$. Next, the line is scanned by the "tokenise" routine to replace any occurances of reserved language symbols or words by single byte tokens. This process is controlled from the subroutine "perform lexical analysis" at lines 2750 to 2770 which is itself called from "do lexical/syntax/semantic" at lines 2640 to 2670.

Syntax/Semantic Analysis this process is also controlled from the routine at 2640 and takes up the rest of the program. The subroutine "perform syntax/semantic analysis" at lines 3270 to 3300 controls this phase. Depending on the contents of the array L$(), control will be passed to either "handle symbol-type expression" at lines 3590 to 3890 or to "routing of keywords" at 3370 to 3520 where control may be passed to any one of a number of subroutines beginning at 5660 to 8960. These subroutines check the syntax of the appropriate command found. The "symbol-type" branch assumes that the line contains some kind of assignment expression.

Whatever branch is taken, the routine at 4200 to 4760 "expression analysis" and its subordinate routines "function dispatch"; 4830 to 4910 with function handlers beginning at 9040, "literal string handler"; 4980 to 5020, "numeric & symbol evaluation"; 5090 to 5270, "place opcode"; 5340 to 5370, "evaluate numeric string"; 5440 to 5580 and "find symbol"; 3960 to 4130 will eventually be called.

These routines work together to correctly sequence any calculations made in an expression and in some cases, evaluate literal numbers. The "expression analysis" subroutine is capable of handling very complex expressions with functions and/or parenthesis. One of the main tasks carried out by this routine is to ensure that calculations are carried out in the correct order. The precedence of an operation or function is determined by its position in the keyword table.

The higher the position, the higher the precedence; thus * has a higher precedence than + whereas OR has a lower precedence than AND. Fig. 2 shows the contents of the keyword table and the values of the tokens used to represent each keyword. Type checking is also carried out to ensure that no illegal operations or assignments are carried out such as adding a number and a string.

The Pseudo Code

Much has been said about the pseudo code generated by this program. Fig 3 lists the pseudo opcodes and their meanings.

Fig. 3 table of Pseudo Codes.

Code	Operand bytes	Function
1	2	Load AC2 with the value given by the operand bytes.
2	0	Push the contents of AC2 to the stack.
3	0	Retrieve the contents of AC1 from the stack.
4	2	Save AC2 to the address given by the operand bytes.
5	2	Load AC2 from the address given by the operand bytes.
6	2	Increment the value at the address given by the operand bytes.
7	2	Decrement the value at the address given by the operand bytes.
8	0	Move the contents of AC2 to UP1.
9	0	Move the contents of AC2 to UP2.
10	2	Load SD2 with the literal string at the address given by the operand bytes.
11	2	Save SD2 to the address in the op. bytes.
12	2	Load SD2 from the address in the operand bytes.
13	–	unused
14	0	Move SD2 to the stack.
15	0	Recover SD1 from the stack.
16	0	String operation prefix. Indicates that the next operation is to be treated as a string operation.
17	0	Select channel in AC22 for input.
18	0	Select channel in AC2 for output.
19	0	Write value in AC2 to output.
20	0	Write the string pointed to by SD2 to output.
21	0	Write to a Carriage return to output.
22	0	Write a TAB to output.
23	0	Load AC2 from array. Array address is in APT (array pointer).
24	0	Save AC2 to array.
25	0	Load SD2 from array.
26	0	Save SD2 to array.
27	0	Recover the value from the top of the stack and place in array pointer.
28	0	Increment array element.
29	0	Decrement array element.
30	0	Move AC2 to array pointer.
31	0	Read a numeric literal from input into AC2.
32	0	Read a string literal from input into SD2.
33	0	Clear I/O channels.
128-191	0	Tokens for keywords in Fig. 1.

Extending COMPILE

There are several stages to adding new commands to the compiler. First, you must add the keyword into the correct section of the keyword table initialisation routine; statements operators or functions. I will warn you now that while it is relatively easy to add new statements and functions, adding operators is not recommended. Once the keyword is in place you must add the necessary service subroutine and its corresponding line number into the appropriate dispatch routine; "routing of keywords" for statements or "function dispatch" for functions. In some cases, certain existing service subroutines may be able to cope with your new keywords. Notice how several functions use a common subroutine (e.g. **byte** and **word**).

The FCL compiler: User's Manual

The program should be LOADed and RUN. Lowercase mode is selected and the sign-on banner displayed. Alter a few moments, you will be asked for the name of the file to be processed. This file should have the default extension FCL. Thus, if you have created a file FILE.FCL you need only enter FILE when asked for the filename. **COMPILE** is a one-pass language processor and displays any error messages in reverse video characters under the lines in which they occur. A list of error and warning messages is given in Fig 4, "**COMPILE** Error messages".

Upon completion of a successful compilation the code generator **CODEGEN** is automatically loaded and RUN. Refer to the **CODEGEN** User's manual for information regarding this program.

Speed of compilation

COMPILE is written in commodore BASIC V2 as thus it may take some time to process your programs. The average speed of compilation is approximately 25 seconds per screen line. This figure is probably not a very accurate one since the semantic analyser may take some time to process lines which contain complicated expressions and very short lines may compile quickly.

That's all for this "episode". Next time I'll present the CODEGEN and ASSEMBLE programs. In the meantime, you may want to try compiling some of your programs as well as the two example files in the FCL Programmers Manual (presented last time). If you do, it might be a good idea to either remove or REM out line 370 in COMPILE to prevent an attempted load of CODEGEN.

Fig 4 COMPILE Error messages

Symbol not defined – indicates that a symbol was referenced but never declared in the Data Division.

Symbol re-defined – a symbol was declared and then re-declared later in the program.

Incorrect use of type descriptor – type descriptors **int, string** and **array** may only be used in conjunction with **var**. This is printed if they are used used in any other way.

Missing expression – an expression was expected but was not found.

Parenthesis Error – there are an unequal number of opening and closing parenthesis in the expression being scanned. May also indicate operator problems.

Incorrect use of operators – possibly two operator are together in an expression; e.g. 3*+4 is not legal.

Syntax Error – A general syntax message indicating a mispelling or incorrect command layout.

Numeric Overflow – a numeric literal is larger than is allowed.

Garbage at end of line – the compiler could not make sense of this line at all.

Missing symbol – a symbol was expected but was not found.

Illegal symbol – a reserved word or illegal name was used for a symbol.

Function/operator syntax error – an error has occurred within an expression. This is a more explicit message than "syntax error" and points to a problem in the layout of a string or numeric expression.

Missing variable descriptor – a variable type descriptor was expected in a **var** statement but was not found.

Missing operator – an operator was expected in an expression but was not found.

Type mismatch error – you cannot directly assign a quantity of one type to another type.

Incorrect use or reserved word – You have used a function or statement in the wrong context

Control Structure error – the compilerwill not allow you to mix up controlstructure types. Nested controlstructures are allowed but you cannotoverlap them.

Procedure Division Error – noprocedure Division was found.

Statement outside procedure division – self-explanatory.

Control Structure not matched at END – either an **if/endif** or **loop/endloop** control structure is still "open" at the **end** of the procedure.

I/O file mode not defined – no **input**or **output** mode was defined in an **fopen**statement.

Subroutine Not defined – a subroutine was referenced but had not been defined. May indicate a subroutinewhich requires **forward** definition.

Subroutine already defined – you have re-declared a subroutine.

Subroutine structure error – bad structure in a subroutine, possibly missing **begin** or **end** statement.

No subroutine error – a subroutine was defined by **forward** but not explicitly defined.

Illegal use of subroutine name – you have tried to use a subroutine name as a variable.

Bad Subroutine name – illegal characters in subroutine name.

Subroutine inside procedure – you cannot define a subroutine inside another procedure.

Identifier too long – twenty characters is the maximum length of any identifier, subroutine or variable.

Warning Messages

Garbage at end of line – line compiled ok but rubbish was found at the end of the line.

Declaration inside procedure – variable was defined inside a procedure but was still created.

Subroutine definitions inside procedure – a **forward** definition was found inside a procedure.

Wasteland

As nuclear missiles hurtled across the skies to wipe out the super powers a group of US army engineers were building bridges across ravines in the Nevada desert. As the mushrooms started sprouting they took cover by evicting the inmates from a new top security prison.

As the fallout settled and the radioactive levels began to drop in the months that followed the engineers joined forces with survivalist groups to repel the attempts of the thugs, vandals and other criminals that tried to recapture what they claim was "rightfully theirs". As time went by they formed into the desert rangers and became the nearest thing to law and order left in the area. Your job is to take a party of desert rangers into the unknown to investigate a series of disturbances.

Each member of your party has the usual range of role playing characteristics including strength, dexterity, intelligence and charisma as well as individual skills that give the character a better chance of using a specific weapon well, climbing or swimming, disarming a bomb or picking a lock or any of the other skills that might just see you through this adventure alive.

Although Wasteland was developed by the same team that brought you the Bard's Tales there is a notable addition in the guise of Tunnels and Trolls and Monsters Monsters author Ken St. Andre. This combination has created an exceptional game that features the top down wilderness view of SSI fantasy games and the Ultima series and the close up monster graphics as seen in the Bard's Tale. However, players expecting a Bard's Tale type game are in for some big surprises.

The Wasteland contains no easy pickings for characters looking to build up experience as even the weakest wimp can seriously damage your party if he's holding a LAW rocket or sub-machine gun. In the Wasteland it's your firepower that counts.

As your party steps outside the safety of the Ranger Centre (the new name for the prison) your four characters are armed with pistols and a limited number of ammo clips. One of your first priorities must be to find a few carbines, rifles and grenades. However, that's not all you'll find as the towns and cities are now controlled by the crooks you turfed out and if you survive the most continuous attack by snipers and gunmen you may find out where the bosses hideout is and in one town where they're holding the Mayor.

You'll find help in the weirdest places as you mix with the low life that has somehow survived the holocaust. Bartenders are, as always, a useful source of information and the occasional room key but this all costs money which means you're going to have to mug a few muggers to keep your finances in the black. You'll also find some characters that are willing to join your party that become Npc's or non-playing characters.

Although a Npc may add some much needed firepower to your party they also have their drawbacks as you have only partial control over their actions and they may even turn on you if they don't want to attack the enemy. They may also hog the experience gained for mowing down thugs, gunmen, bandits and punks because in Wasteland only the character that actually deals the killing blow gets any experience.

Should you manage to survive long enough to acquire some experience you can radio back to base for a field promotion which may bring you two more hit or constitution points and two points to add to any of your other characteristics. If you choose intelligence then you may be able to learn some skills and grow on confidence to enter one of the larger towns that are still patrolled by wardroids, visit the guardians, mount a commando style raid to free the Major of Needles, gamble in Las Vegas, do strange things with a four legged mutant or encounter one of the strange cults that have grown such as the mushroom people and the dangerous followers of the bloodstaff.

I have now spent the best part of a fortnight in the Wasteland and have a full party of seven adventurers since machine gun firing Christina, Mayor Pedro and the Covenant joined the group. My group are progressing through the ranks and can now handle most opposition since we raided an old arms store, once we'd disarmed the booby traps, and are about to set off into the desert again.

Wasteland is without doubt one of the biggest and best roleplaying games you can cram into your C64. It is packed onto two, double sided, disks and comes complete with an instruction manual and a book of 162 fighting fantasy style paragraphs that deal with the more interesting encounters.

T.H.

Touchline:
Title: *Wasteland.* ***Supplier:*** *Electronic Arts, Langley Business Centre, 11-49 Station Road, Langley, Nr. Slough, Berks., SL3 7YN.* ***Tel:*** *0753 49442.* ***Machine:*** *C64.* ***Price:*** *£16.95.*

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- On board operating system – no programs to load.
- Program your own EPROMs using our EPROM programmer.
- No need to have loads of cartridges – just make a selection from the Superom menu.
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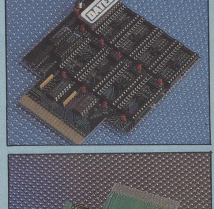

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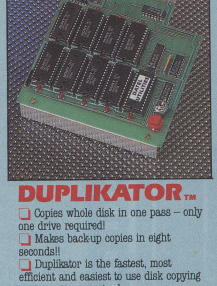

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- Copies standard software as well as errors 21-29 and upto 40 tracks.
- Full disk error check in eight seconds.
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- A must for clubs, user groups etc. How else can you copy over 250 disks and hour for less than £100.
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- Accepts 2 x 8K EPROMs.
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- Full instructions.

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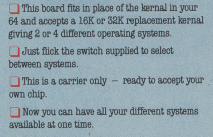

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- Will nibble upto 41 tracks.
- Copy a whole disk in under 2 minutes.
- Full instructions.
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- Fitted in minutes – no soldering usually required.
- Full or ½ tracks.
- No need to buy parallel cable if you have Dick Demon/Dolphin etc.
- Cable has throughbus extension for other add ons.

- Whether to choose FastHack'em or Burst Nibbler? Fast Hack'Em is unbeatable value as an "all-rounder" – with nibblers, 1 or 2 drive copy, format, file copy, 1571 copy etc. etc., so if you have a more general requirement perhaps FastHack'Em is for you. Burst Nibbler is a pure nibbler second to none, for the reasons stated. So if it's just making backups you are interested in, there is no other product to beat it.

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SOFTWARE ONLY £12.99 CABLE ONLY £14.99

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- Simple to use – just nibble the disk then run the individual parameter for that program and the special routine will produce a perfect working copy – in some cases it will even de-protect it!
- Comes complete with "Super Serial Nibbler" program for users who can't fit a parallel copier such as Burst Nibbler to their drive (Excelerator, Oceanic etc)., not as fast as Burst Nibbler but when used in conjunction with parameters its formidable.
- Remember – this disk is by no means a must for Burst Nibbler owners since it already copes with over 90% of Software. But for those who want everything this is it. Also for none Burst Nibbler owners you get a "Super Serial Nibbler" which together with the parameters is a powerful utility.

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- DISK DOCTOR V2 – Read and write any track and sector including extra and renumbered tracks. Repair damaged sectors. Look underneath read errors.
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- DISK LOOK – Sort directory. Recover lost files. Display file start/end addresses. Disassemble any file program directly from the disk to SCREEN or PRINTER including undocumented opcodes. Edit Bam. Much, much more.
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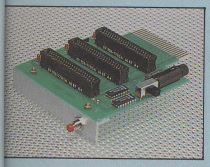

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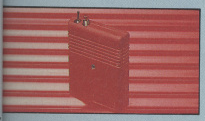

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- Can be switched on or off board via software.
- I/O 2 slot open for special programming techniques.
- 32K version has 4 x 8K pages.
- Some knowledge of M/C is helpful – but full instruction are provided.

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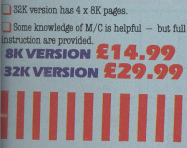

RAM DISK

- Turn your Smart Cart into a 32K RAM/disk.
- 32K of instant storage area for files/programs.
- Load/save instantly.
- Disk type commands: load, save, directory, scratch.
- Program data retained when computer is switched off!
- Full command set with instructions.

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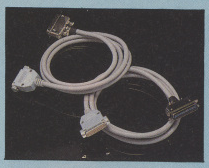

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- Connect your C64/128 to a full size Centronics Parallel Printer.
- Suitable for use with Action Replay IV or Final Cartridge III
- Also works with any Software/Graphics package that has parallel driver software built-in – this includes many popular wordprocessors, databases, etc.
- Top quality connections – ribbon cable 1.5m long.

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Turbo Rom II is a replacement for the actual kernal inside your 64. It provides superfast load/save routines.

- Loads most programs at 5-6 times normal speed.
- Saves at 5-6 times normal.
- Improved DOS support including 10 sec format.
- Programmed function keys:- load, directory, old, etc.
- Return to normal kernal at flick of a switch.
- FCOPY – 250 block file copier.
- FLOAD – special I/O loader.
- Plus lots more.
- Fitted in minutes – no soldering usually required. (On some 64's the old ROM may have to be desoldered).

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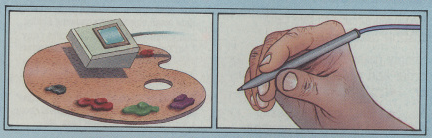

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  - Load/save
  - Advanced colour mixing – over 200 hues!!
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- Blazing Paddles will also work with many other input devices including; Joysticks, Mice, Graphics Tablets, Trackball etc.
- Pictures can be saved from Action Replay and edited with Blazing Paddles.

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A range of utilities to make the most of your high res pictures created with popular graphics utilities or captured with Action Replays unique picture grabber.

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- Very easy to use – simple commands
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- Full colour display.
- Animate to view movements.
- Action Replay can capture/insert sprites with any program – this editor is a perfect companion.

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- Takes your favourite screen – created with a graphics package or captured with action replay and turns it into a scrolling screen message complete with music.
- Send screens to your friends with music and text scrolling.
- Simple text editor – easy to use.
- Choice of music.
- An exciting utility.
- Finished screens stand alone.

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- Robotek 64 is a comprehensive hardware/software package which enables you to connect your 64/128 to the outside world.
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- Software features:- test mode/analogue measurement/voice activate/digital readout etc.
- Excellent value!

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including hardware/software/mic etc. (State tape or disk)

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- The new sampler allows you to record any sound digitally into memory and then replay it with astounding effects.
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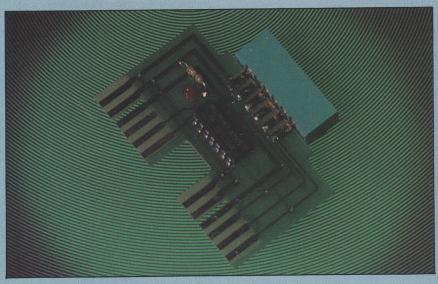

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- This drive is now probably the most compatible drive available for the Commodore. More so than even Commodores own 1541C. Much more so than other so called compatibles. In fact we have been unable to find a program including the latest that would not work. (At time of Press).
- **No need to look elsewhere – this is the best.**

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FAST HACK'EM™

- **Multi Module Disk Nibbler – all on one disk.**

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- Self contained, ready to use (except batts, joysticks).

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- Unique Software/Hardware package to allow you to interface your computer with the Robotarm.
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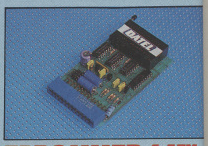

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- We believe Eprommer 64 is the most comprehensive, most friendly and best value for money programmer available for the 64/128.
- Ideal companion for Superom Board, Cartridge Development System, our kernal expanders or indeed any EPROM base project.
- Comes complete with instructions – plus the cartridge handbook.

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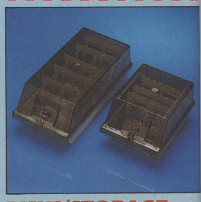

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Musical FX

Creating just the right ZAP, POW or WHEE for your latest game was never easier than with this superb FX editor

By K.A. Lynch and M.W. Else

Many people are very efficient programmers until it comes to producing any form of sound from their computer. This is especially true where the C64 is concerned as it does not have any commands to deal with the afore mentioned.

This is where *FX EDITOR* comes in handy, as it will allow you to produce up to sixteen different fx's for use in your own programs, either basic or machine, and will reside at any location in memory that is required. The actual editor will allow you to create and bank up to 102 fx's for future reference.

There are 15 values that effect each different fx.

A brief explanation will now be given for each value and its effect on the sound you create.

PITCH1: This actually consists of two values (lo and hi bytes respectively) that control the overall pitch of the current fx being played or edited.

PITCH 2: this is also two values. These are treated as single values and control the pitch of the second and third wave forms respectively.

WAVE: This value is used to select the waveform that forms the base of the 4 current fx. There are only certain values that will work and these are:

[11] – TRIANGLE WAVEFORM
[21] – SAWTOOTH WAVEFORM
[41] – PULSE WAVEFORM
[81] – WHITE NOISE WAVEFORM

Please note, these values can be merged to create different fx e.g. [21] + [41] = [61]. The second nibble changes the effect! range 0 - f.

ADSR: These values give the Attack, Decay, Sustain and Release values for the current fx. These range from 00 - ff. Each nibble in both bytes is treated as a single number from 0 - f.
23 f5 A=2 D=3 S=f R=5.

PI: This is an extension to PITCH1 that allows you to enter a greater value for the pitch of the sound.

SP: This is two separate values, each performing a different task. The first nibble determines which, if any, of the three waveforms are to be used or merged. Values to be used are as follows:

[4] Combines wave 2 with the main waveform
[8] Combines wave 1 with the main waveform
[c] Combines all three waveforms

If the main veform is to be used on its own then use value [4] and put a 0 in the [S] section of PS.

The second value on SP is merely a speed counter and can range from 0 – f. 0 is the fastest speed and f the slowest.

WAVE-S: This is used to set up the two secondary waveforms that can be merged with the main waveform throughout the fx as it is played. Each byte uses the same values as given for main waveform. Each of the two waveforms mentioned are directly affected by SP and PS values.

PS: Two separate values again, the first nibble being a pulse value ranging from 0-8. Any values above 8 may effect sounds created after this value. The second number is the length of the secondary waveform that has been chosen.

LENGTH: This is a lo and hi byte format to determine the actual length of the FX currently being played or edited.

RD: This is a pulse control which will give you different pulse forms dependant upon the value (00 – ff).

FX EDITOR main keys

Figure 1 – different keys used within the editor

Function 1	–	Copy FX to FX
Function 2	–	Disk Directory
Function 3	–	Copy FX to FX-BANK
Function 4	–	Load FX data
Function 5	–	Copy FX-BANK to FX
Function 6	–	Save FX (Normal data)
Function 7	–	Save Stand Alone FX-PLAYER
Function 8	–	Save FX-BANK
Keys X / Z	–	Scroll up / Down FX-BANK
Keys + / -	–	Plus / Minus FX number
Left Arrow	–	Auto repeat key On /Off
Return	–	Enter / Play current FX data
Q Key	–	Quick Reference Card (KEYS)
CRSR Keys	–	Move Cursor Respectively

Figure 2 FX EDITOR screen display details.

PITCH1	PITCH2	WAVE	ADSR	PI
00 00	00 00	00 00	00 00	00 00

SP	WAVE-S	PS	LENGTH	RD
00	00 00	00 00	00 00	00 00

FX NUMBER : 00 COPY NUMBER : 00

[00] ..... [33] .....
[00] ..... [34] .....

Using the FX-EDITOR

Once you have loaded the FX-EDITOR there are two different SYS addresses that can be used to gain access to the editor. These are:

32768 ($8000) – Cold start editor. and 32771 ($8003) – Warm start editor.

As you have just loaded the FX-EDITOR you will need to cold start the editor so use SYS 32768. You should now be faced with the main editor screen. If you press the Q key you will jump into the *QUICK REFERENCE CARD* which is just a little aid to help you remember the keys needed to create and store fx.

Storing Effects

The bank facility is an added extra so that you can create a library of named FX, and then create a player to suite your game or program. Press F3 and the cursor will move to the bank section of the screen. Using Z and X to scroll up and down in the bank and CRSR LEFT / RIGHT to choose column one or two.

Once you have chosen the place to store your FX press RETURN and then type the FX-NAME. Press RETURN to enter it into the bank.

F5 key is the exact opposite of 3, when pressed you are prompted to enter a BANK number. When you have entered a number between [$00] and [$65] press RETURN to copy the FX from the BANK to the editor itself.

F1 key is similar to 5 but copies FX to FX using a number between [$00] and [$0f].

FUNCTION keys 4, 6 & 8 are self explanatory, just enter the filename required and press return. All three functions have an error check routine provided.

Your First FX

First enter the data provided below and we will go through what each value does.

```
Line 1  -  00  06  44  06  45  0a  0b  60
Line 2  -     40  00  61  45  10  00  00
```

Press RETURN and you will see that the values you have just entered have given you a *lazer shot* effect, quite good eh! Now lets see how we can change it around.

First we will change the second value (hi byte) of PITCH1 to [16] and press RETURN. See how the effect changes dramatically from a low pitched lazer to a very high pitched lazer. We can also use the ADSR to adjust the volume and length of the FX: A=1 D=f [1f] / S=0 R=4 [04], note that the volume is higher and the FX is cut short.

If we change SP to [80] and change WAVE-S (lo byte) from 00 to 81 you will hear two different sounds being combined to create one FX. PS if changed (try [65]) will give you a variable pulse speed. Notice the higher pitch because the pulse is quicker. The S value of PS is the length of WAVE-S (hi-byte.

LENGTH if changed will give you a long or short fx, try using [40] [00] or [00] [10]. Finally try the RD value which in simple terms gives a set RanDOM pulse value [f9].

The best way to learn about the FX-EDITOR is not to read about it but to actually play with it and fiddle. We have included a few FX for you to look at and use in your own programs if you wish.

```
FX # 1  -  00  11  00  04  21  F9  99  41
             40  41  83  20  00  10  00
FX # 2  -  FF  FF  FF  F6  81  3A  19  55
             80  61  11  60  90  90  FF
FX # 3  -  00  2F  13  3F  13  0B  59  2B
             CF  81  00  10  03  00  00
```

MACHINE-CODE INTERRUPT

```
INTERRUPT SEI          ;Disable interrupts
          LDA < INT    ;Get lo byte of interrupt
          STA $0314    ;Store at interrupt pointer (LO)
          LDA > INT    ;Get hi byte of interrupt
          STA $0315    ;Store at interrupt pointer (HI)
          CLI          ;Re-enable to basic
INT       JSR $CO06    ;Call FX PLAYER
          JMP $EA31    ;Jump to main interrupt routine
```

BASIC USER INTERRUPT (Add to your program!)

```
10 FORT=0 TO 20:READ DT:POKE 896+T,DT:NEXT
20 SYS 832:PRINT "DONE":END
30 DATA 120,169,141,141,20,3,169,3,141
40 DATA 21,3,88,96,32,6,192,76,49,234
```

If you have no previous knowledge of machine code or hexadecimal, then use the set values [$CO] otherwise change the reversed numbers to the address you set the player.

Creating a Stand-Alone Player

This is the main objective of the actual *FX-EDITOR*. A player that will run independent of the editor and can be placed at any location in memory.

When you have designed all of the FX that you require for your game/program it is time to create the player.

To create the player you must have all of the FX needed stored in one of the 15 different easy access FX. When this is done press F7 key and you will be asked for a player address. This is the address at which you would like the player to reside and can range from [04] (SCREEN) to [fc] (KERNAL-ROM/RAM). For now we will use [c0] ($c000) so enter CO (RETURN) or use your own. The editor will now save your stand alone player. Use F2 to get a disk directory. Notice the editor takes up 4 BLOCKS on the disk, this will never change no matter how many fx you use!

Using The Stand Alone Player

This is probably the hardest part of all as you require a small interrupt to run the player in real time.

For machine code users this should be no problem, you can use the program below or just put a JSR $ --06 in your own program, -- is your player address in this case CO.

Basic-users must set up an interrupt using data statements to place the machine code in memory, again you can create your own or use the one provided!!! YC

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The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

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The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:

This symbol means that the program is available on cassette.

These programs are available on disk.

Please Note

Since the programs supplied on cassette are total working versions of the program, we do not put disk-only programs on tape. There is no sense in placing a program that expects to be reading from disk on to tape.

APRIL 1988

AUTO START MAKER — Give your disk programs that professional look by making them auto-start (C64 Disk Only).
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Cassettes or disks are available from March 1986. Please ring the editorial office (01-437 0626) for details of these.

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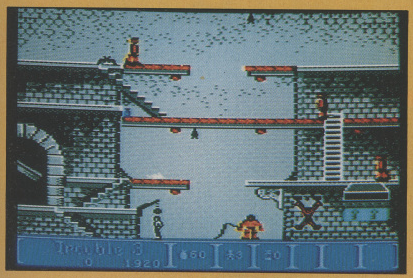


Dark Castle

All computer games tend to follow certain fashions. Somebody comes up with a new idea and within the next few months, there are a dozen clones on the market. Recent examples would include Gauntlet type games and vertically scrolling shoot em-ups. If we keep to the fashion analogy, then Dark Castle, the latest game from MirrorSoft is best likened to flared trousers! Something that you thought disappeared years and years ago but about which there is always the odd rumour of an impending comeback. (What is wrong with flares? I still have several pairs in my wardrobe-Ed) (Enough said – GRH).

Dark Castle is a platform game and perhaps some of our readers are too young to remember the heady delights of Manic Miner and the like but the basic theme is the same. The intrepid hero climbs ladders and ropes, leaping over gaps and all the time avoiding whatever nasties his quest happens to throw at him.

Your quest in this case is short and to the point. Enter the castle and kill the Black Knight. No explanation is given as to why this should be necessary. As in armies all over the world, you are not paid to think, only to blindly carry out orders. So it is that you cross the drawbridge into the castle. It creaks shut behind you cutting off your only line of retreat.

Finding yourself in the entrance hall, you are confronted by four doors. These lead to areas known as Fireball, Shield, Trouble and Black Knight. Select one and the game begins in earnest.

At the start of the game, you have only a bag full of rocks to defend yourself with. How quickly you learn how to master the art of throwing these determines how long you are likely to stay alive. You can adjust the angle at which you release the rocks from up above your head to somewhere just missing your toes. As various creatures start aiming themselves at you, a working knowledge of basic trigonometry could prove useful.

Bats start off attached to the ceiling and this offers your best chance of hitting them. Better a stationary target than a moving one. Vultures line up like squadrons of mediaeval space invaders. The floors are infested with rats. Bites from these, whilst not fatal, do require an elixir to rid you of such wonderful diseases as plague and rabies.

Apart from these minor inconveniences, it only remains to avoid the guards, mutants, henchmen, gargoyles, dragons and the like. Many of these are only stunned when you hit them and quickly regain their previous menace. This wonderful assortment of fauna doesn't poison you, it merely kills you. Fortunately, some kind person has left lots of bags of boulders casually lying around the dungeons, just waiting for you to pick them up. There is also a reasonably plentiful supply of elixirs.

Before you get to meet the big baddy, you will have to find a key that lets you into his domain. Gossip also has it that you stand precious little chance of winning the final encounter unless you also have the knowledge of fireballs and possess the shield. The wizard is the man to see about the secrets of fire. Once gained, every boulder that you casually toss around will become a ball of the hottest flames, burning to a crisp everything that gets in its way. The shield, when found, will render you temporarily invisible and so must be used sparingly.

The castle itself does not seem to hold many terrors. There is the odd trap door but most of the damage is done by its guardians. My favourite amongst these has surely got to be the whip henchman. Casually flogging some poor prisoner, he stops only when you creep up behind him and belabour him about the head with a handily placed mace.

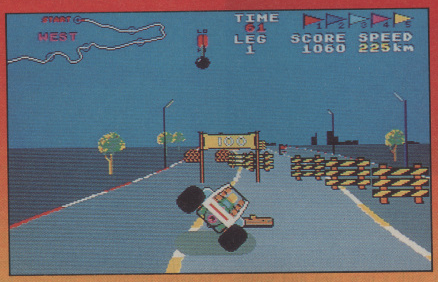
Graphically, I found the game very disappointing. The characters are small and jerkily animated. Colour is almost non-existent and the overwhelming impression is grey. The whole thing looks very dated. Sonically too, some of the effects and music are way off beam, especially a horrendous rendition of the opening of Bach's famous Toccata.

All this had the effect of putting me off the game. Gameplay itself is not too bad although a little fiddly but overall, Dark Castle failed to capture my imagination. And that is despite being a fan of platform games.

G.R.H.

Touchline:
Title: Dark Castle. ***Supplier:*** *MirrorSoft, Athene House, 66-73 Shoe Lane, London EC4P 4AB* ***Tel:*** *01-377 4645.*
Price: £8.99 (Ca) £12.99 (Disk).

Buggy Boy



If games like Pole Position let you pretend that you are some great Formula One racing driver, it is difficult at first glance to see the attraction behind other car simulations. As is often the case though, first impressions can lead you astray. Buggy Boy, Elite's conversion of the Tatsumi arcade game, offers the one ingredient that seems to be missing from a lot of the present crop of computer games – it is great fun to play!

Certainly, your car is no Ferrari. The Baja Bug looks more like a jeep with four badly swollen tyres. But then how many Ferraris do you know that can hit a log at over two hundred kilometres per hour, bounce off it, fly through the air and land safely on the other side?

There are no other cars to compete against either. It is simply a case of you against the clock and the obstacles. The obstacles usually win.

There are five different tracks to test your skills on. The first one – off road – is simply a continuous loop. Complete one lap and you get to go over the same ground again and again. The other four, with the original names of north, south, east and west take you off into the sunset or towards the icy wastes depending on which direction you choose.

The object of each course is to reach the next staging post before your time runs out. Success gives you an extended play allowing you to aim for the next one and so on.

Control of the car is straightforward. All controlled via the joystick, it consists of a simple left, right, accelerate, brake and a choice of low or high gear. Most of the time is spent going flat out in top gear. The only time you really need to change down is after you have hit something. Driving is not the problem though. It is the obstacles.

Hitting a wall or tunnel or driving off a bridge into the water tends not to do your car very much good and you come to a complete standstill wasting valuable seconds. Colliding with boulders, gates, barrels and the like rolls the buggy head over heels. You slow right down but don't actually stop. One way, and indeed sometimes the only way to avoid a hazard is to deliberately drive into a log. This causes you to bounce and hopefully fly over a series of gates blocking the road or whatever. Another trick is to make use of any banked track that happens to be around. Hitting a mole hill or tree stump flips the buggy onto two wheels. It is perfectly safe to drive like this providing that you know how to get down again. It is all too easy to tip the car over by steering the wrong way.

Points are awarded according to how far down the road you get before your time runs out. There is however another major source of points and one that is more than likely to cause your downfall. Scattered all over the track are a series of coloured flags and gates. Hitting a flag or driving through a gate gives you the point value associated with it. These range from 30 to 500 points and the problem is that all the high scoring ones are cunningly placed near the obstacles so that should you try to aim for them, you considerably increase the risk of your having an accident. Hitting the coloured flags in the correct order gives you a few seconds to collect bonus points from the flags and gates and you can also collect extra time. Driving through a 'time' gate adds two seconds to your clock. This might not sound very much but it can make the difference between reaching the next stage or not. Again, you have to make sure that you don't hit anything or you end up losing more time than you gain. Occasionally bonus objects appear such as footballs that disappear satisfyingly into the distance when you hit them.

The game looks bright and colourful although the graphics are not in the top notch and some such as the explosion when you crash are downright disappointing. Sadly as well, Buggy Boy is bugged which is something of a bung**. If you manage to land on top of a boulder or on the edge of the river, the game simply hangs up. That apart though, Buggy Boy really does have that 'just one more go' feel to it and I thoroughly enjoyed playing it.

G.R.H.

Touchline:
Title: *Buggy Boy.* ***Supplier:*** *Elite, Eastern Avenue, Lichfield, Staffs WS13 6RX.* ***Price:*** *£9.95 (Ca) £14.95 (Disk).*

BARD'S TALE III

You know the old saying that "when the going gets tough, the Bard goes drinking". In the third biggest and best game in the Bard's Tale series the Bard will need a lot of drink since it's going to get very tough.

Now Skara Brae is in ruins, the equipment shop, Roscoe's emporium and most of the taverns are little more than a pile of rubble. The Mad God Tarjan has been at work.

Soon you discover that Skara Brae was not the evil one's only target and he now must be stopped. What you now face makes your encounter with the evil Wizard Mangar seem like a fond memory. Armies of Paladins and Archmages have fallen but now great heroes once again form into a small party this time to do battle with the Mad God himself. In your party should be a thief as the thief could be the only way to complete your hazardous quest that leads from a starter dungeon to battles across seven dimensions and a final conflict with Tarjan himself.

However, those battles are many weeks away as your meagre level one and two characters that begin the game have enough trouble staying alive against vipers and bandits and must put ideas of grappling with gods out of their mind until they've at least conquered the starter dungeon.

Bard's Tale fans will of course know that in these a starter dungeon means you have to be over level 10 to stand a chance of taking out Brilhasti ap Tarj whose a nasty piece of work and one of Tarjan's minions. So inevitably your first session consist of quick forays into the Tarj's lair to grab some experience points, treasure and maybe even some weapons since there's nowhere in the town left to buy them.

Luckily, the review board still stands but is now only manned by an old man but he can still review your chances for advancement. Class changing, provides a source of information and procides over changes in class.

Bard's Tale III has not only 500 monsters, over 100 spells, seven dimensions and 84 dungeon levels to explore, it also has two new classes of magic user.

The Chronomancer takes a lot of developing as he must have learnt all seven levels of spells in three classes then he becomes the magical equivalent of a taxi to take you to the other dimensions. They lose all the spells they learnt to become a Chronomancer but gains access to some particularly effective spells that can send and retrieve people from the grave, cure old age and at the highest level cause up to 1500 points worth of damage with a Fatal Fist spell.

Many Bard's Talers feel that fighters have a raw deal as they keep the magic users alive long enough to gain in power but then they fall behind. In Bard's Tale III a fighter can also wield magic by becoming a Geomancer.

The fighter can be changed from anything from a Bard to a Hunter, Rogue or Monk and must find the single location in the game where he can change. If he does this he loses all his previous special abilities, such as a Bard will loose his songs, a Hunter his critical hit ability, a Monk his armour class bonuses, in return for predominantly offensive spells.

Most will feel the transition is worthwhile as the level one spells include the Earth Dagger that cuts down a group from 40 feet for 200-800 points of damage, Earth Song, reveals all the booby traps in the area and Earth Ward zaps them all. Then the spells can wipe a group of enemies from 50 feet. It costs 80 spell points but it's quite effective.

Bard's Tale III is not only bigger than the others it is also better as now a built-in map function guides you around the wilderness and provides dungeon maps while underground. If you look far enough you'll find the one and only tavern that's still serving drinks to top up your bards, a shrine for some quick but pricey cures and the refugee camp where you can add new characters to your party. You can now also save the game at any time and any place which cures one of the minor quibbles that spoilt it's predecessor.

The result is an extremely playable and enjoyable game that's the software equivalent to a good book as you just won't be able to put it down. I've been exploring the game for days now and have a party of level nine characters that are now ready to delve deeper into the game. However, I'm still a long way from reaching another dimension or even deciphering the three level cardboard wheel included in the game box.

If you want to cut corners you can load in your party from Bard's I or II but I wouldn't recommend it. Instead savour every minute of this exceptional game. **T.H.**

Touchline:
Title: *Bard's Tale III – Thief of Fate.* ***Supplier:*** *Electronic Arts, Langley Business Centre, 11-49 Station Road, Langley, Nr Slough, Berks. SL3 7YN.* ***Tel:*** *0753 49442.* ***Machine:*** *C64.* ***Price:*** *£14.95.*

C64 Sampler

OK, so the sound out produced using this program may not be studio quality but playing with your own sound samples is great fun!

By S.R. Thom

Ever since my early days with my trusty C64 I have wanted it to sample sounds so I could play them backwards, forwards and at different speeds. The only way that I was able to do this was by using fairly expensive hardware. Until now that is.

C64 SAMPLER uses just your C64 and Commodore cassette recorder to sample sounds. Although the sample quality is not as good as an expensive sampler some excellent results can be achieved.

The program allows you to create two different types of samples. The first type of sample lasts for about two seconds and can be cropped and played forward or backwards at different speeds. The second sample lasts quite a bit longer at around 13-14 seconds. However, this cannot be played at different speeds.

Getting Going

When you start C64 SAMPLER a menu appears that will offer you the following choices:

1.. Cue tape
2.. Sample (L)
3.. Sample (S)
4.. Play Sample
5.. Menu 2
6.. Quit

The first option allows you to cue your tape to the correct position for your sample. When you press play on the cassette recorder, whatever is on the tape can be heard through your TV speaker. Once the tape is positioned correctly, press the spacebar and you will return to the main menu. The tape will stop at its current position and not turn again until you either select option 1 again or select one of the sample options.

The second and third options are the two sample options. Selecting the option 2 makes a long sample of the sound. To use it you must first press play on the tape before selecting the option, otherwise you will end up by loosing valuable sample time while pressing play. The same applies for the short samples (3).

Play sample, plays back the sample which you have just made. If there isn't one in memory then this command will not work.

Option 5 moves you onto the second menu which is explained later.

The last option allows you to quit the program, to restart it type in RUN. If you had a sample in memory at the time of exiting the program. Type **SYS 2080** to return to the program without losing the sample.

MENU 2

The second menu has options which allows you to play the sample forwards, backwards and change the speed. The second menu has the following options:

1. Play sample in reverse
2. Change the speed of sample (S)
3. Manual play (S)
4. Crop sample
5. Screen help
6. Kill sample
7. Main menu

Note the options with an (S) on the end indicate that this is for short samples only.

Option 1 is self-explanatory. Upon pressing 1 you are asked if you wish to play the sample backwards or forwards.

To change the speed of the sample use option 2. This will only alter the speed of a short sample. The current speed of the sample is shown. Pressing the '+' sign increases the number, decreasing the speed and the '-' sign to decrease the number, increasing it. This option changes the speed of playback for both forwards and backwards playing. To exit press the runstop key.

The manual play option, which again only works when a short sample has been made, allows you to play your sample, cropped or otherwise, at set speeds either backwards or forwards. It is similar to a piano only the samples do not play a proper scale. The keys used are **Q,W,E,R,T,Y,U,I,O,P** which play the sample forward at different speeds starting with the slowest speed assigned to **Q** and the fastest speed assigned to **P**. Keys **A,S,D,F,G,H,J,K,L,** play the sample backwards at different speeds. Press the runstop key to end this selection.

If there is a small part in your sample which you wish to extract and play back then you use the crop sample option. This gives you the choice to restore the values back to default so you can hear the whole sample again or crop the sample. When you select

to crop the sample press *SPACE* to start the sample. To mark the beginning of where you want to crop the sample press the *CTRL* key then press *SPACE* to mark the end of your sample. When you press *SPACE* the sample will stop and the new sample can be played back by selecting option one and pressing 'F' for forward. If you make a mistake then simply do the same process until you get the sample you require. Pressing Run Stop returns you to menu 2 again.

Menu option 5 gives on screen help just in case you get into a muddle. The on screen help is only very brief.

The last option is kill sample. If you get fed up of your sample then select option 6 and the computer will ask if you wish to clear the computers memory. At this prompt you should either press Y or N.

How It Works

When I produced the program I tried to keep as much memory as possible free for the sample area. The program has 1024 bytes of machine code low in memory between $0801-$0C00 or for those who prefer it in decimal 2049-3072. This merely contains the shell of the program such as the menu drivers. The actual sampling routines are located under the Kernal ROM at $E000-$FFFF or 57344-65535. Not all this area is actual coding. The first half of the Kernal contains the screens for the two menus. Each screen takes up 2K bytes of RAM. 1K for the screen data and 1K for the screen colours. The actual code starts at $F000 or 61440. The Help screens are located under the VIC/SID I/O area which is at $D000-$E000 or 53248-57344. There are four screens each 1K bytes long. In order to get at all these routines some bank switching has to be done.

I had thought of placing the whole program under the Kernal ROM but then hit upon a problem when I wanted to use kernal routines such as the *Chrout* routine. This was because when the kernal is switched out you are unable to use it until you switch it back in again. I decided to split the program and have half of the program in the Basic area of RAM and the rest under the ROMs.

The actual sampling routines are quite simple. They use the same idea as the normal kernal loading routines. The key location is $DC0D or 56333. This location changes when a tape is playing into the computer. Bit 4 of $DC0D is altered and can be either set or not. When it is set then the computer pokes 54296 with 15 thus producing a click. When the bit is not set then a 0 is placed in 54296. This has to be done very quickly in order to get the best quality sample. All interrupts are turned off and the screen is blanked to get as much speed out of the computer as possible. Because there is only one bit affected the sample is unable to reproduce amplitude, if it samples something too quiet then it will only pick up small parts of the sound. The short sample routine is the simplest because the computer reads the location $DC0D and checks to see if bit 4 is set. If it is then it not only places 15 in 54296 but also places it in RAM. If the bit was not set then

it places a zero in RAM. By the end of the sample the memory between $0C00 and $D000 will be full of either $0F's or $00's.

It becomes an easy task to reproduce these sounds once in memory by reading them back out of memory and storing them directly into 54296. However, this is a waste of good memory only storing one bit of information in an eight bit memory location. I therefore made a routine which reads $DC0D and checks if the bit is set or not. If the bit is set then the computer sets the carry flag. If the bit is not set then the computer clears the carry flag. Then the carry flag is rolled onto an eight bit number. This is repeated eight times so that at the end you get an eight bit number containing eight times more information than the previous method. This is then stored in memory. Then to play back the sample the bits are rolled back into the carry flag. If the carry flag is set then $0F is placed in the SID volume and if the carry is clear then $00 is placed in the SID volume (54296). That is all there is to it. The reason why you can not change the speed of a long sample is because the routine is too long and can only just playback the sample at the normal speed.

While writing the program I was going to add a load and save feature but decided against this when I realised that it would take far longer to save the sample to either tape or disk than it did to make the sample in the first place.

Getting it all in

The program is quite large and will take quite a bit of typing in. There are three sections to it which need to be typed in. When they are all correctly typed in the programs will read the data and store it in the basic area starting at $0801. It is for this reason that there is a little boot program which is to be typed in and run first. This program relocates the start of basic by poking locations 43 with 1 and location 44 with 64 and then performing a NEW. The program then loads the first data loader called DATA1. When run DATA1 will read the code and start to store it in memory. When this has been done the program will load DATA2 into memory and will run. Then when this program has finished it will load the final data loader called DATA3. When this has read all the code it will ask you to press return to save the program. Ensure, if you are saving to disk, that you have a disk with enough space on it, about 47 blocks or more should be enough. If you are using tape then you should change all the ,8's you see to ,1's.

All the programs have a checksum at the end of each line. However if the program gives an error and the line number it gives you does not have an error in it then try looking at the line before it or the line after it.

Hints and Tips

When sampling a sound it is best to look for sounds which are not too complex and are clear. A whistle will sample quite well. It is best to experiment with different sounds and see how well they sample. You could start by sampling a Commodore 64 computer tape. YC

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BASIC 8

Unleash the hidden graphics power of your 128. At last, your Commodore 128 can rival the 16 bit micros! Imagine your 128 in 80 columns producing a resolution of 640 x 200 in mono and 640 x 192 in 16 colours without any additional hardware! (640 x 400 version available soon.) Sounds impossible? Not with Basic 8, the new graphics language extension.

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New from SOGWAP Software Inc., The Big Blue Reader is ideal for those who use IBM PC compatible computers at work and have the Commodore 128 or 64 at home. The Big Blue Reader is not an MS-DOS emulator, but rather a unique and easy way to transfer word processing, text and ASCII files between two totally different formats, Commodore and MS-DOS. The Big Blue Reader requires a 1571 on both the Commodore 128 and 64 and will not work with a 1541 or similar drive. **Only £34.95.**

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The drive box allows you to easily change the device number (8, 9, 10, or 11) of your 1541, 1571, 1570 or 128D computer. It will, as a bonus, allow you to bypass the write protect sensor, allowing you to write to the back side of the disk without cutting a notch. Installation requires a little soldering. **Only £19.95.**

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At last, an 80-column high-resolution drawing package that's powerful and easy to use. Create colourful graphics or have Page Illustrator assist you in drawing simple geometric figures. Create clip-art from any portion of the screen, then mirror, reverse, or flip it. Import graphics from popular drawing packages for your own creations. Page Illustrator is a window and Icon system presented in the Amiga Desktop style. **Only £29.95.**

THOUSAND Characters per second loading rate. Software for this new drive includes, VizaWrite Classic, HackPack, Petspeed, Oxford Pascal, CAD PAK, Chart Pack, Fontmaster, Spellmaster and much more. Using a package called Super 81 Utilities most software can simply be copied across to the new format. The drive is available for **£184.95.**

The CP/M Kit & Users Guide

The CP/M Kit introduces and explains the unknown, third mode of the C128. The CP/M Users Guide is a 300 page book by Abacus Software covering all aspects of CP/M. Subjects which include the system disk, resident commands and disk copying are described in detail. The CP/M kit contains over 20 CP/M programs including a word processor, chess game and a disk cataloguing program accompanied by a detailed guide to running programs in CP/M. The CP/M kit and Users Guide. **Only £34.95.**

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Disk Monitor

Talk directly to your disk drive with this handy utility for the C16 and Plus/4

By Mark Jaycocks

Disk Monitor is a utility program for the C16 and Plus/4 primarily written to get access to the drive's internal memory and to unscratch, lock or unlock any file on disk. It has these facilities and many more to make it into a powerful disk utility. Some of the commands write directly onto a track and sector so it is advisable to make a copy of the disk before starting, as one error could possibly damage the disk you are working on and make the data unrecoverable.

Typing It In

Type in the program **CHECK LOADER** and RUN it. Once executed type **MONITOR** to enter **TEDMON** (the built in machine language monitor). Now type **S"MEM CHECKER 600" 8 600 686** and Press RETURN. This is used later on to check that the data is entered correctly.

Type **F 1000 3FFF 00** and Press RETURN. This clears the memory from $1000 to $3FFF. Type in the **MONITOR M/C** listing, once entered type **L"MEM CHECKER 600" 8** and press RETURN. This will enter the check program into memory. To check the program type **G 600 3 1000 37EC**. Change the 3 to a 4 for use with a printer. To pause the listing press CTRL+S or use the commodore key to slow it down. Check the listing against **TABLE 1** and if there are any differences then check the corresponding piece of memory. To save the program type **S"FILENAME" 8 1001 37EC** and press RETURN. To exit from monitor type **X** and press RETURN. Execute the program type **sys4112** or type RUN and press RETURN.

Commands

The commands are presented (apart from the commands in monitor and memory) in menus. All numerical inputs and outputs are in hex.

Main Menu Commands

DISK –upon selection another menu called DISK MENU is presented.

FILE – upon selection another menu called FILE MENU is presented.

MONITOR – this command allows you to view and alter specified sectors. It works in a similar way to TEDMON and has the following commands.

+ – this will read the next track and sector into the buffer.

X – this returns you to the MAIN MENU.

> aa xx xx xx xx xx xx xx xx – this command alters up to 8 bytes of memory from the specified address in the buffer.

M xx xx – this command will display memory from the buffer in the specified range. If the address is omitted then the first 8 bytes of the buffer will be displayed.

R xx xx – this command will read a track/sector directly off the disk into a buffer in the computer.

W xx xx – writes the buffer to the specified track/sector.

DATA MAKER – this coverts a program file into data statements and writes them back to the same disk under a different filename.

PRINTER OPTIONS – this command produces another menu called PRINTER OPTIONS.

EXIT – this returns you to basic. Re-entry to disk monitor is done by typing SYS4112 and pressing RETURN.

TABLE 1

1000	52	1050	1E	10A0	CF	10F0	4A	1140	3D	1190	16	11E0	35
1230	FE	1280	B2	12D0	F2	1320	C9	1370	EC	13C0	F5	1410	8D
1460	24	14B0	3B	1500	C1	1550	17	15A0	67	15F0	DF	1640	74
1690	CF	16E0	D7	1730	ED	1780	2E	17D0	6F	1820	5A	1870	7D
18C0	74	1910	E7	1960	D0	19B0	06	1A00	09	1A50	00	1AA0	52
1AF0	B8	1B40	C1	1B90	65	1BE0	5D	1C30	82	1C80	07	1CD0	3C
1D20	EB	1D70	E8	1DC0	AD	1E10	10	1E60	28	1EB0	B6	1F00	41
1F50	19	1FA0	8D	1FF0	BE	2040	22	2090	3B	20E0	A5	2130	BE
2180	7F	21D0	EF	2220	AF	2270	C6	22C0	E1	2310	EE	2360	20
23B0	D5	2400	62	2450	E2	24A0	D1	24F0	FF	2540	CB	2590	67
25E0	CD	2630	7C	2680	2F	26D0	4A	2720	B6	2770	1B	27C0	09
2810	82	2860	95	28B0	8D	2900	C4	2950	87	29A0	8D	29F0	E6
2A40	8B	2A90	50	2AE0	20	2B30	2D	2B80	D4	2BD0	8B	2C20	66
2C70	74	2CC0	1E	2D10	B6	2D60	BF	2DB0	4B	2E00	B8	2E50	C8
2EA0	6F	2EF0	C6	2F40	C8	2F90	85	2FE0	B8	3030	2E	3080	03
30D0	75	3120	D4	3170	64	31C0	3E	3210	0A	3260	CC	32B0	11
3300	A8	3350	1A	33A0	95	33F0	D8	3440	3B	3490	11	34E0	C9
3530	82	3580	41	35D0	E3	3620	BE	3670	98	36C0	80	3710	EA
3760	D0	37B0	26										

Disk Menu Commands

DRIVE – this allows you to change the drive you are working on. (0-1)

UNIT – this allows you to alter the disk unit you are working on. (08-0F)

DIRECTORY – this displays the directory of a disk giving the size of the file, the track and sector of the first block of the file, the filename and filetype including deleted files. If the file is a program file then the start address is given.

COLLECT – this command frees up space allocated to improperly closed files and deletes reference to them from the directory. If a file has been unscratched from the monitor by setting byte 2 in a scratched file entry from $81 to $84 or $C1 to $C4 then this will allocate blocks to that file.

INITIALISE – this command initialises the disk drive and re-reads the current diskettes BAM (Block Availability Map) into the drives internal memory.

FORMAT DISK – this commands prepares a new diskette for use. If a disk has previously been formatted then omitting the i.d. number will perform a quick format, which just clears the disk's directory.

ALTER HEADER – this allows you to change the disk's name and i.d. number.

VIEWBAM– this allows you to view the Block Availability Map and to see which blocks are free or allocated.

EXIT – this returns you to the MAIN MENU.

MEMORY – this allows you to view or alter the drives internal memory. It works like TEDMON and has the shown commands.

X – this exits the memory command and returns to the DISK MENU.

M×××× ×××× – display contents of the drives memory between specified address range. If the address is omitted then one page of data is printed.

> ×××× ×× ×× ×× ×× ×× ×× ×× – used to alter between 1 and 8 memory locations, from the specified address, at a time.

G ×××× – to executed a routine in the drives memory.

T ×××× ×××× ×××× – to transfer a block of memory to another location in memory.

H ×××× ×××× **data** – to search for the specified data between the specified address range. Ascii data must be preceded by a ' and multiple data or hex codes must be seperated by a space. Upto 32 bytes of data are allowed.

F ×××× ×××× ×× – to fill the specified range of locations with a specified byte.

D ×××× ×××× – to disassemble machine code into assembly language between the specified address range. If the address is omitted then one page of data is printed.

A or . ×××× opcode operand – to enter a line of assembly code.

P – this command when preceding the M and D commands will divert output to printer.

S"file name" ×××× ×××× – this saves the contents of the specified memory, upto 255 bytes long, as a utility user program. This program can be loaded in by typing in basic OPEN 15,8,15,"&0:filename":CLOSE15: This works on the 1551 by loading the user program into the disk's internal memory, to the place it was previously saved from, and then executing it.

L"filename" – this is the same as the DOS command "&0:filename"

File Menu Commands

TRACE – this will trace a specified file, and display all sectors belonging to that specified file.

LOCK – this will lock specified files allowing those files to be write protected so that they cannot be scratched via the scratch command.

UNLOCK – this is the opposite to the above.

SCRATCH – this command will delete any unwanted files (accept locked files) from disk.

UNSCRATCH – this command tries to recover any erased file from the disk.

ALTER START ADDRESS – this allows you to alter the load address of a program file.

EXIT – this command returns you to the MAIN MENU.

Printer Options Menu

ALTER DEVICE NUMBER – this allows you to change the printer device you are working on. (4 –6)

ENABLE PRINTER – this activates a interrupt driven machine code routine which allows any screen to be printed to the printer by pressing SHIFT/CONTROL.

DISABLE PRINTER – this de-activates the interrupt driven routine.

EXIT – this returns you to the MAIN MENU.

Disk Editing

All the necessary information needed to start you off can be found in :-

YOUR COMMODORE DISK USERS HANDBOOK (supplied with the December 87 issue of YOUR COMMODORE.)
and

YOUR COMMODORE SERIOUS USERS GUIDE

Writing on the Desk

Desktop publishing is the current computer buzzword, but what does it mean?

By Eric Doyle

One man's desktop publishing program is another man's wordprocessor – the mere mention of DTP is guaranteed to create an atmosphere of confusion. In reality the true desktop system is the next stage on from word and image processing, the combination of pictures and text to form the finished printed page.

The C64 has several utilities available which can all be described as desktop products but each takes the principal one step further along the pathway to true, finished page production. At the rudimentary end comes The Print Shop, Newsroom takes things one step further and joint top honours go to Geowrite and Stop Press

This covers the range from simplicity to sophistication but, although the top two programs can serve many of Print Shop's functions, each program has its own target audience. Sophistication means complexity and expense, if your needs are humble why buy a Porsche when a Fiat will do.

The Print Shop

This program is aimed at Bill Stickers and his kin. The program produces respectable signs, letterheads, birthday cards and banners for all occasions from personalised greetings to jumble sale flyers.

The Print Shop has a rigid structure of sequential menus which means that anyone can use it with a minimum of tuition. A typical page would consist of a border surrounding text with a large single image or several repeated images set around the page in one of several fixed grids. The text can be superimposed over the illustrations or can be skilfully planned to surround the images.

Artwork for the illustrations can be self-designed using The Print Shop graphic editor or modified from a library of images which is commonly known as clip art. Don't expect images of great complexity, they are cartoon line drawings which vary in quality from silly to sensible: something for everyone.

Text space is at a premium with only ten, 18 character lines at your disposal but with a little judicious editing this could prove more than enough for most small notices. The text is entered into the program via a very crude wordprocessing system which is little more than a series of input lines which allow little more than centring or left/right justification.

An additional kaleidoscope generator routine is included so that a psychedelic pattern can be created. This can then be used as a pretty wild background for any notice that is produced. The patterns are really wild, freaky, sixties stuff which would probably look great if the caption read 'Peace, man', still if flower power ever makes a comeback you could corner the poster market.

The Newsroom

Like The Print Shop, the structure of Newsroom is fairly rigid and offers the user options rather than creative freedom but it is one step closer to professional DTP.

Newsroom splits the page into 'panels' which are individually designed and then assembled at the print stage. The panels represent an eighth of a page block which gives dimensions of a quarter of an A4 page in height and half its width. Documents produced in this way would therefore consist of two columns of four panels. The title page can use a modified form of this arrangement by combining the top panels in each column to form a banner for the title of the newspaper.

The page is created from the Newsroom's graphic menu which shows the various departments of the production team in cartoon form. By selecting the Photo Lab, Copy Desk, Banner, Layout, Press, or Wire Service departments, the program will take you to the relevant area of the production cycle.

First impressions are important and the banner design is important because it gives the publication its identity in true newspaper tradition. The special format of this section allows larger letters to be used across the top of the page and this can be given a personal touch by adding clip art items from Newsroom's own library.

Letters can be selected from a bank of five fonts: small and large serif and sans serif or large old English. The restriction is for one small and one large font for each panel but any combination can be used for the banner.

Once the banner design is complete, the individual articles can be added to the page. On a banner page only six panels are allowed. Each panel is created separately so pages have to be carefully planned before starting.

The page is split into two columns of three panels which can mix clip art and text. The two column format cannot be disguised but each column can be given continuity by running text on from one panel to another. With care, even clip art can be split across the boundary of two of the panels.

Although the word clip art is usually being bandied around, it's not quite as simple as this. The clip art has to be processed first in the Photo Lab where an image can be built up from individual items and art library images. Like Print Shop, the art consists of a range of cartoons which can be modified through the Lab's graphics toolbox.

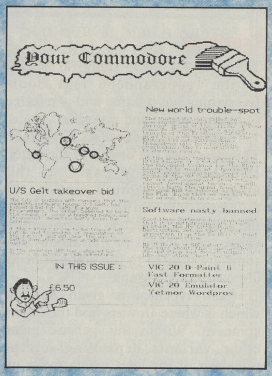
After processing the image, it can then be 'photographed' and stored in a photo library for inclusion in a panel. Photographing merely consists of creating a window around the image and then saving that area to disk.

Once all of the page sections have been created the selected layout can be printed out and the newspaper has gone to press.

The Wire Service option plays no part in the creation of the page. For most people it will be a redundant option because it is devised to allow a page to be transmitted through a modem.

Throughout this description, the Newsroom page has been described as a banner and six panel or as an eight panel sheet. This is true if the normal A4 paper size is used. There is an option to use longer printout sheets on 14 x 8 inch paper and this allows ten panels to be fitted on a page.

The Print Shop uses standard text menus for feature selection but Newsroom moves into the realm of WIMP (windows, icons, menus and pointer) systems by adopting icon option selection. The two products also differ because with Print Shop the designer does the job 'blind'. In Newsroom the screen display shows the panels as they will appear on the final printout. Colloquially, this is known as a 'what you see is what you get' approach, which is where the term WYSIWYG (pronounced wizeewig) comes from. So Newsroom could be described as a modular, icon-driven, WYSIWYG publishing program.



The Jargon Jungle

Step into the realm of DTP and you step into a world surrounded by jargon. A blend of computer speak and printers' terms, the new language needs a bit of clarification before continuing with the top range programs.

The basic informative medium is the written word. This simply consists of letters. Did I say simple? A letter has size, shape and weight, a typographer can wax lyrical about Univers, Baskerville, Helvetica and Times. They speak boldly about lightweight

typefaces, point excitedly at the various sizes of letter available and talk fondly of fonts they have known and loved.

Typefaces

There is no such thing as simple in the typographer's text book. Everything has a name and is referred to by that name and no other.

A letter is produced as a typeface. This describes the design of the letter. Flip through the pages of this magazine and you'll notice the difference between the letters used in the adverts. Characters can be conservative, curvaceous or outrageous and some are stylised to the point of being almost unrecognisable.

Each typeface is given a name which is where Univers and the others come in. Within this generic name come variants depending on the thickness of the lines which make up the letter. In this way the names become modified into ranges like Helvetica Light, Helvetica Medium and Helvetica Bold. In the typesetting world this is known as a font and this is the basic unit in which a typeface is purchased for DTP purposes.

Point size is a measure of the height of the characters and is taken as the distance from the bottom of the descender on letters like 'y' and 'g' to the top of a capital letter or an ascender on 'b' and 'l'. A point is a unit of measure and there are 72 points to the inch. 'By' is a word which spans the full point size of the current font and most magazines use 9pt or 10pt characters which is just under an eighth of an inch.

Leading

The gap between lines of text is known as the leading (pronounced as ledding). This stops ascenders and descenders from running into one another. Sometimes this space is also called the linefeed which can cause a bit of confusion in the minds of computer users because a linefeed on a printer is measured from the top of a row of letters rather than from the bottom of a descender.

When a page is designed the text and picture areas are marked out within a margin which is known as the gutter. This is sometimes used to describe the gap between a left and right page but correctly it is the continuous area around the page which may be partially removed when the finished magazine is trimmed. If an illustration is laid across this area it is said to bleed off the page (all this talk of bleeding into the gutter sounds pretty revolting to me). Unless it is a design feature, text should never be bled which is why the gutters are there.

A line of text can be justified or ragged. Justification gives a straight edge such as this column of text that you're reading. A *Your Commodore* column is described as right and left justified to make each line the same width despite the number of characters that it contains. The eveness of width is created by varying the space between words.

The alternatives are left justified, ragged (pronounced as ragg-ed) right; right justified, ragged left, or centred which produces a ragged right and left. To understand this think of a typewritten page. The carriage return makes sure that each line is vertically aligned but the right edge depends on how many characters are typed. The consequence is that each line has a different length and the right edge is jagged rather than straight.

Proportional Spacing

The final terms which need explanation are proportional spacing and kerning. Letters have different widths and this can be seen by comparing an 'i' with an 'm'. Both characters are allotted the same space on a computer screen but this doesn't give a pleasing result. In printing a line of text each character is allotted a space which is proportional to its width, therefore an 'i' takes up less space than an 'm'.

Proportional spacing works for most circumstances but occasionally two letters are placed together which create spacial disparity. A capital 'V' beside a capital 'A' would align the tip of the 'V' with the foot of the 'A'. This looks wrong and would be improved if the two letters were placed together. This is a special case and can be solved by kerning. No this is not the art of pulling grotesque faces while framing your face with a harness or a toilet seat – that's gurning. Kerning allows one letter to be dragged towards its neighbour to eliminate these unsightly gaps.

Meanwhile, back at the range, the point has been reached to look at the more professional approach to desktop publishing as provided by Stop Press and GeoPublish.

The screen display has a page window with pull down menus above and icon options down to right. In a similar way to Newsroom, the page is created as a series of panels so a degree of pre-planning is necessary to get the overall layout sorted out before starting. Unlike Newsroom, the panels span the full width of the page and the panels have a generous overlap so that graphics or illustrations can be positioned accurately wherever you want them.

The screen acts as a window onto a section of the current page panel but a reduced, overall view of the panel can be displayed via one of the icons. Moving the screen view in the vertical plane is achieved by clicking the mouse button when the pointer is on one of the arrow icons. Alternatively, the view can be changed by selecting the overall view where a frame shows the current screen viewpoint. This frame can be moved freely over the panel and a new area selected for detailed viewing on the composing screen. This method is also the only one available for horizontal movement.

Graphic Toolbox

Included in the icon menu is a graphic toolbox which is used to produce soft and hard dividing lines. The soft lines are used in defining text or graphics areas and don't appear on the printout. Hard lines are printable and can be used to form rules. These are separation lines between articles or frames around images. The toolbox is fairly sophisticated and can even be used to knock up a quick bit of instant art.

When text is entered from either a PRG or SEQ wordprocessor file, it can be made to either overwrite whatever is on that portion of the screen or flow around the graphics area according to your wishes. If the former option is activated, a special inverse option will cause the text, which is normally black on white, to automatically reverse to white when it overwrites a black background. No matter how uneven the transition line is, the inverter can cope.

The autoflow option can be used to skirt around pictures and designs to give a professional look to the page or to fill graphic shapes to give eye-catching effects. Even elipses and circles can be properly filled using autoflow.

Once defined, areas can be filled with predetermined shading or other patterns created with the integral

designer facility. Illustrations can also be pulled in from a clip art disk which contains images that are generally more stylish than clip art for Newsroom or Print Shop.

Self-drawn clip art files can be built up and the package includes an image convert so that the clip art for Newsroom or Print Shop can be converted for use by Stop Press. The big step upwards in graphics is the ability to include digitised images on the page. There is no information in the manual on how these images should be formatted for Stop Press but a digitising service is advertised on the back pages.

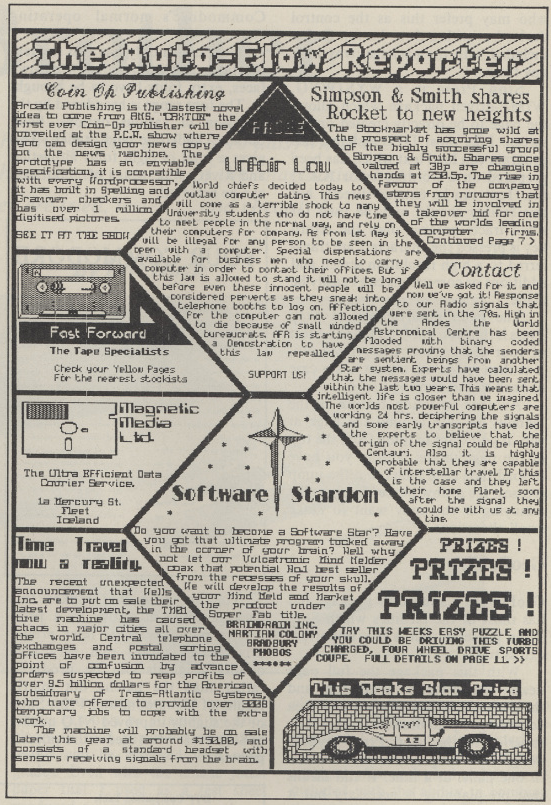
Another useful facility is the ability to zoom in on a small area of the page to fine-tune its appearance at pixel level. This can be used to allow kerning or just to clean up the artwork generally. Selected letters can be customised to create illuminated capitals to create the classical monastic effect.

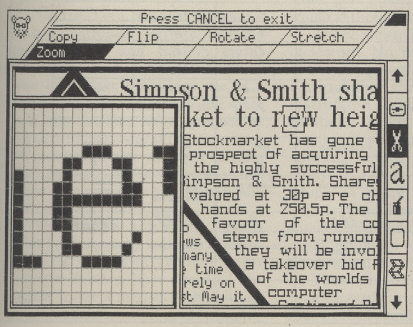
If several characters need to be redefined, why not go the whole hog and produce a typeface of your own? Although there are 32 different fonts to choose from, the program includes a font designer so that the range can be extended at no extra cost. The new character set can then be saved to disk for future use.

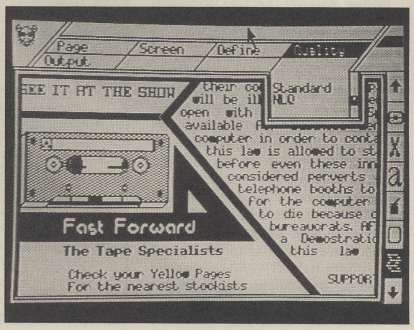
Point size is not fixed as in Newsroom or Print Shop. Before the text is imported from the disk file the point size can be adjusted to suit headline or body text applications.

Stop Press

Produced by AMS, it's not surprising that this is a mouse-driven package. A joystick option is included for those







who may prefer this as the control device but with a three-button mouse included with the package, why look any further?

Stop Press is a WYSIWYG, WIMP-driven package which allows the page to be directly created on the screen. Like most DTP systems, this program can load text which has been prepared on a wordprocessor ASCII file. Text can be entered directly but this facility should only be used for small tracts because once the return key is pressed the characters are transferred to a high resolution screen and additions or corrections can't easily be made.

The main disadvantage of Stop Press is that you don't see the full effect of your design until it is printed out. If it then needs tidying up, it's a case of back to the drawing board.

Another irritating feature is the inability to skip around the page at will. If you want to jump from the top of the page to the bottom you have to load pass each panel that the jump crosses. It's a slow process and can be annoying if you only want to make small alterations.

GeoPublish

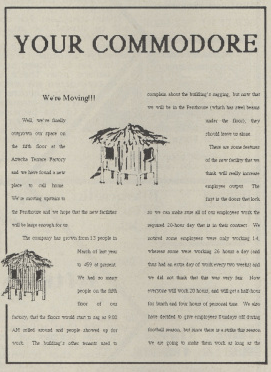
GeoPublish is a full DTP package and has most of the facilities which Stop Press possesses but a few important extras too.

With this package the full page design can be viewed at any time and the screen can zoom in on any area according to your desires. This is vastly superior to the Stop Press keyhold design that only allows an overview of one panel at a time. It still means that pre-planning is necessary but it can be altered at any stage if an effect does not seem to be working out.

Being part of the GEOS system means that the program is mouse controlled but certain keyboard shortcuts can be used. The program can only be booted via the GEOS master disk so the user must acquire a copy of this first. Similarly, owning GeoWrite as the text source is an advantage but a text grabbing program is included to convert other WP files to GeoWrite format.

A page layout is designed first and then the areas can be filled with graphics or text. Images can also be enlarged, reduced or cropped, even if they contain text, and a special smoothing routine ensures no jagged edges such as those which appear when a sprite is enlarged on the Commodore's normal operating system.

GeoPublish only has two resident typefaces and cannot design its own faces, extra fonts have to be brought in. The font range is broadened by the inclusion of various options: bold, outline, underline and italics. This gives a total of eight fonts altogether and a very wide range of point sizes can be achieved.


YOUR COMMODORE

We're Moving!!

The attribute that makes this package more attractive to a prospective publisher is its laser printer driver. This means that very high quality originals can be produced rather than the patchy dot matrix results of Newsroom and Print Shop or the slightly improved NLQ quality of Stop Press when used with a suitable printer.

The Stop Press pixel editor is not duplicated which would have enhanced GeoPublish immensely and there is no facility for using digitised images which would work very well on a laser printout.

Conclusions

A true comparison isn't really viable because the application depends on the user's individual need.

Print Shop is an amusing product with serious applications for those who only need to produce the odd poster. Its simplicity is its main strength and it can be useful when an impending birthday is remembered at the last minute, after the shops have closed!

Newsroom is a good introduction of the DTP world and could be used by schools and clubs to produce a newsletter. The Clip Art library is large and comprehensive but there is a heavy bias towards Americana which indicates its source.

Stop Press is for the serious user who has to produce a better quality document. It is a once and only buy because everything that you need is supplied, including the mouse.

GeoPublish is the top of the range DTP package for the professional. Its laser interface is its strongest recommendation though I preferred the range of facilities included in Stop Press.

The only observation I would make is that, if AMS redesigned their package to give a full page layout display and a laser driver, Stop Press would be the one for me. As this is unlikely, I'll stick with GeoPublish.

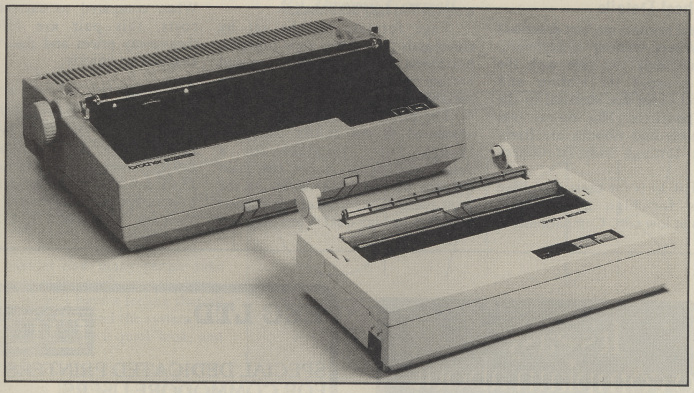
DTP Comparison Table

	Print Shop	Newsroom	Stop Press	GeoPublish
Range of facilities	★	★★	★★★	★★★★
WYSIWYG	✗	✓	✓	✓
Supplied fonts	8	5	32	8
Clip art	✓	✓	✓	✓
Kerning	✗	✗	✓	✗
Text generation	internal	internal	imported	imported
Graphic toolbox	✓	✓	✓	✓
Pixel editing				
Menu system	Sub-menus	Icon	WIMP	WIMP
Digitised images	✗	✗	✓	✗
Printers	Dot matrix	Dot matrix	RS232 Dot matrix	Laser RS232 Dot matrix
Ease of use	★★	★	★★★	★★★★
Special features	Birthday cards and banners	Modem link	Font designer	Full design display
Price				
Supplier				

Brother

The HR-5 thermal printer and HR-10 daisywheel are not new machines by any stretch of the imagination but they are tried, tested ... and cheap!

By Eric Doyle



In the office we have a few Brother daisywheel typewriters which get an occasional airing when someone wants to play the role of a hack sweating over a hot keyboard. The presence of these machines was probably the reason for noticing a couple of Brother printers at the last Commodore Show.

The HR-5 is a compact workhorse with a Centronics interface, nine pin matrix head and battery/mains operated. This makes it ideal for those who only make occasional use of a printer and cannot afford to give space to a large machine. When grabbed by the urge to make a printout, the owner of such a machine can take it from the cupboard, shove any reasonable piece of paper over the platten and start printing immediately.

The fact that this has a thermal print-head does not limit the machine to using expensive thermal paper because Brother have included the facility to use a thermal ribbon which produces results on any grade of paper. The manual stipulates that optimum results can only be attained by using glossy finished paper but acceptable results can be achieved with other grades. Even with the coarse jotter paper that I used as a test sheet produced a result which, though not suitable for an impressive business letter, gave a readable printout which would suffice for listings.

The machine has a limited range of features but not to the exclusion of a bit image setting for screen dumps or user-defined character printing. The instruction manual is of little assistance in this mode. Despite the fact that its general quality is good and informative, the bit image section resorts to a form of Japanese English which is more inscrutable than informative. Fortunately, there is enough information to allow a little experimentation which soon clarified the practical side of bit imaging.

Text printing is surprisingly sophisticated for a small printer and follows IBM standard codes which are close enough to Epson standards to make very little difference. I used a standard Epson emulation interface and it worked perfectly well. Reduced, enlarged, elite and pical styles are all included with the ability to combine them to create special effects and to use emphasised print mode to create a higher quality printout which is almost NLQ.

Using subscripts and superscripts poses one or two problems because there is no true facility for these functions. Commands exist to produce super and subscript but the process amounts to a half linefeed. The characters produced are normal size shifted up or down but applying condensed reduced elite characters can overcome this problem to some extent.

The overall shape of the document can be controlled by setting the left and right margins and linefeed distance. The linefeed is essential for graphic mode so that there is no gap between the printed lines. In passing, it's interesting to note that, although

the Epson linefeed standard is based around an eighth of an inch, this machine uses a ninth of an inch but this shouldn't cause any practical problems.

Whether used with thermal paper or a thermal ribbon, the machine runs reliably, though is somewhat slow by current standards. The result is a fairly sophisticated, very quiet, compact machine with a reasonable range of features which suit it to most practical purposes. Don't expect the quality of the latest NLQ dot matrix but don't expect to pay the price of one either.

Daisywheel Details

Daisywheel printers are best described as typewriters without a keyboard. This is certainly the case with the HR-10 because its ribbon and daisywheel range are identical to the office typewriters. This means that extra wheels and ribbons are freely available through most stationery suppliers.

The HR-10 is for users who have demands for high quality text printouts at low cost. Compatibility is assured with the CBM serial interface included as standard but Commodore graphics are not supported.

The range of daisywheels covers 14 typefaces in various language formats and some have dual pitch capabilities to allow fixed variations of letter spacing.

There is nothing complex about a daisywheel printer but that doesn't mean a total lack of facilities. Characters can be underlined or otherwise emphasised with double strike and shadow modes. There is even a facility for striking through characters with a hyphen as though a correction had been made.

Page formats can be set by commands for left and right margins, horizontal and vertical tabs, top and bottom margins, page length, tabs and variable linefeeds.

The printout speed is slow when compared to dot matrix machines, though fairly standard for a daisywheel. Speed is not the main concern of daisywheel users, its the print quality. The feature of a daisywheel printer is its high quality lettering and this is assured with the Brother's use of standard typewriter parts.

Conclusions

Both printers performed well under test conditions and at these prices they are both bargains. The thermal printer is especially useful for programmers who want to keep a record of their work whereas the daisywheel is for those who want to produce impressive business letters on a limited budget.

Although both machines are now at the end of their production runs, the use of standard Brother accessories ensures a longer life for the machines. When compared to current printer costs, this pair are offered at throwaway prices and deserve to be snapped up quickly. YC

Touchline:
Brother HR10 Daisywheel Printer £99.95 (tractor feed £9.95 extra) plus £5.05 postage, HR5 Thermal Printer £49.95 (power supply £2.95 extra) plus £3.05 postage. ***Supplier:*** *UK Home Computers, 82 Churchward Avenue, Swindon, Wilts.* ***Tel:*** *0793 695034.*

CP/M Lives!

CP/M, although widely regarded as totally obsolete, offers much to the C128 user. We look at the new kit from Financial Systems Software aimed at getting the most out of your C128's CP/M

By Jeremy Cornell

I've often felt that YC should poll you C128-owning readers, just to see what you get up to with your 128s. After all, the machine does suffer from something of an identity crisis. You can look at it as a C64 with a nice keyboard, a super C64 with double the memory and an adequate Basic, or as a Z80-based micro running CP/M.

I wonder how many people take advantage of the machine in the latter, CP/M mode. I have a feeling that all too many simply load the system disk once or twice, have a quick look, and then forget it.

This is a shame, for although CP/M (Control Program for Microprocessors – not a lot of people remember that...) has been superseded in general by MSDOS and its successors, it offers the advantages of a wide range of established software, and as a disk operating system its infinitely superior to the usual Commodore approach with its gobbledygook commands.

The one problem, is that CP/M has become something of a fossil. Quite simply, no-one hacks it anymore. Financial System Software's latest kit may well revive some interest in this venerable operating system.

Double Pack

The FSS's package is really a bundling of two useful bits of CP/M arcana in one package. One is the Commodore CP/M User's Guide from Abacus, the other is the CP/M kit from Inca, a collection of useful utilities.

Abacus's User's Guide covers a lot of territory. It starts at absolute base level (What is a computer...?) and progresses to levels designed to please the machine-code hacker.

It's not a flashy book, but the layout is very clear. The text forms a very clear progression, so that you can leave off reading at the point at which you feel you don't need to know much more.

For me, it's an excellent reference work. My CP/M's terribly rusty, which is sad, considering I cut my teeth on it.

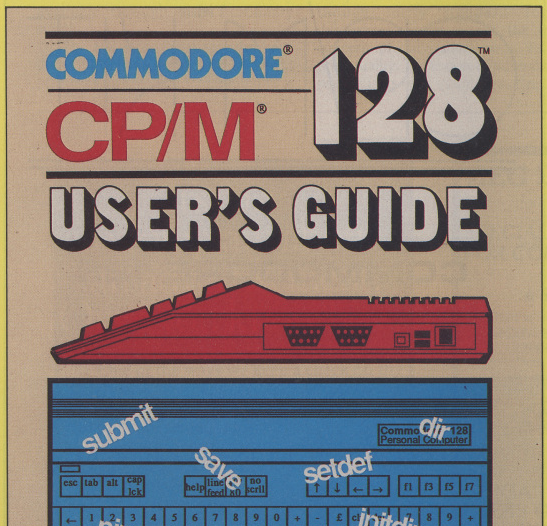
Even when I had to use the PIP command regularly, I had to look it up most of the time. I wish I'd had this manual at the time – for looking up commands, it's admirably concise.

After an extended introductory section, containing descriptions of the resident commands, the guise goes on to describe the transient commands. For those in need of an explanation, transient commands constitute command files on disk and have to be loaded in, whereas CP/M 3.0 contain the six resident commands DIR, DIRSYS, ERASE, RENAME, TYPE and USER. There used to be only four, but this is CP/M Plus.

Abacus then goes on to discuss many machine-specific details, such as the multi-format capabilities of the 1571 drive. I felt that the guide could have gone into a lot more detail about this, as it's a complex subject, and needs a little explaining.

The last half of the manual is the juicy part. If you want to hack CP/M, this is the part for you. You get a good explanation of how to use Digital Research's MAC and RMAC assemblers, successors to the original ASM. This is followed by a worthy account of how to use BDOS functions.

The grand finale, an annotated disassembly of the C128 Z80 Roms, tails things off. All CP/M life is here.



Kitting Yourself Out

You may or may not find Inca's CP/M kit as useful. The kit contains a range of added CP/M commands. Some of these are better versions of existing CP/M commands, others are complete applications in their own right. Commands include several versions of the DIR command, a very useful patch which will enable you to speed up your 1571, and NEWSWEEP, an advanced disk utility.

The CP/M Kit commands I found to be useful additions to a CP/M repertoire. The applications are rather basic, but could easily serve a useful purpose for the first time CP/M user, who may subsequently go on to better things. CP/M Kit is good value, even if the documentation is a little scanty.

Summary of CP/M Kit Commands and Applications

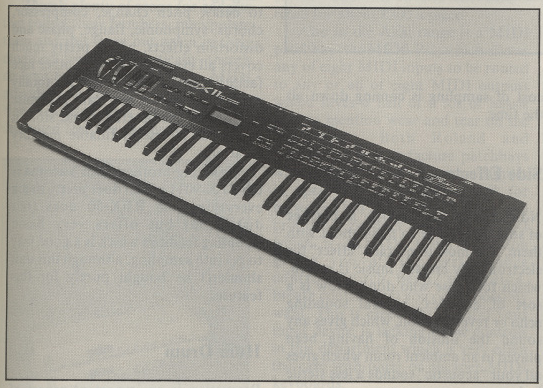
C1571:	Speeds up the disk drive
CONF:	Sets up system parameters
DD:	Quick directory listing
DE-LBR:	Separates libraries into their individual files
EDFILE:	An alternative line editor to ED
LDIR:	Gives a directory of a library
LRUN:	Allows programs to be loaded and run while still inside a library
LTYPE:	Displays any ASCII file on the screen, squeezed or not
MCAT43:	Disk cataloguing program
MEX128:	CP/M terminal program
NEWS-WEEP:	Comprehensive disk utility
NEWSYS:	Updates CP/M systems
NULU12:	Library file utility
SCAN12:	View documentation files backwards and forwards
SD-50:	Quick directory
SQ:	Produces compressed (squeezed) files
USQ:	Unsqueeze files
VED13:	Wordprocessor
XCAT40:	Produces disk or paper copies of directories
ZCHESS:	Chess

Touchline: Supplier: *Financial Systems Software, 18 High Street, Pershore, Worcester WR10 1BG* ***Tel:*** *0386 553153* ***Price:*** *£34.95*

Beyond the Sequencer

Turn a nice ditty into a glorious production

By Darrin Williamson



We've all seen what can be done with a Commodore and the right software. Compositions can be entered, altered and output to a series of musical instruments. However by incorporating certain hardware and software, the skys the limit, as to what you can produce!

The first area for improvement would be your sound sources. Most people tend to start off with a single keyboard which is only capable of generating one sound at a time. So all the different parts you have programmed in (i.e. Bassline, chords, etc) will come out in one voice which will sound boring to say the least.

Even if your set-up allows different voices for different parts the whole piece is likely to sound very synthetic and dry, not through any fault of the user or indeed the piece of music, but because the sounds used are artificially generated and never actually exist as sounds until after the piece has been recorded.

This may not seem like a big problem at first and for many users it may not prove limiting at all, but as soon as you begin to take computer music seriously you'll find that straight compusitions will lack that slick production that our ears are now accustomed. At this stage you may be forgiven for thinking that what was a nice little hobby is now in danger of turning into a multi-million pound venture.

Fear not! Thanks to the modular magic of MIDI you can produce some very professional sounding compusitions on a relatively small budget. All you need is a few little black boxes and a handful of 5-pin DIN leads (Squeezy bottles, sticky-back plastic?) Allow me to explain...

Sounds Around

Until recently there was only solution to the problem of having enough sounds to make your music work. This was the space and money consuming process of buying additional keyboards. This is rather impractical as you don't want or need dozens of keyboards all over the place.

The solution is synth modules; the sound generation circuitry of a synth without keyboard and performance controls which can be triggered via a MIDI keyboard and/or sequencer.

Not surprisingly it's the Japanese music moguls, Roland and Yamaha that so far dominate this market. Yamaha have two budget units in their range. The first is the FB-01 which sells for around £200. This unit provides some very nice sounds and at the price of £199 works out as a cost effective expander. The unit is eight voice polyphonic which allows (in this instance) you to play one sound with up to eight voices or eight sounds monophonically.

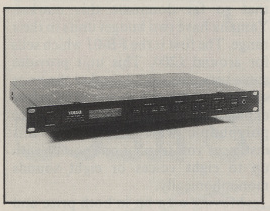
Moving on a bit in both price and flexibility we find the Yamaha TX-81Z retailing for about £400. This unit does feature programmability and is housed in a 1U high 19" rack mounted unit (the industry standard for studios). This unit does sound nicer than the FB-01 and is more flexible in that performance patches can be created which allow you to define how many sounds you want, what they are, how many voices you want to assign to each (maximum of eight again), and so on. A great improvement on the FB-01, but still requires a degree of forward planning in sorting out what sounds are likely to take up what voices.

Roland have come to the rescue on this point with the MT-32 which costs £450 and is designed specifically with the sequencer user in mind. Like the Yamaha models, this also allows eight different timbres at the same time but is 32 voice polyphonic so you can quite happily run all eight timbres and play each polyphonically. Further-

more the MT-32 has a built-in digital reverb and the 30 PCM percussion sounds from the latest Roland drum machine the TR-626 so you can allot one of your sequencer tracks to playing purely the drum part and save yourself the cost of a drum machine.

Just released from Roland is the D-110 which is very similar to the MT-32 in many respects. However the D-110 has separate audio outputs which is a very useful feature if you intend to hook the unit up to a reasonable mixer and allows you to program in your own sounds without software assistance.

All the above units have 128 sounds and in general consist of imitations of orchestral sounds (strings, brass, bass, piano, etc) although all units offer some very nice, distinctive sounds of their own. So which has the best sounds? Well there is no simple answers, it's really just a question of listening to all of them for yourself, although my personal favourite is the MT-32.



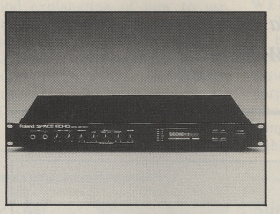
Sampling Delights

Sounds Sampling differs from synthesis in that with sampling you "record" a sound by coverting it into numbers and then playing back the numbers, converting them back into sound. There are several packages that work on the 64 which act as a good introduction to the process, most notably the Microvox.

However, for musical applications, far more sophisticated units are required which, again are MIDI driven. A samplers main use is to copy the sound of an acoustic instrument, for instance piano or drums. This use of sampling is so widespread that about this time last year Phil Collins estimated that his drum sounds had been pillaged and used on seven of the songs in the Top Ten that week.

Samplers aren't just used as Audio Robin Hoods though. Many bands use them to capture the sound of something that is not normally considered musical and making it so. Many of the Hi-Tech indie bands such as Depeche Mode and Erasure will have samples of tin trays, milk bottles, buckets, etc on their records.

The Akai S900 and the Roland S-50 have the lions share of this market although both machines retail for around £1500. Not to worry though, both manufacturers have produced models under the £1000 mark, and the



cost of sampling is coming down all the time.

Side Effects

Now you've sorted out a barrage of sounds it's time to mess about with them. The most important "effect" for electronically created music is reverb, which for those who don't know is a sort of complex, natural sounding echo or reverberation, which gives any sound the illusion of having been played in an ambient room which gives all your "acoustic" sounds a less sterile feel.

Just recently we have seen a revolution in Digital Reverb. Prices have just kept falling and falling to the point where you can now get a reasonable selection of reverb treatments (short, long, gated and reverse) for about £150. However the added advantages of MIDI do add something like £50 to the price of a unit.

Alesis (distributed in this country by Sound Technology) have pretty much cornered the budget reverb market with the Midiverb which was released a couple of years ago. This model has 64 presets (which is enough for most people) and all of these can be called up by a MIDI patch change. In other words you can transmit a program change from your input device which changes the reverb treatment. Since its launch the Midiverb has been superseded by the Midiverb II which gives you 99 presets. Not just straight reverb effects but variations on a theme like echo, flange phase, etc. The Midiverb II costs £299.

Simulating a room, however is just one treatment you can give a sound. There are all manner of different ways of squashing, stretching and delaying sounds to make them more interesting. Several manufacturers produce units that store all the effects that you're likely to need in one convenient box. Most of these units are now MIDI controlled which again, allows patch changing. Many of these effect units also allow MIDI triggering of effects where audio triggering proves too slow to be useful.

Yamaha lead the way here with the REX-50. This has 30 preset effects ranging from reverbs of various types to delay, pitch change, compressor, chorus, symphonic, flange, phase and distortion effects, which pretty much covers all eventualities. The other nice facility is that all the effects are totally programmable so you can customise any one of the 30 effects and store it in one of 60 user-definable memory locations.

Rex's big brother from Yamaha is the SPX-9011 which does pretty much everything the REX-50 does (bar distortion) but offers very basic sampling facilities which is a good way to get into sampling, although this unit shouldn't be bought purely for this feature.

Hum Drum

Percussion is an important aspect of most forms of music nowadays. Dedicated sound packages exist for the 64 but a much better way of tackling the problem is to use a Drum Machine which gives your finished composition, better quality and a better variety of drum sounds. Most sequencer packages will give you the option of syncronising a beat box to it. So, effectively the sequencer will take its timing from the Rhythm track (just like in real life!). This will also give you the benefit of having spare sequencer memory for your tune. There are literally dozens of different drum machines for the budget-minded. Roland TR-626, Alesis HT-16, and the Yamaha RX11 are just a few of the units on offer. All of these

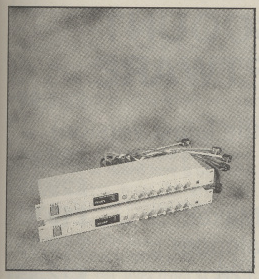
feature sampled drum voices and have both real time and step time programming modes. Some models will allow you to enter the drum voices from a MIDI keyboard which may well give the added advantage of touch sensitivity which can really make a drum pattern come to life.

Cheetah Marketing have gone one step further and added a set of five dedicated drum pads to their digital drum machine. The total package price for these two units is £300 (£140 for the MD8 drum machine, £160 for DP5 drum pads).

MIDI Manipulation

That's just the start of what you can do with MIDI, as it's just numbers being pushed through a serial comms port.

There's plenty of scope for gadgets that collect these numbers, manipulate them and spit them out again in their modified form. Theoretically there's no limit to what you can do to MIDI provided you have the right hardware. New features can be added and unwanted features can be filtered out.



*Akai have produced two wonderful units; the MB-76 gives you the ability to set volume levels of various instruments which can be stored and called up as MIDI patch numbers. The other does the same kind of thing with tone (or equalisation) settings.

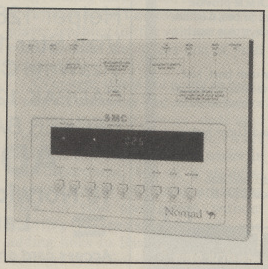
The PEQ-6 behaves pretty much like six graphic equalisers which, again can be set, stored and recalled via MIDI. The combination of these two units gives the user, in effect a spare pair of hands which would normally be needed on a mixing desk of some kind. You also have the added advantage of speed as MIDI can do things much quicker than the likes of us.

In conjunction with a sequencer these units are of great use in a number of ways. Firstly the Mix Bay can be used to mute instruments that are not needed for both verse and chorus. You can also vary the volume levels within pieces (gradually bringing up the volume of an instrument to achieve a "big finish" to the song). The PEQ-6 can also do some magical things particularly if you're swapping instruments around a lot in apiece.

Each set of instruments can have their own set of tone treatments which can be called up at the same time as the sounds themselves. All that is required is leaving a sequencer track spare just to put patch changes on which will drive units like this as well as all the effect units I mentioned earlier. The MB-76 and the PEQ-6 retail for about £300 a piece.

Also in the Akai range is a MIDI patchbay (the ME30-PII) which allows any of eight MIDI inputs to be routed to any or all of eight MIDI outputs which saves a hell of a lot of hassle (not to mention wear and tear on the equipment). Both Roland and Yamaha also manufacture patchbays which appear to be somewhat similar in spec. All three units retail for between £100 and £200. Yamaha also produce a product called an MCS-2 which is a MIDI Control Station giving you all the performance controls (pitch bend, modultion, breath control, etc) you could possibly want. This is especially useful if your input device is lacking a few controls in this department which is very often the case with older or cheaper MIDI keyboards.

Hertfordshire based company Nomad have brought to these shores two pretty nifty little gadgets for the MIDIphile. The first is an audio to MIDI trigger interface which converts, say a drum beat into a MIDI code so if a friend of yours insists on playing live drums you can take the audio signal and convert it into a stream of MIDI codes which could be fed into your drum machine.



The P2M costs about £150. Also in the range is the SMC 1.0 which converts MIDI codes into SMPTE (Society of Motion Picture and Television Engineers) codes which allow very accurate synchronisation to a tape machine which is extremely useful if you intend to link your sequencer to a multi-track recorder at some stage.

As you can see, MIDI opens up a whole wealth of possibilities to both professional musicians and the home enthusiasts. Contrary to what some "real musicians" may say, MIDI isn't just a cop out for people with no musical talent but a means of extracting what talen in the individual and exploring it to the full. YC

Touchlines:

Akai (UK) Ltd, *Haslemere/ Heathrow Estate, Silver Jubilee Way, Hownslow Middx.* ***Tel:*** *01-897 2487*

Alesis, *Sound Technology PLC, 6 Letchworth Business Centre, Avenue One, Letchworth, Herts SG6 2HR.* ***Tel:*** *0462 480000.*

Casio UK Ltd, *Unit 6 1000 North Circular Road, London NW2 7JD.* ***Tel:*** *01-450 9131.*

Cheetah Marketing Ltd, *Norbury House, Horbury Road, Fairwater, Cardiff CF5 3AS.* ***Tel:*** *0222 555525.*

Nomad Ltd, *North Road Farm, North Road, Wendy, Nr Royston, Herts SG8 0AB.* ***Tel:*** *0223 207770.*

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Making Music

Continuing our music series, this month we look at creating and using soundtracks

By Peter Gerrard

The first rule to observe when creating musical soundtracks seems to be to make it as long as possible! I've seen a number of cassette inlay cards and game instructions boasting about the fact that the game contains "a ten minute musical soundtrack by Frieda Villain", or words to that effect. Creating such a length of music is no great hardship, and the routine in this section will take up none of the available Basic RAM from the Commodore 64. Indeed, there is nothing to stop you having one soundtrack playing while, say, the player of the game is reading the instructions, and then loading in another one with the main game itself. The point to be noted here is of course that the player must be given the option to turn the blessed thing off.

In the program for this section you'll see that the main 'tune' is held in memory from $C000 to $C7FF and the repeating 'riff' lives from $C800 to $C8FF. There is no real reason why this cannot be made longer, if you want to experiment, but I think that 256 notes for a repeating riff and 2048 notes for the main tune is long enough, and provided that you don't get too carried away and don't play more than about three and a half, four notes per second, you'll easily achieve your ten minute soundtrack. You can of course, play at a fraction of that speed and have a half hour musical interlude if you want, but however good the game might be this could possibly induce severe boredom on the part of the player.

The second rule to observe is to be harmonious. When starting to compose your first soundtracks, try and think in terms of simple tunes and don't attempt to create a magnum opus all in one go. Think of simple note sequences. The classical C, F, C, G, F and back to C again, for instance, might be a reasonable sequence for the repeating riff, perhaps playing some sixteen or so notes in each key. For example, assuming each note to be played at the same speed, then:

C, E, G, A, C, A, G, E

and then repeated gives a fairly familiar little boogie style of playing, and if this can then be moved up to the key of F, back to C, on to G and back to F again before it starts to repeat, this gives the main tune something to work its way around.

If possible, keep the repeating riff to a fairly low octave, letting the main tune ride over it and play at a much higher one. I've found this a reasonably simple way of writing a long running background tune, and it's a way that doesn't necessarily have the player reaching for the volume control every time he encounters one of your programs.

Of course, this is not going to make it easy to transpose one of the classics to your computer, more dedicated commercially available software packages can make life a lot easier in that department, but as a straightforward way of producing a backing track for your own games, without resorting to special commands and adding links to Basic or whatever, it manages to suffice quite nicely.

Having got the background riff going, you can then concentrate on the main tune itself. A sequence of 16 notes played out eight times gives us a total of 128 notes before that sequence starts to repeat itself. This is only using half of the available notes, but it will do to get us started. Bear the number of 128 in mind, because if your main tune doesn't in some way adhere to this number, things can start to become terribly discordant. Every 128 notes or so you're probably going to have to either revert to something starting in the key of C, or something that harmonies well with C, unless you want to go into electronic wizardry and start introducing ring modulation and synchronisation, perhaps changing the filtering of a note as it passes through the ADSR sequence of its life.

This can produce some wonderful sounds, so find out where the waveforms are stored in memory (just hunt through the loader program to find a sequence of numbers like 141,11,212 to indicate voice 2, or 141,18,212 for voice three) and change the waveform immediately before that. This waveform will be a 17, a 33, a 65 or a 129 in this basic example, since no attempt has been made to cater for ring modulation or synchronisation.

To change the filter as a note is being played is slightly more complicated, but we've already seen which registers to alter to do this, and so a small amount of code will have to be inserted immediately after playing one note and before playing another, so that the effects of the changing filter can clearly be heard.

By playing through the main tune once, and then altering the ring modulation settings, or synchronisation, or changing the filters, your ten minute soundtrack can indeed be made to go on for half an hour or more without starting to repeat itself. In theory it could go on indefinitely, I suppose, but that's up to you to experiment with!

Program Changes

On to the program itself. We've seen where the notes are stored in memory, and you may have been puzzled as to why I said that $C800 to $C8FF gives us the space to store 256 notes, since there are only 256 bytes available in that particular amount of memory. No, we haven't gone back to just using the frequency, and in any case most of those cover two byte numbers anyway; the low and high value frequencies in fact.

No, we're relying on the fact that most tunes do not expand over more than about three octaves, and are using some 31 notes in all. A separate table reads a number from the data in $C800 to $C8FF and converts that into the high/low values of the frequency. Say it comes across a number 27. The 27th entry in our table will tell us perhaps that note 27 corresponds to a high value of 31 and a low value of 165. These values are then POKEd into the correct registers (or, strictly speaking, the value held in the accumulator is stored in the correct registers) and the right note is then played.

In Basic terms, it might look something like this:

```
1000 DATA 2,24,2,56,2,90,2,
125,2,163,2,204,2,246.
```

If you, look at your manual you'll see that this corresponds to the high/low frequencies for all the notes from C-1 to F -1. Obviously, you'd have more data than that in our program to cover all 31 notes. Then, another set of data contains the notes to be played:

```
100 DATA 1,3,5,6,5,3,1
```

The first note has the high/low frequencies of 2,24 (as read in from the table), the third one has the high/low frequencies of 2,90, and so on. Thus by just using these 31 notes we can effectively halve the amount of memory required to store a long tune and use the spare RAM from $C000 to $CFFF into the bargain, leaving us with a very long tune that takes up no amount of memory at all.

As with the ordinary musical soundtrack program I used the synthesiser program, slightly modified, to POKE numbers in the range 0 to 31 into memory, the precise area of memory ($C000-$C7FF or $C800-$C8FF) depending on which voice I was altering at the time. Play a note, determine which one it is in our sequence of notes from 0 to 31, and put the number in that range of 0 to 31 into memory.

Filters, ring modulation and synchronisation are up to you: the basics of the program are there to be played with and modified. It's the only way to learn, believe me!

Next time, we'll look at a slightly technical roundup of the SID chips capabilities. It all helps in understanding how the thing works!

Howdy Partner 128

A quick notepad utility cartridge for the busy executive

By Norman Doyle

Apart from making disk backup systems, British cartridge manufacturers seem to be devoid of ideas. Apparently, this isn't true of our colonial cousins in the States if Partner 128 is anything to go by.

Contained within the little black box is a desk diary, calculator, memo pad and address book with a C128 disk turbo, all on ROM supported by a small RAM chip. This may not seem very revolutionary because there are many software programs, like Database's Mini Office II, which do similar things but Partner can be used in conjunction while another program is running in the computer's memory.

The cartridge sits quietly in the rear of the computer with a jump lead in Port 2. By pressing the reset button on top of the cartridge, the current program is interrupted and Partner's menu window indicates that it is ready to use. When the utility has been used, Partner's control is released by pressing the ESC button and, like magic, the original program appears and continues from where it was interrupted.

The only disadvantage of the cartridge is that it cannot access tape. This is because two assumptions are made: that the user is a rich American who would have a drive anyway, and that no-one can live without a disk drive for a C128.

The Options

The first option on the Partner menu brings up the appointments diary. A calendar is presented which displays one month per page from January 1986 to December 1999. Cynics may think that this utility has obsolescence built in but the C128 will have long disappeared by 1999 – except for those which have been lovingly maintained as museum pieces.

Selection of the current month is achieved by skipping through the calendar in six month chunks until the approximate position is reached. Then, by advancing or retreating through the calendar entries month by month, the current page can be found and the acutal day can be selected.

Pressing return when the cursor is on the actual date flips the calendar into the appointments page. There are four boxes for data, the first one of which permits a ten character label to be entered for display, after the rest of the appointment's boxes have been completed. These boxes are for key tasks, things to do and time-labelled appointments for that day. Not all boxes have to be filled and then, on returning to the calendar, the date entry has been changed to display the ten character label which was entered earlier. The appointments diary must now be saved to disk before entering the other facilities.

Saving data before each function change is advisable because the cartridge has limited RAM which is also accessed by utilities such as the address book and memo pad. Similarly, any saved data can be rapidly recalled by loading back in from disk. To help with loading, the disk directory can be viewed to enable datafile selection. Of course, all of this means that a disk must be kept alongside the Partner, preferably with a backup locked away somewhere safe.

The memo feature is a simple notepad/wordprocessor which can be used for quickly scribbled reminders to yourself or even to print out short letters and internal memos. Another function can be as a Help screen for other programs. Plug in Partner, load the program and then press the reset button. A previously prepared help disk can then be loaded and displayed to show user-defined functions within the resident program or simply to show its standard features.

The memo page can also be used to turn the C128 and printer into a limited-memory typewriter. With the typewriter function on, anything typed onto the keyboard will be directed to the printer when the return key is pressed.

Modem users will find the address book a boon. Not only can names, addresses and phone numbers be entered but autodial modems can also

be given the relevant number to call by the press of a key. Sadly this database uses American titles for the fields within the address base but I managed to cope without too much trouble. The only real probelm is encountered when an address is too long – ironically, Commodore's address came into this category.

The full database can be listed to a printer, address labels created or a phone list generated from the in-built data processor. The distance between labels can also be set but this is done from the setup option which we'll be meeting later.

Wordprocessors usually have fairly basic calculator functions, if they can calculate at all. With Partner a full desktop adding machine is provided so that a printed record of the calculations can be kept for future reference. The printer can also be used to get a dump of the current C128 program screen, but only if text alone is displayed – if the screen uses high resolution or user-defined graphics, forget it.

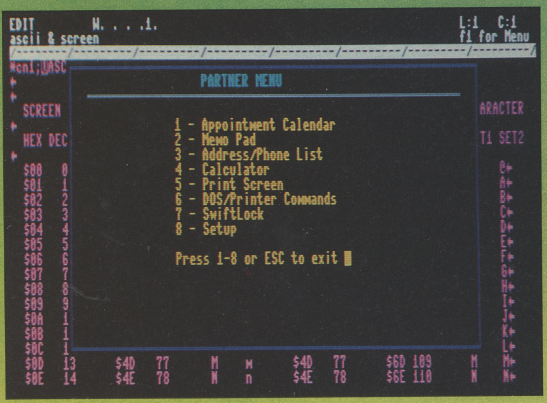
Disk commands can be sent to the drive for all of the DOS features but for me the most interesting feature of this section is the printer command line. Some older wordprocessors are unable to support some of the latest printer features. This facility over-rides the program in the computer's memory so that commands can be sent to set up alternative typefaces and other specialised facilities.

If you work in a busy office you'll appreciate this next feature. Before leaving Partner a five letter code can be entered which locks up the keyboard. This means that it is safe to leave a program running because no-one will be able to use the keyboard until the password is entered. If you're called away by a friend or by nature, the program is tamper proofed. Unfortunately, this feature does not protect against the power switch!

The final option allows protocol codes to be set for printers, disk drives and modems. Label spacing is set here, along with the secondary printer address, and ASCII or CBM character code selection.

According to the manual, the standard facilities can be supplemented by adding self-penned, machine code routines which can be stored in the cartridge RAM. The technique is a closely guarded secret and a certain amount of money will have to change hands before Timescape will reveal all.

I'm currently using Partner in conjunction with SuperScript 128 and found to my chagrin that disk access is inhibited because the wordprocessor leaves an open channel to the disk drive. A search through the informative manual revealed that pressing the CBM key and letter 'O' at the same time would clear the channel, but could possibly cause problems when leaving Partner. Being brave, I tried it, the disk was freed and no ill effects were created when returning to the program. This is indicative of the care with which Partner has been implemented and it is highly recommended for use by the busy executive, or anyone else for that matter.



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Listings

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Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:

[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:

[SS],[C*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

PROGRAM: SYNTAX CHECKER

```
S REM SYTAX CHECKER - ERIC DOYLE

10 BL=10   :LN=70   :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1632
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time. YC

Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

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LISTINGS

CONSTRUCTING A COMPILER

PROGRAM: EDIT

```
0D   10 FOR X=832 TO 878
7A   20 READ B:POKEX,B
9C   30 NEXT
47   40 POKE 770,64:POKE 771,3:PO
     KE 774,243:POKE 775,166
A0   50 PRINT CHR$(14);"[CLR,SF,S
     C,SL] [SE,SD,SI,ST] CODE INS
     TALLED."
D0   60 PRINT "[SW,SA,SR,SN,SI,SN
     ,SG]!! [SD]ON'T [SE,SD,SI,ST
     ] [SB,SA,SS,SI,SC] PROGRAMS!
     !":NEW
44   70 DATA 32,96,165,134,122,13
     2,123,32,115,0,170,240,243,1
     62,255,134
C0   80 DATA 58,144,6,32,121,165,
     76,225,167,32,107,169,166,12
     2,160,4
72   90 DATA 189,0,2,232,200,153,
     251,1,201,0,208,244,76,162,1
     64
```

CONSTRUCTING A COMPILER

PROGRAM: COMPILE

```
F2   10 GOSUB 980:REM INITIALISE
0E   20 WT%=0:EF%=0:ET%=0
24   30 :
C7   40 REM **********************
     **********
0B   50 :
7A   60 DE%=0
91   70 GOSUB 1940:REM OPEN FILES

A2   80 IF DE% THEN PRINT "[SD]IS
     K FILE ERROR. [SM]ISSING FIL
     E OR [SD]ISK FULL":CLOSE2:CL
     OSE3:END
60   90 :
B8   100 :  OC$="":GOSUB 2410
72   110 :  IF EN% THEN GOTO 230
17   120 :  PRINT IL$;
B0   130 :  IF DE%=0 AND IL%<>0 T
     HEN GOSUB 2640
B6   140 :
4E   150 :  IF LEN(OC$)>0 AND ER%
     =0 THEN GOSUB 2560
9A   160 :
7E   170 :  IF ER% THEN ET%=ET%+1
     :PRINT"[RVSON]";EM$(ER%)
85   180 :  IF WR% AND ER%=0 THEN
     WT%=WT%+1:PRINT"[RVSON]";WM
     $(WR%)
54   190 IF DE%=0 AND EF%=0 THEN
     100
F2   200 :
13   210 REM **********************
     **********
```

```
E6  220 :
DC  230 IF EF%=0 AND CD%<>0 THEN
     PRINT "{SHIFT}UNEXPECTED END OF
    FILE.":KR%=128:GOSUB6940:GO
    SUB2560
D2  240 IF EF%=0 AND CK%(CP%)<>0
    THEN PRINT "{SHIFT}CONTROL STRU
    CTURE ERROR."
53  250 IF EF% THEN PRINT "{SHIFT}S
    E,SV,SE,SR,SE} {SHIFT}SE,SR2,SO,SR
    ]. {SHIFT}CANNOT CONTINUE..."
43  260 IF EF%=0 AND FO%>0 THEN
    PRINT "{SHIFT}WARNING - {SHIFT}FILE
    OPENS OUTNUMBER FILES{SHIFT}CL
    OSURES."
89  270 IF EF%=0 AND FO%<0 THEN
    PRINT "{SHIFT}WARNING - {SHIFT}FILE
    CLOSURES OUTNUMBER FILE  OPE
    NS."
96  280 CLOSE 2:CLOSE 3
19  290 :
23  300 PRINT ET%;" ERRORS IN FI
    LE."
0D  310 PRINT WT%;" WARNINGS IN
    FILE."
DF  320 S$="":GOSUB 3960
48  330 IF SD% THEN PRINT "{SHIFT}F,S
    A,ST,SA,SL}!! {SHIFT}FORWARD {SHIFT}S
    UBROUTINE DEFINITIONS  NOT
    MATCHED"
08  340 IF SD%=0 AND ET%=0 AND E
    F%=0 THEN GOSUB 2080
67  350 IF DE% THEN PRINT "{SHIFT}DI
    SK FILE ERROR DURING DATA FI
    LE WRITE."
0F  360 FR=FRE(0):PRINT FR;"BYTE
    S FREE."
7A  370 IF SD%=0 AND ET%=0 AND E
    F%=0THENCLR:PRINT"{SHIFT}STARTIN
    G {SHIFT}CODEGEN":LOAD"CODEGEN",
    8,1
FD  380 END
BD  390 :
A8  400 :
CA  410 REM ************************
    ************
BC  420 REM ERROR MESSAGES
D6  430 REM ************************
    ************
83  440 :
3F  450 EP%=-1
F8  460 EP%=EP%+1
27  470 READ EM$(EP%)
A1  480 IF EM$(EP%)<>"!END!" THE
    N 460
D1  490 :
E7  500 EP%=0
4A  510 EP%=EP%+1
64  520 READ WM$(EP%)
D8  530 IF WM$(EP%)<>"!END!" THE
    N 510
90  540 RETURN
12  550 :
31  560 DATA "{SPC33}"
91  570 DATA "{SHIFT}SYMBOL NOT DEFI
    NED.
FA  580 DATA "{SHIFT}SYMBOL RE-DEFIN
    ED.
B7  590 DATA "{SHIFT}INCORRECT USE O
    F TYPE DESCRIPTOR.
3F  600 DATA "{SHIFT}MISSING EXPRESS
    ION.
59  610 DATA "{SPACE}ARENTHESIS ERR
    OR.
45  620 DATA "{SHIFT}INCORRECT USE O
    F OPERATORS.
F4  630 DATA "{SHIFT}SYNTAX ERROR.
BE  640 DATA "{SHIFT}NUMERIC OVERFLO
    W.
21  650 DATA "{SHIFT}ARBAGE AT END
    OF LINE.
11  660 DATA "{SHIFT}ISSING SYMBOL.
37  670 DATA "{SHIFT}ILLEGAL SYMBOL.
55  680 DATA "{SHIFT}UNCTION/OPERAT
    OR SYNTAX ERROR."
44  690 DATA "{SHIFT}ISSING VARIABL
    E DESCRIPTOR."
55  700 DATA "{SHIFT}ISSING OPERATO
    R."
D3  710 DATA "{SHIFT}YPE MISMATCH E
    RROR."
9E  720 DATA "{SHIFT}INCORRECT USE O
    F RESERVED WORD."
01  730 DATA "{SHIFT}ONTROL STRUCTU
    RE ERROR."
F5  740 DATA "{SHIFT}PROCEDURE DIVIS
    ION ERROR."
1B  750 DATA "{SHIFT}TATEMENT OUTSI
    DE PROCEDURE DIVISION."
CC  760 DATA "{SHIFT}ONTROL STRUCTU
    RE NOT MATCHED AT {SHIFT}SE,SN,SD}
    ."
1A  770 DATA "{SHIFT}}/{SHIFT}SO} FILE MOD
    E NOT DEFINED."
EC  780 DATA "{SHIFT}SUBROUTINE NOT
    DEFINED."
A9  790 DATA "{SHIFT}SUBROUTINE ALRE
    ADY DEFINED."
2F  800 DATA "{SHIFT}SUBROUTINE STRU
    CTURE ERROR."
D3  810 DATA "{SHIFT}NJO SUBROUTINE E
    RROR."
D5  820 DATA "{SHIFT}ILLEGAL USE OF
    SUBROUTINE NAME."
EA  830 DATA "{SHIFT}BJAD SUBROUTINE
    NAME."
DC  840 DATA "{SHIFT}SUBROUTINE INSI
    DE PROCEDURE DIVISION."
A2  845 DATA "{SHIFT}IDENTIFIER TOO
    LONG."
F9  850 DATA "!END!"
65  860 :
53  870 :
C0  880 DATA "{SHIFT}ARBAGE AT END
    OF LINE."
BE  890 DATA "{SHIFT}ECLARATION INS
    IDE PROCEDURE DIVISION."
8A  900 DATA "{SHIFT}SUBROUTINE DEFI
    NITIONS INSIDE PROCEDURE DIV
    ISION."
B5  910 DATA "!END!"
A1  920 :
9F  930 :
D6  940 REM ************************
    ************
19  950 REM INITIALISE
02  960 REM ************************
    ************
F7  970 :
FD  980 PRINT "{CLR}-----------
    ----"
FE  990 PRINT CHR$(14);"{SHIFT}, SC,S
    L} {SHIFT}COMPILER"
B9  1000 PRINT "{SHIFT}VERSION 1.0/C
    SCJ64"
24  1005 PRINT "{SHIFT}IEVE {SHIFT}ARR
    IE 1988"
1D  1010 PRINT "----------------
    {DOWN}"
C5  1020 :
6C  1030 REM ** INTEGERS **
3E  1040 SS%=200:VT%=1:SP%=0:IT%
    =1:TP%=0:CP%=0:CD%=0:FO%=0
24  1050 :
B9  1060 REM **  ARRAYS  **
02  1070 DIM KW$(128),L$(50),L(5
    0)
2C  1080 DIM VN$(SS%),VT%(SS%),V
    V%(SS%)
B7  1090 DIM LS%(SS%),CK%(SS%),V
    %(4),LN%(SS%)
13  1100 DIM TK%(50),SK%(50),EM$
    (30),WM$(5)
60  1110 :
D7  1120 GOSUB 450:REM ERROR MES
    SAGES
94  1130 GOSUB 1230:REM DEFINE F
    UNCTIONS
FF  1140 GOSUB 1430:REM KEYWORD
    TABLE
CB  1150 GOSUB 1790:REM GET FILE
    NAMES
02  1160 RETURN
AC  1170 :
9A  1180 :
DB  1190 REM ************************
    ************
C5  1200 REM DEFINE FUNCTIONS
E7  1210 REM ************************
    ************
F2  1220 :
BC  1230 DEF FNGC(LP)=ASC(MID$(I
    L$,LP,1))
E6  1240 :
15  1250 DEF FNN(X)=(C%>=48 AND
    C%<=57) OR C%=36 OR C%=37 OR
     C%=64 OR C%=46
```

```
BF  1260 DEF FNA(X)=C%>65 AND C
    %<=90 OR C%=34
72  1270 DEF FNAN(X)=FNN(0) OR F
    NA(0)
CF  1280 DEF FNBC(X)=C%=40 OR C%
    =41
F4  1290 DEF FNSP(X)=C%=32 OR C%
    =9
FF  1300 DEF FNTK(X)=C%=42 OR C%
    =43 OR C%=45 OR C%=47 OR (C%
    =>60 AND C%<=62)
67  1310 DEF FNCC(X)=C%=44 OR C%
    =59 OR C%=39
17  1320 :
90  1330 DEF FNCK(X)=ABS(FNAN(0)
    +2*FNTK(0)+3*FNBC(0)+4*FNSP(
    0)+5*FNCC(0))
24  1340 DEF FNHI(DV)=INT(DV/256
    )
C3  1350 DEF FNLO(DV)=DV-256*FNH
    I(DV)
DB  1360 RETURN
65  1370 :
53  1380 :
B2  1390 REM ******************
    **********
20  1400 REM READ IN KEYWORD TAB
    LE
BE  1410 REM ******************
    **********
AB  1420 :
50  1430 KW%=-1
0E  1440 KW%=KW%+1
BA  1450 READ KW$(KW%)
E0  1460 IF KW$(KW%)="OR" THEN F
    S%=KW%+128
F7  1470 IF KW$(KW%)="--" THEN F
    E%=KW%+128
F9  1480 IF KW$(KW%)<>"!END!" TH
    EN 1440
59  1490 RETURN
DB  1500 :
3A  1510 REM ** KEYWORDS **
65  1520 DATA END
AC  1530 DATA VAR,INT,STRING,ARR
    AY
FA  1540 DATA BSET,WSET
B3  1550 DATA LOOP,ENDLOOP,WHILE
    ,WHEN
99  1560 DATA IF,ENDIF,ELSE,CHAR
    OUT,FOPEN
CC  1570 DATA BEGIN,FCLOSE,FOR,I
    NPUT,OUTPUT
04  1580 DATA WRITE,READ,SUBROUT
    INE,RETURN
B5  1590 DATA CALL,EXTERNAL,FORW
    ARD
B0  1600 DATA CLS,WAIT,HALT,SYSC
    ALL
6A  1610 :
24  1620 REM ** OPERATORS **
72  1630 DATA OR,XOR,AND,NOT,=,<
    >,<=,>=,<,>
E4  1640 DATA +,-,*,/,++,--
42  1650 :
FA  1660 REM ** FUNCTIONS **
64  1670 DATA BYTE,WORD,LEN,CHAR
    ,STR,ASCII
F7  1680 DATA STOP,KEY,CHARIN
DC  1690 DATA LEFT,RIGHT,MID
A8  1700 DATA SYSFN,IOSTAT,DSTAT
    ,DERR
BE  1710 :
BA  1720 DATA "!END!"
F2  1730 :
EB  1740 :
49  1750 REM ******************
    **********
23  1760 REM GET FILENAMES
75  1770 REM ******************
    **********
C0  1780 :
7A  1790 INPUT "CDOWN,SSJOURCE F
    ILENAME (.FCL) ";FS$
55  1800 IF FS$="" THEN 1790
23  1810 :
65  1820 FCS=FS$+".SFC"
2C  1830 FYS=FS$+".SYM"
7A  1840 FLS=FS$+".LIR"
C6  1850 FSS=FS$+".FCL"
B3  1860 PRINT"CDOWN,SCJOMPILING
    ";FS$
DB  1870 RETURN
65  1880 :
53  1890 :
B2  1900 REM ******************
    **********
0E  1910 REM OPEN DISK FILES
BE  1920 REM ******************
    **********
AB  1930 :
83  1940 DE%=0
EB  1950 OPEN 2,8,2,FS$+",P,R"
F1  1960 IF ST OR DS THEN DE%=-1
    :RETURN
DB  1970 GET#2,A$:GET#2,A$
24  1980 IF ST THEN DE%=-1:RETUR
    N
99  1990 OPEN 3,8,3,"@0:"+FC$+",
    S,W"
61  2000 IF ST OR DS THEN DE%=-1

6F  2010 RETURN
D1  2020 :
CF  2030 :
0C  2040 REM ******************
    **********
57  2050 REM WRITE DATA FILES
BB  2060 REM ******************
    **********
24  2070 :
CC  2080 OPEN 4,8,4,"@0:"+FY$+",
    S,W"
78  2090 IF ST OR DS THEN DE%=-1
    :RETURN
7A  2100 PRINT "CDOWN,SWJRITING
    SYMBOLS.";
E5  2110 PRINT#4,VT%
E5  2120 IF VT%=1 THEN GOTO 2190

CB  2130 FOR X=1 TO VT%-1
3B  2140 :  PRINT#4,VN$(X)
1C  2150 :  PRINT#4,VT%(X)
20  2160 :  PRINT#4,VV%(X)
FE  2170 :  PRINT".";
3B  2180 :NEXT
62  2190 CLOSE 4
39  2200 PRINT
90  2210 :
2F  2220 OPEN 5,8,5,"@0:"+FL$+",
    S,W"
6C  2230 IF ST OR DS THEN DE%=-1
    :RETURN
8F  2240 PRINT "CDOWN,SWJRITING
    LITERALS.";
18  2250 PRINT#5,TT%
BE  2260 IF TT%=1 THEN GOTO 2320

9D  2270 FOR X=1 TO TT%-1
61  2280 :  PRINT#5,LN%(X)
95  2290 :  PRINT#5,LS$(X)
7C  2300 :  PRINT".";
8D  2310 NEXT
EC  2320 CLOSE 5
BA  2330 PRINT
A3  2340 RETURN
0D  2350 :
7B  2360 :
7A  2370 REM ******************
    **********
D1  2380 REM READ LINE FROM DISK
     FILE
B6  2390 REM ******************
    **********
53  2400 :
AA  2410 IL$="":DE%=0
A0  2420 GET#2,IA$:GET#2,IB$:IF
    IA$="" AND IB$="" THEN EN%=-
    1:RETURN
7F  2430 GET#2,LO$:GET#2,HI$
DA  2431 LO$=LO$+CHR$(0):HI$=HI$
    +CHR$(0)
92  2440 PRINT ASC(LO$)+256*ASC(
    HI$);
D4  2450 GET#2,FC$:IF FC$="" THE
    N FC$=CHR$(13)
0E  2460 IL$=IL$+FC$
41  2470 IF FC$<>CHR$(13) THEN 2
    450
0A  2480 IL%=LEN(IL$)
4D  2490 RETURN
F7  2500 :
ED  2510 :
4E  2520 REM ******************
    **********
7E  2530 REM WRITE TO FILE
5A  2540 REM ******************
    **********
C5  2550 :
D9  2560 PRINT#3,LEN(OC$):PRINT#
    3,OC$;
9A  2570 RETURN
24  2580 :
12  2590 :
59  2600 REM ******************
    **********
8B  2610 REM DO LEXICAL/SYNTAX/S
    EMANTIC
55  2620 REM ******************
    **********
6A  2630 :
1D  2640 ER%=0:WR%=0:SP%=0:TP%=0

77  2650 GOSUB 2750
15  2660 IF ER%=0 THEN GOSUB 327
    0
F6  2670 RETURN
BB  2680 :
B6  2690 :
E5  2700 REM ******************
    **********
0F  2710 REM ******************
    **********
E2  2720 REM PERFORM LEXICAL ANA
    LYSIS
1B  2730 REM ******************
    **********
B4  2740
E5  2750 GOSUB 3030
8E  2760 IF L$(1)<>";" THEN GOSU
    B 2840
52  2770 RETURN
DC  2780 :
CA  2790 :
01  2800 REM ******************
    **********
D6  2810 REM TOKENISE LINE IN L$

1C  2820 REM ******************
    **********
23  2830 :
74  2840 EP%=1
17  2850 :
64  2860 DP%=-1
7B  2870 :
76  2880 DP%=DP%+1
0B  2890 MA%=L$(EP%)=KW$(DP%)
17  2900 IF MA%=0 AND DP%<>KW% T
    HEN 2880
53  2910 :
73  2920 IF MA% THEN L$(EP%)=CHR
    $(128+DP%)
C8  2930 EP%=EP%+1
B7  2940 IF EP%<=L% THEN 2860
AB  2950 :
15  2960 RETURN
9F  2970 :
95  2980 :
06  2990 REM ******************
```

```
          ***********
10  3000 REM SPLIT LINE IL$ INTO
    L$()
12  3010 REM ********************
    ***********
ED  3020 :
7E  3030 L%=0:LP=0:CT%=-1:L$(L%)
    ="":QF%=0
D1  3040 :
30  3050 LP=LP+1
68  3060 C%=FNGC(LP):LT%=CT%:CT%
    =FNCK(0)
7A  3070 IF C%=13 THEN 3190
71  3080 IF C%<>34 THEN 3120
9B  3090 :  QF%=NOT(QF%)
5B  3100 :  IF QF% THEN 3150
3B  3110 :  GOTO 3160
48  3120 IF QF% THEN 3160
4C  3130 IF CT%=4 THEN 3050
9D  3140 IF CT%=LT% AND CT%<>5 A
    ND CT%<>3 THEN 3160
93  3150 L%=L%+1:L$(L%)=""
BE  3160 L$(L%)=L$(L%)+CHR$(C%)
81  3170 GOTO 3050
42  3180 :
85  3190 L%=L%+1:L$(L%)=CHR$(13)
    :RETURN
B6  3200 :
AC  3210 :
0F  3220 REM ********************
    ***********
F1  3230 REM ********************
    ***********
5A  3240 REM PERFORM SYNTAX/SEMA
    NT ANALYSIS
CD  3250 REM ********************
    ***********
F2  3260 :
B1  3270 IP%=1
AC  3280 IF L$(IP%)=";" THEN RET
    URN
E5  3290 IF ASC(L$(IP%))>127 THE
    N GOSUB 3370:RETURN
BE  3300 GOSUB 3590:RETURN
C0  3310 :
3E  3320 :
1C  3330 REM ********************
    ***********
A3  3340 REM ROUTING OF KEYWORDS

4B  3350 REM ********************
    ***********
17  3360 :
D9  3370 KR%=ASC(L$(IP%))
D2  3380 IF CD% AND (KR%=129 OR
    KR%=154 OR KR%=155) THEN WR%
    =2
DB  3390 IF CD%=0 AND KR%<>129 A
    ND KR%<>144  AND KR%<>151 AN
    D KR%<154 THEN ER%=18:RETURN

05  3400 IF KR%=>FS% THEN ER%=12
    :RETURN
20  3410 ON KR%-127 GOSUB 6950,5
    660,3500,3500,3500,5950,5950
    ,6120,6280,3510,3510
0B  3420 IF KR%>138 THEN ON KR%-
    138 GOSUB 6450,6710,6590,708
    0,7270,6830,7460,3510
7A  3430 IF KR%>146 THEN ON KR%-
    146 GOSUB 3510,3510,7590,784
    0,8110,8290,8380,8480,8650
B7  3440 IF KR%>155 THEN ON KR%-
    155 GOSUB 8820,8910,8820,891
    0
09  3450 RETURN
AB  3460 :
A1  3470 :
F4  3480 REM ****** SET ERROR FL
    AG ******
95  3490 :
E6  3500 ER%=3:RETURN
7C  3510 ER%=16:RETURN
43  3520 RETURN
ED  3530 :
DB  3540 :
30  3550 REM ********************
    ***********
DE  3560 REM HANDLE SYMBOL-TYPE
    EXPR.
0C  3570 REM ********************
    ***********
33  3580 :
42  3590 IF CD%=0 THEN ER%=19:RE
    TURN
45  3600 S$=L$(IP%):C%=ASC(S$):I
    F FNA(0)=0 OR C%=34 THEN ER%
    =7:RETURN
49  3610 GOSUB 3960
E2  3620 IF ER% THEN RETURN
1F  3630 IF CV%<5 THEN 3660
9B  3640 IP%=IP%+1:IF L$(IP%)<>C
    HR$(13) THEN WR%=1
88  3650 O%=153:DV=AD%:GOSUB 534
    0:RETURN
E8  3660 REM ADDRESS OF SYMBOL I
    N VAR TA%
4A  3670 TS%=CV%:AS%=AR%:IF AS%
    THEN OC$=OC$+CHR$(2)
EF  3680 TA%=AD%:IP%=IP%+1
39  3690 IF ASC(L$(IP%))<>FS%+4
    THEN 3800
FE  3700 IP%=IP%+1:IF L$(IP%)=CH
    R$(13) THEN ER%=4:RETURN
B9  3710 GOSUB 4200:IF ER% THEN
    RETURN
28  3720 IF TS%<>CV% THEN ER%=15
    :RETURN
7B  3730 O%=11:IF TS%=1 THEN O%=
    4
AE  3740 IF AS% AND O%=4 THEN O%
    =24
BC  3750 IF AS% AND O%=11 THEN O
    %=26
AE  3760 IF AS% THEN OC$=OC$+CHR
    $(27)
25  3770 DV=TA%:GOSUB 5340
5C  3780 RETURN
E6  3790 :
95  3800 REM ** CHECK FOR ++/--
CA  3810 :
4E  3820 IF ASC(L$(IP%))<>FS%+14
     THEN 3860
9F  3830 IF TS%<>1 THEN ER%=15:R
    ETURN
CA  3840 O%=6:IF AS% THEN O%=28
BC  3850 GOTO 3760
99  3860 IF ASC(L$(IP%))<>FS%+15
     THEN ER%=4 RETURN
F0  3870 IF TS%<>1 THEN ER%=15:R
    ETURN
B0  3880 O%=7:IF AS% THEN O%=29
54  3890 GOTO 3760
71  3900 :
6F  3910 :
AC  3920 REM ********************
    ***********
2E  3930 REM FIND SYMBOL IN TABL
    E
9B  3940 REM ********************
    ***********
47  3950 :
D2  3960 ER%=1
09  3970 AD%=0:SD%=0
A1  3980 :
20  3990 AD%=AD%+1
A5  4000 IF S$=VN$(AD%) THEN ER%
    =0
68  4010 IF VT%(AD%)=5 THEN SD%=
    -1
A4  4020 IF ER% AND AD%<>VT% THE
    N 3990
F7  4030 :
C7  4040 CV%=VT%(AD%)
7A  4050 IF CV%<3 OR CV%>4 OR ER
    % THEN AR%=0:RETURN
94  4060 AR%=-1:CV%=CV%-2
EC  4070 IP%=IP%+1:IF L$(IP%)<>"
    (" THEN ER%=7:RETURN
7B  4080 IP%=IP%+1:SP%=SP%+3:SK%
    (SP%-2)=AR%:SK%(SP%-1)=AD%:S
    K%(SP%)=CV%
F4  4090 GOSUB 4200:IF ER% THEN
    RETURN
5B  4100 IF CV%<>1 THEN ER%=15:R
    ETURN
6D  4110 IF L$(IP%)<>")" THEN ER
    %=7:RETURN
FB  4120 AR%=SK%(SP%-2):AD%=SK%(
    SP%-1):CV%=SK%(SP%):SP%=SP%-
    3
BC  4130 RETURN
06  4140 :
7C  4150 :
FF  4160 REM ********************
    ***********
6F  4170 REM EXPRESSION ANALYSIS

CB  4180 REM ********************
    ***********
54  4190 :
C4  4200 IP%=IP%-1
11  4210 SP%=SP%+1:SK%(SP%)=0
EB  4220 OI%=0
3B  4230 IP%=IP%+1
20  4240 S$=L$(IP%):C%=ASC(S$)
9E  4250 IF C%=0 THEN GOTO 4230
DB  4260 IF (FNCK(0)=0 AND C%<FS
    %) OR C%=13 OR FNCC(0) THEN
    4300
DA  4270 GOSUB 4430:IF ER% THEN
    RETURN
8E  4280 IF S$<>")" THEN GOTO 42
    30
EB  4290 :
2F  4300 IF SK%(SP%)=0 THEN 4360

AB  4310 O%=3:IF CV%=2 THEN O%=1
    5
18  4320 GOSUB 4670
E0  4330 O%=C%:GOSUB 4670
2C  4340 GOTO 4300
34  4350 :
D0  4360 SP%=SP%-1:S$=""
85  4370 IF SP%<0 THEN ER%=7
A3  4380 RETURN
0D  4390 :
85  4400 REM **** ANALYSIS OF LI
    NE ****
71  4410 :
6F  4420 :
C2  4430 IF C%<FS% THEN GOTO 458
    0
B4  4440 IF C%>FE% THEN GOSUB 48
    30:RETURN
3C  4450 IF OI% THEN ER%=6:RETUR
    N
EC  4460 OI%=-1
BD  4470 :
1B  4480 IF C%>SK%(SP%) OR SK%(S
    P%)=0 THEN GOTO 4550
16  4490 TV%=C%
24  4500 O%=3:IF CV%=2 THEN O%=1
    5
CB  4510 GOSUB 4670
17  4520 O%=C%:GOSUB 4670
62  4530 C%=TV%
EC  4540 GOTO 4480
30  4550 O%=2:IF CV%=2 THEN O%=1
    4
09  4560 GOSUB 4670
65  4570 RETURN
CF  4580 :
93  4590 IF C%=40 THEN GOSUB 421
    0:RETURN
F0  4600 IF C%=41 THEN RETURN
03  4610 OI%=0
6B  4620 IF C%=34 THEN GOSUB 498
    0:RETURN
```

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01  4630 GOSUB 5090:RETURN
08  4640 :
11  4650 REM **** GENERATE OP CO
    DES ****
7C  4660 :
6F  4670 IF O%>=FS% AND CV%=2 TH
    EN OC$=OC$+CHR$(16)
56  4680 OC$=OC$+CHR$(O%)
3F  4690 IF CV%=2 AND O%>FS% AND
     (O%<FS%+4 OR O%>FS%+10) THE
    N ER%=15:RETURN
44  4700 IF CV%=2 AND O%=FS%+10
    THEN RETURN
2A  4710 IF O%>=FS% THEN CV%=1:R
    ETURN
E9  4720 IF O%=2 OR O%=14 THEN S
    P%=SP%+1:SK%(SP%)=C%:TP%=TP%
    +1:TK%(TP%)=CV%
DC  4730 IF O%<>3 AND O%<>15 THE
    N RETURN
AE  4740 C%=SK%(SP%):SP%=SP%-1
E0  4750 IF CV%=TK%(TP%) THEN TP
    %=TP%-1:RETURN
F4  4760 ER%=15:RETURN
BE  4770 :
B4  4780 :
17  4790 REM ********************
    **********
35  4800 REM FUNCTION DISPATCH
63  4810 REM ********************
    **********
DC  4820 :
FB  4830 IP%=IP%+1:IF L$(IP%)<>"
    (" THEN ER%=7:RETURN
39  4840 SP%=SP%+1:SK%(SP%)=C%
F2  4850 R%=C%-FE%
95  4860 ON R% GOSUB 9040,9040,9
    120,9220,9220,9120,9320,9320
    ,9040,9420
AB  4870 IF R%>10 THEN ON R%-10
    GOSUB 9420,9570,9760,9320,93
    20,9910
D2  4880 IF L$(IP%)<>")" THEN ER
    %=7:RETURN
61  4890 C%=SK%(SP%):SP%=SP%-1
11  4900 OC$=OC$+CHR$(C%)
CF  4910 RETURN
71  4920 :
6F  4930 :
AC  4940 REM ********************
    **********
B4  4950 REM LITERAL STRING HAND
    LER
98  4960 REM ********************
    **********
47  4970 :
9F  4980 IF RIGHT$(S$,1)<>CHR$(3
    4) THEN ER%=7:RETURN
3D  4990 LS$(IT%)=MID$(S$,2,LEN(
    S$)-2):LN%(IT%)=LEN(S$)-2
EA  5000 OC$=OC$+CHR$(10)+CHR$(F
    NLO(IT%))+CHR$(FNHI(IT%))
16  5010 CV%=2:IT%=IT%+1
21  5020 RETURN
B3  5030 :
F9  5040 :
12  5050 REM ********************
    **********
FB  5060 REM NUMERIC & SYMBOL EV
    ALUATION
4E  5070 REM ********************
    **********
D1  5080 :
56  5090 IF FNN(0)=0 THEN GOTO 5
    140
1F  5100 GOSUB 5440
35  5110 IF ER%=0 THEN O%=1:GOSU
    B 5340
9A  5120 RETURN
24  5130 :
F3  5140 IF FNA(0)=0 THEN GOTO 5
    260
43  5150 GOSUB 3960
87  5160 IF CV%>4 THEN ER%=26:RE
    TURN
F6  5170 IF ER% THEN RETURN
82  5180 DV=AD%
C9  5190 O%=12:IF CV%=1 THEN O%=
    5
BD  5200 IF AR% AND O%=5 THEN O%
    =23
93  5210 IF AR% AND O%=12 THEN O
    %=25
E3  5220 IF AR% THEN OC$=OC$+CHR
    $(30)
A9  5230 GOSUB 5340
02  5240 RETURN
AC  5250 :
33  5260 IF ER%=0 THEN ER%=7
24  5270 RETURN
8E  5280 :
B4  5290 :
17  5300 REM ********************
    **********
CF  5310 REM PLACE VALUE IN OPCO
    DE STRING
63  5320 REM ********************
    **********
DC  5330 :
D4  5340 OC$=OC$+CHR$(O%)
A5  5350 OC$=OC$+CHR$(FNLO(DV))
F1  5360 OC$=OC$+CHR$(FNHI(DV))
80  5370 RETURN
23  5380 :
19  5390 :
B2  5400 REM ********************
    **********
6S  5410 REM EVALUATE NUMERIC SI
    RING
EE  5420 REM ********************
    **********
71  5430 :
97  5440 DV=0:B%=10
AA  5450 I$=LEFT$(S$,1)
9S  5460 IF I$="$" THEN B%=16
69  5470 IF I$="%" THEN B%=2
EE  5480 IF I$="@" THEN B%=8
8A  5490 ER%=0:P%=1:IF B%<>10 TH
    EN P%=2
AB  5500 :
BE  5510 C%=ASC(MID$(S$,P%,1))
A0  5520 DV=DV*B%+(C%-48-(B%>10)
    *(7*(C%>65)))
5C  5530 P%=P%+1
2F  5540 IF P%<=LEN(S$) THEN 551
    0
F9  5550 :
4E  5560 IF DV>65535 THEN ER%=8
B0  5570 CV%=1
6F  5580 RETURN
D1  5590 :
CF  5600 :
0C  5610 REM ********************
    **********
56  5620 REM ********************
    **********
13  5630 REM VAR KEYWORD (DECLAR
    E VARS)
6D  5640 REM ********************
    **********
12  5650 :
8C  5660 IP%=IP%+1:TP%=ASC(L$(IP
    %))
30  5670 IF TP%<>130 AND TP%<>13
    1 THEN ER%=13:RETURN
7C  5680 :
FD  5690 IP%=IP%+1
54  5700 S$=L$(IP%)
4B  5710 IF S$=CHR$(13) THEN ER%
    =10:RETURN
BC  5720 C%=ASC(S$):IF FNA(0)=0
    OR C%=34 THEN ER%=11:RETURN
2B  5730 GOSUB 3960:IF ER%=0 THE
    N ER%=2:RETURN
B9  5740 IF CV%>4 THEN ER%=26:RE
    TURN
C0  5750 ER%=0
BB  5760 IF LEN(S$)>20 THEN ER%=
    29:RETURN
E0  5770 VN$(VT%)=S$:VT%(VT%)=TP
    %-129
21  5780 IP%=IP%+1:S$=L$(IP%)
72  5790 IF ASC(S$)<>132 THEN 58
    50
B1  5800 IP%=IP%+1:IF L$(IP%)<>"
    (" THEN ER%=7:RETURN
95  5810 IP%=IP%+1:S$=L$(IP%):GO
    SUB 5440:IF ER% THEN RETURN
AB  5820 IP%=IP%+1:IF L$(IP%)<>"
    )" THEN ER%=7:RETURN
AF  5830 VV%(VT%)=DV:VT%(VT%)=VT
    %(VT%)+2
CD  5840 IP%=IP%+1:S$=L$(IP%)
B7  5850 V%(VT%(VT%))=V%(VT%(VT%
    ))+1
CA  5860 VT%=VT%+1:IF S$="," THE
    N 5690
9S  5870 IF S$<>CHR$(13) THEN ER
    %=9
80  5880 RETURN
23  5890 :
1S  5900 :
B2  5910 REM ********************
    **********
E2  5920 REM BSET/WSET KEYWORDS
EE  5930 REM ********************
    **********
71  5940 :
07  5950 IP%=IP%+1:TS%=1
7A  5960 GOSUB 4200:IF ER% THEN
    RETURN
16  5970 IF CV%<>1 THEN ER%=15:R
    ETURN
6B  5980 IF L$(IP%)<>"," THEN ER
    %=7:RETURN
C8  5990 IP%=IP%+1
FB  6000 OC$=OC$+CHR$(2)
3C  6010 GOSUB 4200:IF ER% THEN
    RETURN
4C  6020 IF CV%<>1 THEN ER%=15:R
    ETURN
14  6030 IF ASC(L$(IP%))<>13 THE
    N WR%=1
5A  6040 OC$=OC$+CHR$(3)+CHR$(B)
    +CHR$(KR%)
37  6050 RETURN
F9  6060 :
F7  6070 :
24  6080 REM ********************
    **********
E7  6090 REM LOOP KEYWORD
30  6100 REM ********************
    **********
CF  6110 :
09  6120 OC$=OC$+CHR$(KR%)
AB  6130 CP%=CP%+1:CK%(CP%)=1
16  6140 IP%=IP%+1
7E  6150 C%=ASC(L$(IP%)):IF C%=1
    3 THEN RETURN
E6  6160 IF C%<>137 THEN ER%=16:
    RETURN
F7  6170 IP%=IP%+1
69  6180 GOSUB 4200:IF ER% THEN
    RETURN
45  6190 OC$=OC$+CHR$(137)
AB  6200 IF ASC(L$(IP%))<>13 THE
    N WR%=1
D4  6210 RETURN
5E  6220 :
54  6230 :
C7  6240 REM ********************
    **********
D5  6250 REM ENDLOOP KEYWORD
D3  6260 REM ********************
    **********
AC  6270 :
64  6280 OC$=OC$+CHR$(KR%)
EF  6290 IF CK%(CP%)=0 OR CK%(CP
    %)<>1 THEN ER%=17:RETURN
```

```
1C  6300 CP%=CP%-1
03  6310 IP%=IP%+1
7B  6320 C%=ASC(L$(IP%)):IF C%=1
    3 THEN RETURN
7F  6330 IF C%<>138 THEN ER%=16:
    RETURN
69  6340 IP%=IP%+1
83  6350 GOSUB 4200:IF ER% THEN
    RETURN
0A  6360 OC$=OC$+CHR$(138)
20  6370 IF L$(IP%)<>CHR$(13) TH
    EN WR%=1
BA  6380 RETURN
34  6390 :
23  6400 :
4B  6410 REM ******************
    **********
CA  6420 REM IF KEYWORD
44  6430 REM ******************
    **********
7B  6440 :
0E  6450 IP%=IP%+1
B8  6460 CP%=CP%+1:CK%(CP%)=2
E6  6470 IF ASC(L$(IP%))=13 THEN
     ER%=7:RETURN
54  6480 GOSUB 4200:IF ER% THEN
    RETURN
49  6490 :
BC  6500 IF ASC(L$(IP%))<>13 THE
    N WR%=1
01  6510 OC$=OC$+CHR$(KR%)
1F  6520 RETURN
A1  6530 :
9F  6540 :
FC  6550 REM ******************
    **********
4A  6560 REM ELSE KEYWORD
28  6570 REM ******************
    **********
F7  6580 :
7A  6590 IP%=IP%+1
9F  6600 IF L$(IP%)<>CHR$(13) TH
    EN WR%=1
05  6610 OC$=OC$+CHR$(KR%)
A3  6620 IF CK%(CP%)<>2 OR CK%(C
    P%)=0 THEN ER%=17:RETURN
4A  6630 CK%(CP%)=3
B7  6640 RETURN
29  6650 :
24  6660 :
B7  6670 REM ******************
    **********
BC  6680 REM ENDIF KEYWORD
83  6690 REM ******************
    **********
7C  6700 :
FD  6710 IP%=IP%+1
00  6720 IF L$(IP%)<>CHR$(13) TH
    EN WR%=1
0B  6730 OC$=OC$+CHR$(KR%)
13  6740 IF (CK%(CP%)<>2 AND CK%
    (CP%)<>3) OR CK%(CP%)=0 THEN
     ER%=17:RETURN
30  6750 CP%=CP%-1
0C  6760 RETURN
B6  6770 :
AC  6780 :
0F  6790 REM ******************
    **********
1F  6800 REM BEGIN KEYWORD
1B  6810 REM ******************
    **********
B4  6820 :
5F  6830 IF CO% THEN ER%=18:RETU
    RN
30  6840 IP%=IP%+1:IF ASC(L$(IP%
    ))<>13 THEN WR%=1
04  6850 CO%=-1
FA  6860 OC$=OC$+CHR$(KR%)
7E  6870 RETURN
C0  6880 :
3E  6890 :
1D  6900 REM ******************
    **********
19  6910 REM END KEYWORD
48  6920 REM ******************
    **********
17  6930 :
70  6940 PRINT "[SE]ND CODE SUPP
    LIED COURTESY OF COMPILER."
5F  6950 IF SH% THEN SH%=0
5A  6960 IF CO%=0 THEN ER%=18:RE
    TURN
F1  6970 IP%=IP%+1:IF ASC(L$(IP%
    ))<>13 THEN WR%=1
C7  6980 CO%=0
E5  6990 IF CK%(CP%)<>0 THEN ER%
    =20:RETURN
9D  7000 OC$=OC$+CHR$(KR%)
F3  7010 RETURN
BD  7020 :
AB  7030 :
E0  7040 REM ******************
    **********
0B  7050 REM CHAROUT KEYWORD
FC  7060 REM ******************
    **********
83  7070 :
AC  7080 CO%=0
9D  7090 IP%=IP%+1:IF L$(IP%)<>"
    #" THEN 7150
E1  7100 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
AE  7110 IF CV%<>1 THEN ER%=15:R
    ETURN
29  7120 OC$=OC$+CHR$(18):CO%=-1
    
2D  7130 IF L$(IP%)<>"," THEN ER
    %=7:RETURN
42  7140 IP%=IP%+1
F4  7150 GOSUB 4200:IF ER% THEN
    RETURN
44  7160 IF CV%<>1 THEN ER%=15:R
    ETURN
B5  7170 IF ASC(L$(IP%))<>13 THE
    N WR%=1
DC  7180 OC$=OC$+CHR$(KR%)
BB  7190 IF CO% THEN OC$=OC$+CHR
    $(33)
B2  7200 RETURN
7C  7210 :
6A  7220 :
A1  7230 REM ******************
    **********
CE  7240 REM FOPEN KEYWORD
BD  7250 REM ******************
    **********
42  7260 :
0C  7270 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
33  7280 IF CV%<>1 THEN ER%=15:R
    ETURN
14  7290 OC$=OC$+CHR$(2)
FE  7300 IF L$(IP%)<>"," THEN ER
    %=7:RETURN
D4  7310 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
0E  7320 IF CV%<>2 THEN ER%=15:R
    ETURN
0D  7330 IF ASC(L$(IP%))<> 146 T
    HEN ER%=20:RETURN
F5  7340 IP%=IP%+1
4E  7350 C%=ASC(L$(IP%)):IF C%<>
    147 AND C%<>148 THEN ER%=20:
    RETURN
F8  7360 OC$=OC$+CHR$(3)+CHR$(B)
    +CHR$(C%)+CHR$(KR%)
94  7370 IP%=IP%+1:IF ASC(L$(IP%
    ))<>13 THEN WR%=1
41  7380 FO%=FO%+1
74  7390 RETURN
3E  7400 :
34  7410 :
A7  7420 REM ******************
    **********
F9  7430 REM FCLOSE KEYWORD
B2  7440 REM ******************
    **********
0D  7450 :
EB  7460 IP%=IP%+1:IF ASC(L$(IP%
    ))=13 THEN ER%=7:RETURN
F6  7470 GOSUB 4200:IF ER% THEN
    RETURN
9A  7480 IF CV%<>1 THEN ER%=15:R
    ETURN
FA  7490 IF ASC(L$(IP%))<>13 THE
    N WR%=1
7B  7500 OC$=OC$+CHR$(KR%)
DD  7510 FO%=FO%-1
F3  7520 RETURN
BD  7530 :
AB  7540 :
E0  7550 REM ******************
    **********
2E  7560 REM WRITE KEYWORD
FC  7570 REM ******************
    **********
83  7580 :
53  7590 CO%=0:FR%=-1
95  7600 IP%=IP%+1:IF L$(IP%)<>"
    #" THEN IP%=IP%-1:GOTO 7650
E1  7610 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
AE  7620 IF CV%<>1 THEN ER%=15:R
    ETURN
29  7630 OC$=OC$+CHR$(18):CO%=-1
    
2D  7640 IF L$(IP%)<>"," THEN ER
    %=7:RETURN
42  7650 IP%=IP%+1
99  7660 C%=ASC(L$(IP%))
92  7670 IF C%<>13 THEN 7710
6A  7680 IF FR% THEN OC$=OC$+CHR
    $(21)
85  7690 IF CO% THEN OC$=OC$+CHR
    $(33)
BC  7700 RETURN
D4  7710 IF C%=44 THEN OC$=OC$+C
    HR$(22):FR%=0:GOTO 7650
49  7720 IF C%=39 THEN OC$=OC$+C
    HR$(21):FR%=-1:GOTO 7650
0A  7730 IF C%=59 THEN FR%=0:GOT
    O 7650
87  7740 GOSUB 4200:IF ER% THEN
    RETURN
AD  7750 OC$=OC$+CHR$(CV%+18)
EB  7760 FR%=-1
9A  7770 GOTO 7660
B8  7780 :
B6  7790 :
E5  7800 REM ******************
    **********
28  7810 REM READ KEYWORD
F1  7820 REM ******************
    **********
BE  7830 :
28  7840 CO%=0
B0  7850 IP%=IP%+1:IF L$(IP%)<>"
    #" THEN IP%=IP%-1:GOTO 7900
BC  7860 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
03  7870 IF CV%<>1 THEN ER%=15:R
    ETURN
D3  7880 OC$=OC$+CHR$(17):CO%=-1
    
EE  7890 IF L$(IP%)<>"," THEN ER
    %=7:RETURN
5F  7900 IP%=IP%+1
19  7910 S$=L$(IP%):GOSUB 3960:I
    F ER% THEN RETURN
4D  7920 IF CV%>4 THEN ER%=26:RE
    TURN
03  7930 IF AR% THEN OC$=OC$+CHR
    $(30)
A2  7940 OC$=OC$+CHR$(30+CV%)
BC  7950 O%=11:IF CV%=1 THEN O%=
    4
7A  7960 IF AR% AND O%=4 THEN O%
    =24
```

```
E8  7970 IF AR% AND O%=11 THEN O
    %=26
D2  7980 DV=AD%:GOSUB 5340
B6  7990 IP%=IP%+1:C%=ASC(LS(IP%
    ))
B6  8000 IF C%<>13 THEN 8030
78  8010 IF CO% THEN OC$=OC$+CHR
    $(33)
FD  8020 RETURN
D1  8030 IF C%=44 THEN 7900
B0  8040 ER%=7:RETURN
AB  8050 :
A1  8060 :
0A  8070 REM ******************
    **********
01  8080 REM SUBROUTINE KEYWORD
06  8090 REM ******************
    **********
F9  8100 :
B5  8110 IF SH% THEN ER%=24:RETU
    RN
07  8120 IF CO% THEN ER%=28:EF%=
    -1:RETURN
5B  8130 IP%=IP%+1:S$=LS(IP%):C%
    =ASC(S$):IF FNA(0)=0 OR C%=3
    4 THEN ER%=27:EF%=-1:RETURN
08  8140 GOSUB 3960
A7  8150 IF ER%=0 THEN 8200
12  8160 VN$(VT%)=S$:VT%(VT%)=7
C3  8170 SH%=-1
32  8180 O%=KR%:DV=AD%:GOSUB5340

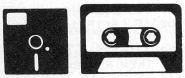
4A  8190 VT%=VT%+1:ER%=0:RETURN
81  8200 IF CU%<5 THEN ER%=27:EF
    %=-1:RETURN
69  8210 IF CU%=5 THEN VT%(AD%)=
    7:GOTO 8170
23  8220 ER%=23:FE%=-1:RETURN
7C  8230 :
6A  8240 :
A1  8250 REM ******************
    **********
BC  8260 REM RETURN KEYWORD
BD  8270 REM ******************
    **********
42  8280 :
C5  8290 IF SH%=0 THEN ER%=25:RE
    TURN
60  8300 OC$=OC$+CHR$(KR%)
1B  8310 RETURN
9A  8320 :
90  8330 :
1B  8340 REM ******************
    **********
DC  8350 REM CALL KEYWORD
17  8360 REM ******************
    **********
EB  8370 :
6A  8380 IP%=IP%+1:S$=LS(IP%):GO
    SUB 3920
08  8390 IF ER% THEN ER%=22:RETU
    RN
F5  8400 O%=KR%:DV=AD%:GOSUB5300

74  8410 RETURN
3E  8420 :
34  8430 :
A7  8440 REM ******************
    **********
B4  8450 REM EXTERNAL KEYWORD
B2  8460 REM ******************
    **********
0D  8470 :
52  8480 IF CO% THEN WR%=3
B8  8490 IP%=IP%+1:S$=LS(IP%):C%
    =ASC(S$)
1B  8500 IF C%=13 THEN RETURN
34  8510 IF C%=44 THEN 8490
C2  8520 IF FNA(0)=0 OR C%=34 TH
    EN ER%=27:RETURN
80  8530 GOSUB 3960
A2  8540 IF ER%=0 THEN ER%=23:RE
    TURN
D3  8550 ER%=0
6B  8560 VN$(VT%)=S$:VT%(VT%)=6
8A  8570 VT%=VT%+1
C1  8580 GOTO 8490
95  8590 :
83  8600 :
28  8610 REM ******************
    **********
DE  8620 REM FORWARD KEYWORD
24  8630 REM ******************
    **********
DB  8640 :
00  8650 IF CO% THEN WR%=3
56  8660 IP%=IP%+1:S$=LS(IP%):C%
    =ASC(S$)
65  8670 IF C%=13 THEN RETURN
7F  8680 IF C%=44 THEN 8660
64  8690 IF FNA(0)=0 OR C%=34 TH
    EN ER%=27:RETURN
BA  8700 GOSUB 3960
69  8710 IF ER%=0 THEN ER%=23:RE
    TURN
AE  8720 ER%=0
EF  8730 VN$(VT%)=S$:VT%(VT%)=5
B7  8740 VT%=VT%+1
F1  8750 GOTO 8660
60  8760 :
5E  8770 :
BD  8780 REM ******************
    **********
5D  8790 REM CLS AND HALT KEYWOR
    DS
E9  8800 REM ******************
    **********
B6  8810 :
C4  8820 IP%=IP%+1:IF ASC(LS(IP%
    ))<>13 THEN WR%=1
64  8830 OC$=OC$+CHR$(KR%)
24  8840 RETURN
8E  8850 :
84  8860 :
17  8870 REM ******************
    **********
3A  8880 REM WAIT AND SYSCALL KE
    YWORDS
63  8890 REM ******************
    **********
DC  8900 :
EE  8910 IP%=IP%+1:IF ASC(LS(IP%
    ))=13 THEN ER%=7:RETURN
A7  8920 GOSUB 4200:IF ER% THEN
    RETURN
CB  8930 IF CU%<>1 THEN ER%=15:R
    ETURN
85  8940 IF ASC(LS(IP%))<>13 THE
    N WR%=1
8C  8950 OC$=OC$+CHR$(KR%)
AD  8960 RETURN
17  8970 :
0D  8980 :
EE  8990 REM ******************
    **********
50  9000 REM ******************
    **********
CA  9010 REM BYTE,WORD & CHARIN
    FUNCTIONS
AC  9020 REM ******************
    **********
53  9030 :
1D  9040 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
42  9050 IF CU%<>1 THEN ER%=15:R
    ETURN
09  9060 RETURN
AB  9070 :
E0  9080 REM ******************
    **********
09  9090 REM LEN & ASCII FUNCTIO
    NS
FC  9100 REM ******************
    **********
83  9110 :
CD  9120 IP%=IP%+1:GOSUB 4200:IF
    ER% THEN RETURN
55  9130 IF CU%<>2 THEN ER%=15:R
    ETURN
B0  9140 CU%=1
6F  9150 RETURN
D1  9160 :
CF  9170 :
0C  9180 REM ******************
    **********
47  9190 REM CHAR & STR FUNCTION

7B  9200 REM ******************
    **********
27  9210 :
2A  9220 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
FD  9230 IF CU%<>1 THEN ER%=15:R
    ETURN
90  9240 CU%=2
C8  9250 RETURN
6A  9260 :
60  9270 :
A1  9280 REM ******************
    **********
F8  9290 REM STOP, KEY, IOSTAT,D
    STAT
9D  9300 REM ******************
    **********
B8  9310 :
9E  9320 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
D9  9330 IF CU%<>1 THEN ER%=15:R
    ETURN
FF  9340 CU%=1
24  9350 RETURN
BE  9360 :
B4  9370 :
17  9380 REM ******************
    **********
7B  9390 REM LEFT & RIGHT FUNCTI
    ONS
63  9400 REM ******************
    **********
DC  9410 :
72  9420 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
C0  9430 IF CU%<>2 THEN ER%=15:R
    ETURN
4F  9440 OC$=OC$+CHR$(14)
C4  9450 IF LS(IP%)<>"," THEN ER
    %=7:RETURN
FA  9460 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
6D  9470 IF CU%<>1 THEN ER%=15:R
    ETURN
3D  9480 OC$=OC$+CHR$(8)+CHR$(15
    )
93  9490 CU%=2
CF  9500 RETURN
71  9510 :
6F  9520 :
AC  9530 REM ******************
    **********
B8  9540 REM MID FUNCTION
98  9550 REM ******************
    **********
47  9560 :
71  9570 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
A1  9580 IF CU%<>2 THEN ER%=15:R
    ETURN
08  9590 OC$=OC$+CHR$(14)
FD  9600 IF LS(IP%)<>"," THEN ER
    %=7:RETURN
79  9610 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
26  9620 IF CU%<>1 THEN ER%=15:R
    ETURN
9F  9630 OC$=OC$+CHR$(2)
65  9640 IF LS(IP%)<>"," THEN ER
    %=7:RETURN
E1  9650 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
```

```
AE  9660 IF CV%<>1 THEN ER%=15:R
    ETURN
61  9670 OC$=OC$+CHR$(9)+CHR$(3)
    +CHR$(8)+CHR$(15)
E9  9680 CV%=2
71  9690 RETURN
33  9700 :
29  9710 :
A2  9720 REM ******************
    **********
0E  9730 REM SYSFN FUNCTION
59  9740 REM ******************
    **********
06  9750 :
70  9760 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
DF  9770 IF CV%<>1 THEN ER%=15:R
    ETURN
50  9780 OC$=OC$+CHR$(2)
42  9790 IF L$(IP%)<>"," THEN ER
    %=7:RETURN
B8  9800 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
AA  9810 IF CV%<>2 THEN ER%=15:R
    ETURN
17  9820 OC$=OC$+CHR$(3)
80  9830 CV%=2
18  9840 RETURN
9A  9850 :
90  9860 :
1B  9870 REM ******************
    **********
42  9880 REM DERR FUNCTION
17  9890 REM ******************
    **********
E8  9900 :
0E  9910 IP%=IP%+1:GOSUB 4200:IF
     ER% THEN RETURN
69  9920 IF CV%<>1 THEN ER%=15:R
    ETURN
EC  9930 CV%=2
74  9940 RETURN
3E  9950 :
34  9960 :
```

CONSTRUCTING A COMPILER



Oops! Last month we forgot to give you the example programs for the series Constructing a Compiler - Here they are!

PROGRAM: EXAMPLE 1

```
10 ;
20 ; Example program 1
30 ;
40 ; Data Division
50 ;
60 var int pointer,count
70 var string filename,table arr
ay(10)
80 ;
90 forward inputdata,outputdata
100 ;
110 ; Procedure Division
120 ;
130 begin
140 pointer=0
150 inputdata
160 count=0
170 outputdata
180 end
190 ;
200 ; Subroutines
210 ;
220 subroutine inputdata
230 begin
240 loop while pointer<10
250 write "Enter element ";point
er;":";
260 read table(pointer)
270 pointer++
280 endloop
290 end
300 ;
310 subroutine outputdata
320 begin
330 write "Enter Filename:";
340 read filename
350 fopen 5,filename for output
360 if iostat(0)=0
370 loop
380 write#5,table(count)
390 count++
400 endloop when count=10
410 else
420 write "Data file error!"
430 endif
440 fclose 5
450 end
```

CONSTRUCTING A COMPILER

PROGRAM: EXAMPLE 2

```
10 ;
20 ; Example program 2
30 ;
40 ; Data Division
50 ;
60 var int pointer,fileerror
70 var string filename,table arr
ay(10),disk
80 ;
90 ; Subroutines
100 ;
110 subroutine getdata
120 begin
130 write "Enter filename:";
140 read filename
150 fopen 9,filename for input
170 loop
180 read#9,table(pointer)
181 if dstat(0)<>0
182 fileerror=1
183 else
190 pointer++
191 endif
200 endloop when pointer=10 or f
ileerror
250 fclose 9
260 end
270 ;
280 subroutine printdata
290 begin
300 loop while pointer<>10
310 write table(pointer)
320 pointer++
330 endloop
340 end
350 ;
360 ; Procedure Division
370 ;
380 begin
390 fileerror=0
400 pointer=0
401 disk=derr(0)
410 getdata
420 if fileerror=0
430 pointer=0
440 printdata
450 else
451 write "Data file error!"
```

MAKING MUSIC

PROGRAM: SOUNDTRACK

```
9E  1 REM:SOUNDTRACK
3B  2 :
39  3 :
C9  10 B=0:C=0
BC  20 FORI=51456TO51520
73  25 READA:POKEI,A:B=B+A
E5  30 NEXTI
1E  35 IFB<>3871THENPRINT"[SE]RR
    OR IN LINES 200-235:PLEASE C
    HECK.":STOP
EB  36 PRINT"[SB]LOCK 1 ENTERED
    CORRECTLY."
12  40 FORI=52944TO53198
DF  45 READA:POKEI,A:C=C+A
F9  50 NEXTI
10  55 IFC<>41571THENPRINT"[SE]R
    ROR IN LINES 300 ONWARDS: PL
    EASE[SPC6]CHECK.":STOP
BA  60 PRINT"[SA]LL ENTERED CORR
    ECTLY."
7E  65 POKE53281,7:POKE53280,9:P
    RINT"[CLR]";CHR$(14)
F9  70 V=54272:POKEV+24,15
1C  75 POKEV+12,9:POKEV+19,9
ED  80 FORI=0TO31:POKE49152+I,I:
    POKE51200+I,I:NEXT
EE  85 FORI=0TO31:POKE49183+I,(3
    1-I):POKE51231+I,(31-I):NEXT

0C  86 POKE49215,255:POKE51263,2
    55
9A  90 PRINT:PRINT"[BLACK,SN]OT
    VERY PRETTY, BUT IT WORKS!"
F7  95 SYS53176
1F  100 PRINT:PRINT"[SP,SO,SK,SE
    ] $[SC,SF]0[SC] TO ALTER W/F
    ORM FOR VOICE 2.
7B  102 PRINT"[SP,SO,SK,SE] $[SC
    ,SF]86 TO ALTER W/FORM FOR V
    OICE 3.
6B  104 PRINT"[SP,SO,SK,SE] $[SC
    ,SE,SD]8 TO ALTER DELAY (CUR
    RENTLY AT 12).
EA  106 END
F5  200 DATA 004,073,004,139,004
    ,208,005,025,005,103
14  205 DATA 005,185,006,016,006
    ,108,006,206,007,053
A5  210 DATA 007,163,008,023,008
```

```
   ,147,009,021,009,159
B1 215 DATA 010,050,010,205,011
   ,114,012,032,012,216
F3 220 DATA 013,156,014,107,015
   ,070,016,047,017,037
13 225 DATA 018,042,019,063,020
   ,100,021,154,022,227
90 230 DATA 024,063,025,177,000

61 300 DATA 174,207,206,232,142
   ,207,206,224,012,240
52 305 DATA 004,076,049,234,234
   ,162,000,142,207,206
0F 310 DATA 174,206,206,234,234
   ,142,206,206,234,234
D9 315 DATA 234,076,128,207,234
   ,234,234,234,234,234
44 320 DATA 234,234,234,234,234
   ,234,000,024,174,255
51 325 DATA 206,172,254,206,169
   ,000,141,011,212,169
6F 330 DATA 033,141,011,212,185
   ,096,207,141,029,207
8B 335 DATA 185,097,207,141,030
   ,207,189,000,192,201
9D 340 DATA 255,240,029,010,170
   ,189,000,201,141,008
82 345 DATA 212,189,001,201,141
   ,007,212,174,255,206
58 350 DATA 234,232,224,240,240
   ,019,142,255,206,076
05 355 DATA 049,234,162,000,142
   ,255,206,142,254,206
15 360 DATA 076,000,207,234,234
   ,172,254,206,200,200
9F 365 DATA 140,254,206,162,000
   ,142,255,206,076,049
EB 370 DATA 234,000,255,000,000
   ,192,240,192,224,193
ED 375 DATA 208,194,192,195,176
   ,196,160,197,144,198
52 380 DATA 255,255,255,255,255
   ,255,255,255,255,255
C0 385 DATA 255,255,255,255,255
   ,255,169,000,141,018
D1 390 DATA 212,169,033,141,018
   ,212,174,206,206,189
BF 395 DATA 000,200,201,255,240
   ,017,010,170,189,000
3C 400 DATA 201,141,015,212,189
   ,001,201,141,014,212
F9 405 DATA 076,174,207,162,000
   ,142,206,206,076,128
FF 410 DATA 207,234,174,206,206
   ,232,142,206,206,076
79 415 DATA 000,207,169,208,141
   ,020,003,169,206,141
45 420 DATA 021,003,169,000,141
   ,255,206,141,254,206
00 425 DATA 141,206,206,096,000
```

SAMPLER 64

PROGRAM: BOOT

```
4F  5 PRINT"[CLR]"
0B 10 POKE53280,0:POKE53281,0
9D 20 PRINT"THIS PROGRAM LINKS
   UP TO THE"
6C 30 PRINT"[DOWN]DATA READ PRO
   GRAMS. TO START"
36 40 PRINT"[DOWN]WITH THE PROG
   RAM RELOCATES THE BASIC"
93 50 PRINT"[DOWN]AREA SO THE P
   ROGRAM CAN BE POKED IN"
F8 60 PRINT"[DOWN]CORRECTLY INT
   O ITS CORRECT AREA"
49 70 PRINT"[DOWN]OF MEMORY AND
    THEN SAVED"
37 80 PRINT"[DOWN]PRESS ANY KEY
   TO LOAD"
BC 90 GET A$:IF A$=""THEN 90
B3 100 PRINT"[CLR]POKE43,1:POKE
   44,64:POKE16384,0:NEW[DOWN2]
   "
86 110 PRINT"LOAD"+CHR$(34)+"DA
   TA1"+CHR$(34)+",8"
4A 120 PRINT"[DOWN4]RUN"
0B 130 POKE631,19:POKE632,13:PO
   KE633,13:POKE634,13:POKE198,
   4
```

SAMPLER 64

PROGRAM: DATA 1

```
D9  5 L=2049:CH=0
0B 10 POKE53280,0:POKE53281,0
5E 20 PRINT"[CLR]"
13 30 PRINT"DATA LOADER 1"
1A 40 PRINT"[HOME,DOWN2]POKE LO
   CATION:"L
61 50 FOR I=1 TO 8
9A 60 READ A
9A 65 IF A<0 THEN 120
F0 70 POKEL,A:CH=CH+A:L=L+1
D2 80 NEXT
4E 90 READ SUM
3D 100 IF SUM<>CHTHEN PRINT"CHE
   CKSUM ERROR IN LINE"PEEK(64)
   *256+PEEK(63):STOP
9A 110 CH=0:GOTO 40
2B 120 PRINT"[CLR]NEW[DOWN3]LOA
   D"+CHR$(34)+"DATA2"+CHR$(34)
   +",8[DOWN5]RUN"
0B 130 POKE631,19:POKE632,13:PO
   KE633,13:POKE634,13:POKE198,
   4
65 500 DATA 62,8,10,0,158,50,49
   ,49,386
06 501 DATA 50,58,143,34,20,20,
   20,20,365
2B 502 DATA 20,20,20,20,20,20,2
   0,20,160
08 503 DATA 20,20,20,83,79,85,7
   8,68,453
EC 504 DATA 32,83,65,77,80,76,6
   9,82,564
F5 505 DATA 32,66,89,32,83,84,6
   9,80,535
D7 506 DATA 72,69,78,32,84,72,7
   9,77,563
96 507 DATA 32,39,56,56,0,0,0,1
   69,352
5D 508 DATA 0,141,32,208,141,33
   ,208,169,932
0C 509 DATA 1,141,134,2,169,8,3
   2,210,697
E1 510 DATA 255,160,0,169,224,1
   33,251,169,1361
9C 511 DATA 8,133,252,169,0,133
   ,253,169,1117
5B 512 DATA 208,133,254,120,169
   ,52,133,1,1070
03 513 DATA 177,251,145,253,200
   ,208,249,230,1713
0A 514 DATA 254,230,252,165,254
   ,201,249,208,1813
2E 515 DATA 239,169,55,133,1,88
   ,160,0,845
A0 516 DATA 185,143,8,153,60,3,
   200,192,944
C1 517 DATA 80,208,245,76,60,3,
   234,234,1140
39 518 DATA 234,160,0,169,0,133
   ,251,169,1116
D1 519 DATA 50,133,252,169,1,13
   3,253,169,1160
BA 520 DATA 8,133,254,177,251,1
   45,253,200,1421
67 521 DATA 208,249,230,252,230
   ,254,165,254,1642
9F 522 DATA 201,12,208,239,169,
   0,133,251,1213
30 523 DATA 169,12,133,252,160,
   0,169,0,885
0E 524 DATA 145,251,200,208,249
   ,230,252,165,1700
63 525 DATA 252,201,208,208,241
   ,32,99,166,1407
11 526 DATA 32,142,166,169,0,13
   3,157,76,875
D4 527 DATA 174,167,0,0,0,0,0,3
   2,373
CE 528 DATA 32,32,32,32,32,32,3
   2,32,256
C9 529 DATA 32,32,32,32,32,32,3
   2,32,256
CC 530 DATA 32,32,32,32,32,32,3
   2,32,256
27 531 DATA 32,32,32,32,32,32,3
   2,32,256
CA 532 DATA 32,32,32,32,32,32,3
   2,32,256
95 533 DATA 32,32,32,32,32,32,3
   2,32,256
C4 534 DATA 32,32,32,32,32,80,3
   2,79,351
58 535 DATA 106,119,106,32,106,
   119,116,66,770
76 536 DATA 32,32,32,32,32,32,3
   2,32,256
F1 537 DATA 32,32,32,32,32,32,3
   2,32,256
F4 538 DATA 32,32,32,32,32,32,3
   2,32,256
3C 539 DATA 32,32,96,32,32,106,
   64,116,510
54 540 DATA 106,64,106,32,106,1
   11,116,66,707
5D 541 DATA 32,32,32,32,32,32,3
   2,32,256
10 542 DATA 32,32,32,32,32,32,3
   2,32,256
4B 543 DATA 32,32,32,32,32,32,3
   2,32,256
40 544 DATA 32,32,32,96,32,122,
   32,76,454
D6 545 DATA 106,111,106,111,106
   ,32,32,46,650
5C 546 DATA 32,32,32,32,32,32,3
   2,32,256
4B 547 DATA 32,32,32,32,32,32,3
   2,100,324
FD 548 DATA 100,100,100,100,100
   ,100,100,100,800
FC 549 DATA 100,100,100,100,100
   ,100,100,100,800
F3 550 DATA 100,100,100,100,100
   ,100,100,100,800
F2 551 DATA 100,100,100,100,100
   ,100,100,100,800
B9 552 DATA 100,100,100,100,100
   ,100,100,32,732
81 553 DATA 32,32,32,32,32,32,3
   2,32,256
84 554 DATA 32,32,32,32,32,32,3
   2,32,256
5F 555 DATA 32,32,32,32,32,32,3
   2,32,256
02 556 DATA 32,32,32,32,32,32,3
   2,32,256
```

```
6D  557 DATA 32,32,32,32,32,32,3
    2,32,256
A0  558 DATA 32,32,32,32,32,32,3
    2,32,256
7D  559 DATA 32,32,96,32,9,14,19
    ,20,254
3F  560 DATA 18,21,3,20,9,15,14,
    19,119
69  561 DATA 32,32,32,32,32,32,3
    2,32,256
90  562 DATA 32,32,32,32,32,32,3
    2,100,324
BE  563 DATA 100,100,100,100,100
    ,100,100,100,800
8D  564 DATA 100,100,100,100,100
    ,100,100,100,800
8C  565 DATA 100,100,100,100,100
    ,100,100,100,800
03  566 DATA 100,100,100,100,100
    ,100,100,100,800
AC  567 DATA 100,100,100,100,100
    ,100,100,32,732
96  568 DATA 32,32,32,32,32,32,3
    2,32,256
11  569 DATA 32,32,32,32,32,32,3
    2,32,256
14  570 DATA 32,32,32,32,32,32,3
    2,32,256
6F  571 DATA 32,32,32,32,32,32,3
    2,32,256
92  572 DATA 32,32,32,32,32,32,3
    2,32,256
E6  573 DATA 9,14,32,20,8,5,32,6
    ,126
F2  574 DATA 9,18,19,20,32,13,5,
    14,130
54  575 DATA 21,32,20,8,5,18,5,3
    2,141
B8  576 DATA 1,18,5,32,19,9,24,3
    2,140
03  577 DATA 15,16,20,9,15,14,19
    ,32,140
7C  578 DATA 32,32,32,32,32,32,3
    2,32,256
17  579 DATA 32,32,32,32,32,32,3
    2,32,256
7A  580 DATA 32,32,32,32,32,32,3
    2,32,256
45  581 DATA 32,32,32,32,32,32,3
    2,32,256
7A  582 DATA 32,32,32,32,32,32,3
    2,20,244
16  583 DATA 15,32,21,19,5,32,20
    ,8,152
27  584 DATA 5,19,5,32,1,18,5,32
    ,117
85  585 DATA 3,21,5,32,20,1,16,5
    ,103
91  586 DATA 44,19,1,13,16,12,5,
    32,142
73  587 DATA 40,12,41,44,32,32,3
    2,32,265
22  588 DATA 32,32,32,32,32,32,3
    2,32,256
7F  589 DATA 32,32,96,32,32,32,3
    2,32,320
40  590 DATA 32,32,32,32,32,32,3
    2,32,256
3B  591 DATA 32,32,32,32,32,32,3
    2,32,256
0D  592 DATA 32,32,32,32,32,32,3
    2,19,243
57  593 DATA 1,13,16,12,5,32,40,
    19,138
B8  594 DATA 41,44,16,12,1,25,32
    ,2,173
D3  595 DATA 1,3,11,44,13,5,14,2
    1,112
E6  596 DATA 32,50,44,5,24,9,20,
    46,230
37  597 DATA 32,20,8,5,32,32,32,
    32,193
0B  598 DATA 32,32,32,32,32,32,3
    2,32,256
03  599 DATA 32,32,32,32,32,32,3
    2,32,256
B6  600 DATA 32,32,32,32,32,32,3
    2,32,256
31  601 DATA 32,32,32,32,32,32,3
    2,32,256
6C  602 DATA 32,32,32,32,32,32,3
    2,5,229
16  603 DATA 24,9,20,32,15,16,20
    ,9,145
F3  604 DATA 15,14,32,14,5,5,4,1
    9,108
B4  605 DATA 32,14,15,32,4,5,19,
    3,124
C2  606 DATA 18,9,16,20,9,15,14,
    45,147
4D  607 DATA 32,20,8,5,32,32,32,
    32,193
9E  608 DATA 32,32,32,32,32,32,3
    2,32,256
99  609 DATA 32,32,32,32,32,32,3
    2,32,256
9C  610 DATA 32,32,32,32,32,32,3
    2,32,256
37  611 DATA 32,32,32,32,32,32,3
    2,32,256
71  612 DATA 32,32,32,32,32,32,3
    2,18,242
58  613 DATA 5,19,20,32,1,18,5,3
    2,132
F5  614 DATA 4,5,19,3,18,9,2,5,6
    5
61  615 DATA 4,32,2,5,12,15,23,4
    6,139
46  616 DATA 32,32,32,32,32,32,3
    2,32,256
C1  617 DATA 32,32,32,32,32,32,3
    2,32,256
C4  618 DATA 32,32,32,32,32,32,3
    2,32,256
9F  619 DATA 32,32,32,32,32,32,3
    2,32,256
42  620 DATA 32,32,32,32,32,32,3
    2,32,256
AD  621 DATA 32,32,32,32,32,32,3
    2,32,256
E0  622 DATA 32,32,32,32,32,32,3
    2,32,256
92  623 DATA 32,32,3,21,5,32,20,
    1,146
69  624 DATA 16,5,58,45,5,14,20,
    5,168
74  625 DATA 18,32,20,1,16,5,32,
    9,133
92  626 DATA 14,32,4,5,3,11,32,6
    ,107
B3  627 DATA 15,12,12,15,23,32,3
    2,32,173
AA  628 DATA 32,32,32,32,32,32,3
    2,32,256
75  629 DATA 32,32,32,32,32,32,3
    2,32,256
AB  630 DATA 32,32,32,32,32,32,3
    2,32,256
A3  631 DATA 32,32,32,32,32,32,3
    2,32,256
D6  632 DATA 32,32,32,32,32,32,3
    2,32,256
D8  633 DATA 32,32,20,8,5,32,4,9
    ,142
D0  634 DATA 18,5,3,20,9,15,14,1
    9,103
30  635 DATA 46,32,23,8,5,14,32,
    6,166
7A  636 DATA 9,14,14,9,19,8,5,4,
    82
A1  637 DATA 32,16,18,5,19,19,32
    ,32,173
70  638 DATA 32,32,32,32,32,32,3
    2,32,256
AB  639 DATA 32,32,32,32,32,32,3
    2,32,256
BE  640 DATA 32,32,32,32,32,32,3
    2,32,256
B9  641 DATA 32,32,32,32,32,32,3
    2,32,256
BC  642 DATA 32,32,32,32,32,32,3
    2,32,256
DE  643 DATA 32,32,20,8,5,32,19,
    16,164
53  644 DATA 1,3,5,32,2,1,18,32,
    94
27  645 DATA 20,15,32,5,24,9,20,
    32,157
93  646 DATA 2,1,3,11,32,20,15,3
    2,116
89  647 DATA 13,5,14,21,32,32,32
    ,32,181
66  648 DATA 32,32,32,32,32,32,3
    2,32,256
E1  649 DATA 32,32,32,32,32,32,3
    2,32,256
E4  650 DATA 32,32,32,32,32,32,3
    2,32,256
BF  651 DATA 32,32,32,32,32,32,3
    2,32,256
AC  652 DATA 32,32,32,32,32,32,3
    2,255,479
2A  653 DATA 255,255,255,255,255
    ,255,255,255,2040
BD  654 DATA 255,255,255,255,255
    ,255,255,41,1826
3B  655 DATA 42,43,44,45,46,47,4
    8,32,347
DE  656 DATA 19,1,13,16,12,5,32,
    40,138
23  657 DATA 12,41,58,45,13,1,11
    ,5,186
CB  658 DATA 19,32,1,32,12,15,14
    ,7,132
CA  659 DATA 32,19,1,13,16,12,5,
    32,130
0A  660 DATA 15,6,32,1,32,32,32,
    32,182
D6  661 DATA 99,99,99,99,99,99,9
    9,99,792
7B  662 DATA 99,99,32,32,32,32,3
    2,32,390
43  663 DATA 32,32,32,32,32,32,3
    2,32,256
F6  664 DATA 32,32,32,32,32,32,3
    2,32,256
71  665 DATA 32,32,32,32,32,32,3
    2,32,256
69  666 DATA 19,15,21,14,4,32,1,
    16,122
44  667 DATA 16,18,15,24,32,49,4
    8,32,234
FE  668 DATA 19,5,3,19,46,32,9,2
    0,153
0D  669 DATA 32,3,1,14,32,14,15,
    20,131
00  670 DATA 32,8,1,22,5,32,32,3
    2,164
CB  671 DATA 32,32,32,32,32,32,3
    2,32,256
0E  672 DATA 32,32,96,32,32,32,3
    2,32,320
D9  673 DATA 32,32,32,32,32,32,3
    2,32,256
DC  674 DATA 32,32,32,32,32,32,3
    2,32,256
77  675 DATA 32,32,32,32,32,32,3
    2,32,256
27  676 DATA 9,20,19,32,16,12,1,
    25,134
58  677 DATA 2,1,3,11,32,19,16,5
    ,89
41  678 DATA 5,4,32,1,12,20,5,18
    ,97
50  679 DATA 5,4,46,32,32,32,32,
    32,215
86  680 DATA 32,32,32,32,32,32,3
    2,32,256
01  681 DATA 32,32,32,32,32,32,3
```

```
    2,32,256
04  682 DATA 32,32,32,32,32,32,3
    2,32,256
DF  683 DATA 32,32,32,32,32,32,3
    2,32,256
B2  684 DATA 32,32,32,32,32,32,3
    2,32,256
ED  685 DATA 32,32,32,32,32,32,3
    2,32,256
C4  686 DATA 19,1,13,16,12,5,32,
    40,138
D6  687 DATA 19,41,58,45,13,1,11
    ,5,193
5C  688 DATA 19,32,1,32,19,8,15,
    18,144
A5  689 DATA 20,32,19,1,13,16,12
    ,5,118
2F  690 DATA 32,23,8,9,3,8,32,32
    ,147
80  691 DATA 99,99,99,99,99,99,9
    9,99,792
31  692 DATA 99,99,32,32,32,32,3
    2,32,390
B5  693 DATA 32,32,32,32,32,32,3
    2,32,256
E8  694 DATA 32,32,32,32,32,32,3
    2,32,256
E3  695 DATA 32,32,32,32,32,32,3
    2,32,256
89  696 DATA 3,1,14,32,8,1,22,5,
    86
BE  697 DATA 32,19,16,5,5,4,32,1
    5,128
D5  698 DATA 6,32,16,12,1,25,2,1
    ,95
6D  699 DATA 3,11,32,1,12,20,5,1
    8,102
C7  700 DATA 5,4,46,32,32,32,32,
    32,215
FD  701 DATA 32,32,32,32,32,32,3
    2,32,256
B0  702 DATA 32,32,32,32,32,32,3
    2,32,256
EB  703 DATA 32,32,32,32,32,32,3
    2,32,256
FE  704 DATA 32,32,32,32,32,32,3
    2,32,256
F9  705 DATA 32,32,32,32,32,32,3
    2,32,256
17  706 DATA 16,12,1,25,2,1,3,11
    ,71
9F  707 DATA 58,45,16,12,1,25,19
    ,32,208
61  708 DATA 3,21,18,18,5,14,20,
    32,131
B8  709 DATA 19,1,13,16,12,5,32,
    9,107
20  710 DATA 14,32,20,8,5,32,32,
    32,175
BC  711 DATA 99,99,99,99,99,99,9
    9,99,792
A6  712 DATA 32,32,32,32,32,32,3
    2,32,256
21  713 DATA 32,32,32,32,32,32,3
    2,32,256
24  714 DATA 32,32,32,32,32,32,3
    2,32,256
FF  715 DATA 32,32,32,32,32,32,3
    2,32,256
2D  716 DATA 13,5,13,15,18,25,46
    ,32,167
5A  717 DATA 9,6,32,14,15,14,5,3
    2,127
89  718 DATA 16,18,5,19,5,14,20,
    32,129
64  719 DATA 20,8,5,14,32,9,20,3
    2,140
D7  720 DATA 18,5,20,21,18,14,19
    ,32,147
89  721 DATA 32,32,32,32,32,32,3
    2,32,256
8C  722 DATA 32,32,32,32,32,32,3
    2,32,256
E7  723 DATA 32,32,32,32,32,32,3
    2,32,256
8A  724 DATA 32,32,32,32,32,32,3
    2,32,256
55  725 DATA 32,32,32,32,32,32,3
    2,32,256
EA  726 DATA 20,15,32,20,8,5,32,
    13,145
C0  727 DATA 5,14,21,46,32,32,32
    ,32,214
36  728 DATA 32,32,32,32,32,32,3
    2,32,256
B1  729 DATA 32,32,32,32,32,32,3
    2,32,256
B4  730 DATA 32,32,32,32,32,32,3
    2,32,256
8F  731 DATA 32,32,32,32,32,32,3
    2,32,256
32  732 DATA 32,32,32,32,32,32,3
    2,32,256
1D  733 DATA 32,32,32,32,32,32,3
    2,32,256
D0  734 DATA 32,32,32,32,32,32,3
    2,32,256
0B  735 DATA 32,32,32,32,32,32,3
    2,32,256
4F  736 DATA 13,5,14,21,32,50,58
    ,45,238
99  737 DATA 20,1,11,5,19,32,25,
    15,128
B2  738 DATA 21,32,20,15,32,20,8
    ,5,153
EC  739 DATA 32,19,5,3,15,14,4,3
    2,124
2E  740 DATA 13,5,14,21,32,32,32
    ,32,181
8F  741 DATA 99,99,99,99,99,99,3
    2,32,658
18  742 DATA 32,32,32,32,32,32,3
    2,32,256
13  743 DATA 32,32,32,32,32,32,3
    2,32,256
C6  744 DATA 32,32,32,32,32,32,3
    2,32,256
41  745 DATA 32,32,32,32,32,32,3
    2,32,256
F6  746 DATA 23,8,9,3,8,32,3,15,
    101
38  747 DATA 14,20,1,9,14,19,32,
    19,128
C0  748 DATA 15,13,5,32,5,6,6,5,
    87
D1  749 DATA 3,20,19,32,1,14,4,3
    2,125
75  750 DATA 21,20,9,12,19,46,32
    ,32,191
5B  751 DATA 32,32,32,32,32,32,3
    2,32,256
2E  752 DATA 32,32,32,32,32,32,3
    2,32,256
29  753 DATA 32,32,32,32,32,32,3
    2,32,256
2C  754 DATA 32,32,32,32,32,32,3
    2,32,256
01  755 DATA 32,32,32,32,32,32,3
    2,61,285
21  756 DATA 61,61,61,61,61,61,6
    1,61,488
B0  757 DATA 61,61,61,61,61,61,6
    1,61,488
1F  758 DATA 61,61,61,61,61,61,6
    1,61,488
1E  759 DATA 61,61,61,61,61,61,6
    1,61,488
01  760 DATA 61,61,61,61,61,61,6
    1,32,459
D1  761 DATA 32,32,32,32,32,32,3
    2,32,256
D4  762 DATA 32,32,32,32,32,32,3
    2,32,256
2F  763 DATA 32,32,32,32,32,32,3
    2,32,256
52  764 DATA 32,32,32,32,32,32,3
    2,32,256
3D  765 DATA 32,32,32,32,32,32,3
    2,32,256
8E  766 DATA 32,32,16,18,5,19,19
    ,32,173
F2  767 DATA 19,16,1,3,5,32,20,1
    5,111
FD  768 DATA 32,3,15,14,20,32,15
    ,18,149
08  769 DATA 32,18,47,19,32,20,1
    5,32,215
27  770 DATA 17,21,9,20,32,32,32
    ,32,195
3A  771 DATA 32,32,32,32,32,32,3
    2,32,256
05  772 DATA 32,32,32,32,32,32,3
    2,32,256
38  773 DATA 32,32,32,32,32,32,3
    2,32,256
33  774 DATA 32,32,32,32,32,32,3
    2,32,256
E6  775 DATA 32,32,32,32,32,32,3
    2,32,256
61  776 DATA 32,32,32,32,32,32,3
    2,32,256
64  777 DATA 32,32,32,32,32,32,3
    2,32,256
3F  778 DATA 32,32,32,32,32,32,3
    2,32,256
E2  779 DATA 32,32,32,32,32,32,3
    2,32,256
8F  780 DATA 32,32,32,32,32,32,3
    2,255,479
35  781 DATA 255,255,255,255,255
    ,255,255,255,2040
76  782 DATA 255,255,255,255,255
    ,255,255,41,1826
1D  783 DATA 42,43,44,45,46,47,4
    8,32,347
A1  784 DATA 16,12,1,25,32,19,1,
    13,119
6F  785 DATA 16,12,5,32,9,14,32,
    18,138
E9  786 DATA 5,22,5,18,19,5,58,4
    5,177
73  787 DATA 20,8,9,19,32,16,12,
    1,117
08  788 DATA 25,19,32,32,32,32,3
    2,32,236
3F  789 DATA 99,99,99,99,99,99,9
    9,99,792
BC  790 DATA 99,99,99,99,99,99,9
    9,99,792
82  791 DATA 99,99,99,99,99,99,3
    2,32,658
F1  792 DATA 32,32,32,32,32,32,3
    2,32,256
F4  793 DATA 32,32,32,32,32,32,3
    2,32,256
72  794 DATA 20,8,5,32,19,1,13,1
    6,114
84  795 DATA 12,5,32,2,1,3,11,23
    ,89
98  796 DATA 1,18,4,46,32,9,20,3
    2,162
9E  797 DATA 23,15,18,11,19,32,2
    3,9,150
64  798 DATA 20,8,32,32,32,32,32
    ,32,220
5E  799 DATA 32,32,32,32,32,32,3
    2,32,256
59  800 DATA 32,32,32,32,32,32,3
    2,32,256
5C  801 DATA 32,32,32,32,32,32,3
    2,32,256
F7  802 DATA 32,32,32,32,32,32,3
    2,32,256
5A  803 DATA 32,32,32,32,32,32,3
    2,32,256
FD  804 DATA 2,15,20,8,32,12,15,
```

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   14,118
BB  805 DATA 7,32,1,14,4,32,19,8
    ,117
76  806 DATA 15,18,20,32,19,1,13
    ,16,134
28  807 DATA 12,5,19,46,32,32,32
    ,32,210
81  808 DATA 32,32,32,32,32,32,3
    2,32,256
B4  809 DATA 32,32,32,32,32,32,3
    2,32,256
5F  810 DATA 32,32,32,32,32,32,3
    2,32,256
02  811 DATA 32,32,32,32,32,32,3
    2,32,256
6D  812 DATA 32,32,32,32,32,32,3
    2,32,256
A0  813 DATA 32,32,32,32,32,32,3
    2,32,256
E1  814 DATA 3,8,1,14,7,5,32,19,
    89
05  815 DATA 16,5,5,4,58,45,1,12
    ,146
C8  816 DATA 20,5,18,19,32,20,8,
    5,127
61  817 DATA 32,19,16,5,5,4,32,1
    5,128
1B  818 DATA 6,32,20,8,5,32,32,3
    2,167
61  819 DATA 99,99,99,99,99,99,9
    9,99,792
77  820 DATA 99,99,99,99,32,32,3
    2,32,524
68  821 DATA 32,32,32,32,32,32,3
    2,32,256
63  822 DATA 32,32,32,32,32,32,3
    2,32,256
96  823 DATA 32,32,32,32,32,32,3
    2,32,256
3D  824 DATA 19,8,15,18,20,32,19
    ,1,132
AF  825 DATA 13,16,12,5,19,32,16
    ,12,125
FA  826 DATA 1,25,2,1,3,11,32,18
    ,93
09  827 DATA 1,20,5,32,16,18,5,1
    9,116
4E  828 DATA 19,32,20,8,5,32,32,
    32,180
30  829 DATA 32,32,32,32,32,32,3
    2,32,256
6B  830 DATA 32,32,32,32,32,32,3
    2,32,256
7E  831 DATA 32,32,32,32,32,32,3
    2,32,256
79  832 DATA 32,32,32,32,32,32,3
    2,32,256
7C  833 DATA 32,32,32,32,32,32,3
    2,32,256
83  834 DATA 43,32,20,15,32,9,14
    ,3,168
A2  835 DATA 18,5,1,19,5,32,1,14
    ,95
B1  836 DATA 4,32,45,32,20,15,32
    ,4,184
DC  837 DATA 5,3,18,5,1,19,5,46,
    102
73  838 DATA 32,32,32,32,32,32,3
    2,32,256
26  839 DATA 32,32,32,32,32,32,3
    2,32,256
A1  840 DATA 32,32,32,32,32,32,3
    2,32,256
A4  841 DATA 32,32,32,32,32,32,3
    2,32,256
7F  842 DATA 32,32,32,32,32,32,3
    2,32,256
22  843 DATA 32,32,32,32,32,32,3
    2,32,256
37  844 DATA 13,1,14,21,1,12,32,
    16,110
42  845 DATA 12,1,25,58,45,4,9,6
    ,160
94  846 DATA 6,5,18,5,14,20,32,1
    1,111
BF  847 DATA 5,25,19,32,16,12,1,
    25,135
83  848 DATA 32,20,8,5,32,32,32,
    32,193
13  849 DATA 99,99,99,99,99,99,9
    9,99,792
17  850 DATA 99,99,99,32,32,32,3
    2,32,457
0A  851 DATA 32,32,32,32,32,32,3
    2,32,256
D5  852 DATA 32,32,32,32,32,32,3
    2,32,256
0B  853 DATA 32,32,32,32,32,32,3
    2,32,256
37  854 DATA 19,8,15,18,20,32,19
    ,1,132
5B  855 DATA 13,16,12,5,32,2,1,3
    ,84
6E  856 DATA 11,23,1,18,4,32,15,
    18,122
6B  857 DATA 32,6,15,18,23,1,18,
    4,117
13  858 DATA 32,1,20,32,32,32,32
    ,32,213
B2  859 DATA 32,32,32,32,32,32,3
    2,32,256
9D  860 DATA 32,32,32,32,32,32,3
    2,32,256
50  861 DATA 32,32,32,32,32,32,3
    2,32,256
BB  862 DATA 32,32,32,32,32,32,3
    2,32,256
9E  863 DATA 32,32,32,32,32,32,3
    2,32,256
9C  864 DATA 4,9,6,6,5,18,5,14,6
    7
A2  865 DATA 20,32,19,16,5,5,4,1
    9,120
9E  866 DATA 46,32,32,32,32,32,3
    2,32,270
9A  867 DATA 32,32,32,32,32,32,3
    2,32,256
65  868 DATA 32,32,32,32,32,32,3
    2,32,256
98  869 DATA 32,32,32,32,32,32,3
    2,32,256
93  870 DATA 32,32,32,32,32,32,3
    2,32,256
46  871 DATA 32,32,32,32,32,32,3
    2,32,256
C1  872 DATA 32,32,32,32,32,32,3
    2,32,256
C4  873 DATA 32,32,32,32,32,32,3
    2,32,256
CB  874 DATA 3,18,15,16,32,19,1,
    13,117
30  875 DATA 16,12,5,58,45,18,5,
    6,165
D0  876 DATA 9,14,5,32,20,8,5,32
    ,125
8D  877 DATA 19,1,13,16,12,5,46,
    32,144
E1  878 DATA 16,18,5,19,19,32,32
    ,28,173
65  879 DATA 99,99,99,99,99,99,9
    9,99,792
59  880 DATA 99,99,99,32,32,32,3
    2,32,457
AC  881 DATA 32,32,32,32,32,32,3
    2,32,256
87  882 DATA 32,32,32,32,32,32,3
    2,32,256
AA  883 DATA 32,32,32,32,32,32,3
    2,32,256
2B  884 DATA 20,8,5,32,3,20,18,1
    2,118
E6  885 DATA 32,11,5,25,32,20,15
    ,32,172
F3  886 DATA 13,1,18,11,32,20,8,
    5,108
D0  887 DATA 32,19,20,1,18,20,32
    ,1,143
03  888 DATA 14,4,32,20,8,5,32,3
    2,147
54  889 DATA 32,32,32,32,32,32,3
    2,32,256
AF  890 DATA 32,32,32,32,32,32,3
    2,32,256
D2  891 DATA 32,32,32,32,32,32,3
    2,32,256
BD  892 DATA 32,32,32,32,32,32,3
    2,32,256
70  893 DATA 32,32,32,32,32,32,3
    2,32,256
72  894 DATA 19,16,1,3,5,32,20,1
    5,111
26  895 DATA 32,13,1,18,11,32,20
    ,8,135
4A  896 DATA 5,32,5,14,4,46,32,3
    2,170
BC  897 DATA 32,32,32,32,32,32,3
    2,32,256
57  898 DATA 32,32,32,32,32,32,3
    2,32,256
BA  899 DATA 32,32,32,32,32,32,3
    2,32,256
B5  900 DATA 32,32,32,32,32,32,3
    2,32,256
B8  901 DATA 32,32,32,32,32,32,3
    2,32,256
B3  902 DATA 32,32,32,32,32,32,3
    2,32,256
66  903 DATA 32,32,32,32,32,32,3
    2,32,256
E5  904 DATA 32,32,16,18,5,19,19
    ,32,173
03  905 DATA 19,16,1,3,5,32,15,1
    8,109
51  906 DATA 32,18,47,19,32,20,1
    5,32,215
2C  907 DATA 17,21,9,20,32,20,15
    ,32,166
5A  908 DATA 13,5,14,21,32,32,32
    ,255,404
B5  909 DATA 255,255,255,255,255
    ,255,255,255,2040
F6  910 DATA 255,255,255,255,255
    ,255,255,41,1886
9D  911 DATA 42,43,44,45,46,47,4
    8,32,347
21  912 DATA 11,9,12,12,32,19,1,
    13,109
72  913 DATA 16,12,5,58,45,5,18,
    1,160
FD  914 DATA 19,5,19,32,20,8,5,3
    2,140
B1  915 DATA 19,1,13,16,12,5,32,
    23,121
F6  916 DATA 8,9,3,8,32,32,32,32
    ,156
BF  917 DATA 99,99,99,99,99,99,9
    9,99,792
1B  918 DATA 99,99,99,32,32,32,3
    2,32,457
F6  919 DATA 32,32,32,32,32,32,3
    2,32,256
71  920 DATA 32,32,32,32,32,32,3
    2,32,256
74  921 DATA 32,32,32,32,32,32,3
    2,32,256
DF  922 DATA 9,19,32,3,21,18,18,
    5,125
70  923 DATA 14,20,12,25,32,9,14
    ,32,158
7E  924 DATA 20,8,5,32,3,15,13,1
    6,112
47  925 DATA 21,20,5,18,19,32,13
    ,5,133
79  926 DATA 13,15,18,25,46,32,3
    2,32,213
DE  927 DATA 32,32,32,32,32,32,3
    2,32,256
D9  928 DATA 32,32,32,32,32,32,3
    2,32,256
```

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DC  929 DATA 32,32,32,32,32,32,3
    2,32,256
77  930 DATA 32,32,32,32,32,32,3
    2,32,256
4A  931 DATA 32,32,32,32,32,32,3
    2,99,323
A6  932 DATA 99,99,99,99,99,99,9
    9,99,792
8F  933 DATA 99,99,99,99,99,99,9
    9,99,792
1C  934 DATA 99,99,99,99,99,99,9
    9,99,792
9D  935 DATA 99,99,99,99,99,99,9
    9,99,792
4D  936 DATA 99,99,99,99,99,99,9
    9,32,725
04  937 DATA 32,32,32,32,32,32,3
    2,32,256
DF  938 DATA 32,32,32,32,32,32,3
    2,32,256
82  939 DATA 32,32,32,32,32,32,3
    2,32,256
ED  940 DATA 32,32,32,32,32,32,3
    2,32,256
20  941 DATA 32,32,32,32,32,32,3
    2,32,256
1B  942 DATA 32,32,32,32,32,32,3
    2,32,256
6E  943 DATA 32,32,19,15,21,14,4
    ,32,169
E8  944 DATA 19,1,13,16,12,5,18,
    32,116
E4  945 DATA 2,25,32,32,32,32,32
    ,32,219
C7  946 DATA 32,32,32,32,32,32,3
    2,32,256
EA  947 DATA 32,32,32,32,32,32,3
    2,32,256
B5  948 DATA 32,32,32,32,32,32,3
    2,32,256
E8  949 DATA 32,32,32,32,32,32,3
    2,32,256
E3  950 DATA 32,32,32,32,32,32,3
    2,32,256
16  951 DATA 32,32,32,32,32,32,3
    2,32,256
91  952 DATA 32,32,32,32,32,32,3
    2,32,256
B4  953 DATA 32,32,32,32,19,20,5
    ,16,188
20  954 DATA 8,5,14,32,20,8,15,1
    3,115
12  955 DATA 32,32,32,32,32,32,3
    2,32,256
FD  956 DATA 32,32,32,32,32,32,3
    2,32,256
B0  957 DATA 32,32,32,32,32,32,3
    2,32,256
EB  958 DATA 32,32,32,32,32,32,3
    2,32,256
FE  959 DATA 32,32,32,32,32,32,3
    2,32,256
F9  960 DATA 32,32,32,32,32,32,3
    2,32,256
FC  961 DATA 32,32,32,32,32,32,3
    2,32,256
97  962 DATA 32,32,32,32,32,32,3
    2,32,256
FA  963 DATA 32,32,32,32,32,32,3
    2,32,256
90  964 DATA 49,57,56,56,32,32,3
    2,32,346
F8  965 DATA 32,32,32,32,32,32,3
    2,32,256
F3  966 DATA 32,32,32,32,32,32,3
    2,32,256
A6  967 DATA 32,32,32,32,32,32,3
    2,32,256
21  968 DATA 32,32,32,32,32,32,3
    2,32,256
24  969 DATA 32,32,32,32,32,32,3
    2,32,256
FF  970 DATA 32,32,32,32,32,32,3
    2,32,256
A2  971 DATA 32,32,32,32,32,32,3
    2,32,256
8D  972 DATA 32,32,32,32,32,32,3
    2,32,256
C0  973 DATA 32,32,32,32,32,32,3
    2,32,256
BB  974 DATA 32,32,32,32,32,32,3
    2,32,256
8E  975 DATA 32,32,32,32,32,32,3
    2,32,256
89  976 DATA 32,32,32,32,32,32,3
    2,32,256
8C  977 DATA 32,32,32,32,32,32,3
    2,32,256
E7  978 DATA 32,32,32,32,32,32,3
    2,32,256
8A  979 DATA 32,32,32,32,32,32,3
    2,32,256
55  980 DATA 32,32,32,32,32,32,3
    2,32,256
88  981 DATA 32,32,32,32,32,32,3
    2,32,256
83  982 DATA 32,32,32,32,32,32,3
    2,32,256
36  983 DATA 32,32,32,32,32,32,3
    2,32,256
B1  984 DATA 32,32,32,32,32,32,3
    2,32,256
B4  985 DATA 32,32,32,32,32,32,3
    2,32,256
8F  986 DATA 32,32,32,32,32,32,3
    2,32,256
4F  987 DATA 32,32,32,32,16,18,5
    ,19,186
6A  988 DATA 19,32,19,16,1,3,5,3
    2,127
C0  989 DATA 20,15,32,18,5,20,21
    ,18,149
1D  990 DATA 14,32,20,15,32,13,5
    ,14,145
DD  991 DATA -1
```

SAMPLER 64

PROGRAM: DATA 2

```
AA  5 L=5977:CH=0
0B  10 POKE53280,0:POKE53281,0
5E  20 PRINT"{CLR}"
14  30 PRINT"DATA LOADER 2"
1A  40 PRINT"{HOME,DOWN2}POKE LO
    CATION:"L
61  50 FOR I=1 TO 8
9A  60 READ A
9A  65 IF A<0 THEN 120
F0  70 POKEL,A:CH=CH+A:L=L+1
D2  80 NEXT
4E  90 READ SUM
3D  100 IF SUM<>CHTHEN PRINT"CHE
    CKSUM ERROR IN LINE"PEEK(64)
    *256+PEEK(63):STOP
9A  110 CH=0:GOTO 40
3B  120 PRINT"{CLR}NEW{DOWN3}LOA
    D"+CHR$(34)+"DATA3"+CHR$(34)
    +",8{DOWN5}RUN"
0B  130 POKE631,19:POKE632,13:PO
    KE633,13:POKE634,13:POKE198,
    4
2B  500 DATA 21,32,32,32,32,32,3
    2,32,245
2A  501 DATA 32,32,32,32,32,32,3
    2,32,256
F5  502 DATA 32,32,32,32,32,32,3
    2,32,256
28  503 DATA 32,32,32,32,32,32,3
    2,32,256
23  504 DATA 32,32,32,32,32,32,3
    2,32,256
56  505 DATA 32,32,32,32,32,32,3
    2,32,256
D1  506 DATA 32,32,32,32,32,32,3
    2,32,256
D4  507 DATA 32,32,32,32,32,32,3
    2,32,256
2F  508 DATA 32,32,32,32,32,32,3
    2,32,256
52  509 DATA 32,32,32,32,32,32,3
    2,32,256
3D  510 DATA 32,32,32,32,32,32,3
    2,32,256
F0  511 DATA 32,32,32,32,32,32,3
    2,32,256
3E  512 DATA 32,32,32,32,32,32,3
    2,32,256
39  513 DATA 32,32,32,32,32,32,3
    2,32,256
3C  514 DATA 32,32,32,32,32,32,3
    2,32,256
D7  515 DATA 32,32,32,32,32,32,3
    2,32,256
3A  516 DATA 32,32,32,32,32,32,3
    2,32,256
05  517 DATA 32,32,32,32,32,32,3
    2,32,256
38  518 DATA 32,32,32,32,32,32,3
    2,32,256
33  519 DATA 32,32,32,32,32,32,3
    2,32,256
E6  520 DATA 32,32,32,32,32,32,3
    2,32,256
61  521 DATA 32,32,32,32,32,32,3
    2,32,256
64  522 DATA 32,32,32,32,32,32,3
    2,32,256
3F  523 DATA 32,32,32,32,32,32,3
    2,32,256
E2  524 DATA 32,32,32,32,32,32,3
    2,32,256
CD  525 DATA 32,32,32,32,32,32,3
    2,32,256
00  526 DATA 32,32,32,32,32,32,3
    2,32,256
FB  527 DATA 32,32,32,32,32,32,3
    2,32,256
CE  528 DATA 32,32,32,32,32,32,3
    2,32,256
C9  529 DATA 32,32,32,32,32,32,3
    2,32,256
CC  530 DATA 32,32,32,32,32,32,3
    2,32,256
27  531 DATA 32,32,32,32,32,32,3
    2,32,256
CA  532 DATA 32,32,32,32,32,32,3
    2,32,256
95  533 DATA 32,32,32,32,32,32,3
    2,32,256
C8  534 DATA 32,32,32,32,32,32,3
    2,32,256
C3  535 DATA 32,32,32,32,32,32,3
    2,32,256
76  536 DATA 32,32,32,32,32,32,3
    2,32,256
F1  537 DATA 32,32,32,32,32,32,3
    2,32,256
F4  538 DATA 32,32,32,32,32,32,3
    2,32,256
CF  539 DATA 32,32,32,32,32,32,3
    2,32,256
72  540 DATA 32,32,32,32,32,32,3
    2,32,256
5D  541 DATA 32,32,32,32,32,32,3
    2,32,256
10  542 DATA 32,32,32,32,32,32,3
    2,32,256
4B  543 DATA 32,32,32,32,32,32,3
    2,32,256
```

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5E  544 DATA 32,32,32,32,32,32,3
    2,32,256
FF  545 DATA 32,32,32,32,32,32,3
    2,0,224
97  546 DATA 0,0,0,0,0,0,0,0,0,0
96  547 DATA 0,0,0,0,0,0,0,0,0,0
81  548 DATA 0,0,0,0,0,0,0,0,32,32
25  549 DATA 32,32,32,32,32,32,3
    2,32,256
58  550 DATA 32,32,32,32,32,32,3
    2,32,256
53  551 DATA 32,32,32,32,32,32,3
    2,32,256
06  552 DATA 32,32,32,32,32,32,3
    2,32,256
81  553 DATA 32,32,32,32,32,32,3
    2,32,256
84  554 DATA 32,32,32,32,32,32,3
    2,32,256
E6  555 DATA 32,32,106,119,119,1
    19,119,119,765
E3  556 DATA 119,119,119,119,119
    ,119,119,119,952
C5  557 DATA 119,119,116,32,32,3
    2,32,32,514
A0  558 DATA 32,32,32,32,32,32,3
    2,32,256
9B  559 DATA 32,32,32,32,32,32,3
    2,32,256
D7  560 DATA 32,32,106,32,19,15,
    21,14,271
22  561 DATA 4,32,19,1,13,16,12,
    5,102
9F  562 DATA 18,32,116,32,32,32,
    32,32,326
47  563 DATA 32,32,32,32,32,32,3
    2,32,256
6A  564 DATA 32,32,32,32,32,32,3
    2,32,256
72  565 DATA 32,32,106,111,32,45
    ,32,45,435
60  566 DATA 32,45,32,45,32,45,3
    2,45,308
83  567 DATA 32,111,116,32,32,32
    ,32,32,419
96  568 DATA 32,32,32,32,32,32,3
    2,32,256
11  569 DATA 32,32,32,32,32,32,3
    2,32,256
0F  570 DATA 32,32,32,106,32,23,
    18,9,284
17  571 DATA 20,20,5,14,32,32,2,
    25,150
21  572 DATA 32,116,32,32,32,32,
    32,32,340
7D  573 DATA 32,32,32,32,32,32,3
    2,32,256
30  574 DATA 32,32,32,32,32,32,3
    2,32,256
B9  575 DATA 32,32,106,119,45,32
    ,45,32,443
7A  576 DATA 45,32,45,32,45,32,4
    5,32,308
0F  577 DATA 45,119,116,32,32,32
    ,32,32,440
7C  578 DATA 32,32,32,32,32,32,3
    2,32,256
17  579 DATA 32,32,32,32,32,32,3
    2,32,256
99  580 DATA 32,32,106,32,19,20,
    5,16,262
9E  581 DATA 8,5,14,32,32,20,8,1
    5,134
99  582 DATA 13,32,116,32,32,32,
    32,32,321
73  583 DATA 32,32,32,32,32,32,3
    2,32,256
26  584 DATA 32,32,32,32,32,32,3
    2,32,256
A2  585 DATA 32,32,106,111,111,4
    5,32,45,514
34  586 DATA 32,45,32,45,32,45,3
    2,45,308
E0  587 DATA 111,111,116,32,32,3
    2,32,32,498
22  588 DATA 32,32,32,32,32,32,3
    2,32,256
0D  589 DATA 32,32,32,32,32,32,3
    2,32,256
9C  590 DATA 32,32,32,32,106,32,
    40,3,309
32  591 DATA 41,32,32,49,57,56,5
    6,32,355
71  592 DATA 116,32,32,32,32,32,
    32,32,340
09  593 DATA 32,32,32,32,32,32,3
    2,32,256
0C  594 DATA 32,32,32,32,32,32,3
    2,32,256
5E  595 DATA 32,32,32,32,106,111
    ,111,111,567
85  596 DATA 111,111,111,111,111
    ,111,111,111,888
3E  597 DATA 116,32,32,32,32,32,
    32,32,340
08  598 DATA 32,32,32,32,32,32,3
    2,32,256
03  599 DATA 32,32,32,32,32,32,3
    2,32,256
B6  600 DATA 32,32,32,32,32,32,3
    2,32,256
31  601 DATA 32,32,32,32,32,32,3
    2,32,256
34  602 DATA 32,32,32,32,32,32,3
    2,32,256
01  603 DATA 32,32,32,32,32,32,3
    2,78,302
BD  604 DATA 77,78,77,78,77,78,7
    7,78,620
BC  605 DATA 77,78,77,78,77,78,7
    7,78,620
67  606 DATA 77,78,77,78,77,78,7
    7,78,620
E6  607 DATA 77,78,77,78,77,78,7
    7,78,620
C8  608 DATA 77,78,77,78,77,78,7
    7,77,619
81  609 DATA 79,119,119,119,119,
    119,119,119,912
29  610 DATA 119,119,119,119,119
    ,119,119,119,952
BE  611 DATA 119,119,119,119,119
    ,119,119,119,952
AB  612 DATA 119,119,119,119,119
    ,119,119,119,952
6F  613 DATA 119,119,119,119,119
    ,80,78,78,831
8B  614 DATA 116,32,32,32,32,32,
    32,32,340
93  615 DATA 32,32,32,32,32,32,3
    2,32,256
B2  616 DATA 13,5,14,21,32,32,32
    ,32,181
C1  617 DATA 32,32,32,32,32,32,3
    2,32,256
5D  618 DATA 32,32,32,32,32,106,
    77,77,420
68  619 DATA 116,32,32,32,32,32,
    32,32,340
42  620 DATA 32,32,32,32,32,32,3
    2,32,256
CF  621 DATA 99,99,99,99,32,32,3
    2,32,524
E0  622 DATA 32,32,32,32,32,32,3
    2,32,256
B6  623 DATA 32,32,32,32,32,106,
    78,78,422
BE  624 DATA 116,49,46,46,3,21,5
    ,32,318
FD  625 DATA 20,1,16,5,32,32,32,
    32,170
46  626 DATA 32,32,32,32,160,52,
    46,46,432
67  627 DATA 16,12,1,25,32,19,1,
    13,119
72  628 DATA 16,12,5,32,32,106,7
    7,77,357
DE  629 DATA 116,32,32,32,32,32,
    32,32,340
AB  630 DATA 32,32,32,32,32,32,3
    2,32,256
A3  631 DATA 32,32,32,32,32,32,3
    2,32,256
D6  632 DATA 32,32,32,32,32,32,3
    2,32,256
4B  633 DATA 32,32,32,32,32,106,
    78,78,422
F6  634 DATA 116,50,46,46,19,1,1
    3,16,307
A5  635 DATA 12,5,32,40,12,41,32
    ,32,206
B4  636 DATA 32,32,32,32,32,53,4
    6,46,305
AC  637 DATA 13,5,14,21,32,50,32
    ,32,199
19  638 DATA 32,32,32,32,32,106,
    77,77,420
DC  639 DATA 116,32,32,32,32,32,
    32,32,340
BE  640 DATA 32,32,32,32,32,32,3
    2,32,256
B9  641 DATA 32,32,32,32,32,32,3
    2,32,256
BC  642 DATA 32,32,32,32,32,32,3
    2,32,256
9A  643 DATA 32,32,32,32,32,106,
    78,78,422
50  644 DATA 116,51,46,46,19,1,1
    3,16,308
BA  645 DATA 12,5,32,40,19,41,32
    ,32,213
E2  646 DATA 32,32,32,32,32,54,4
    6,46,306
BB  647 DATA 17,21,9,20,32,32,32
    ,32,195
27  648 DATA 32,32,32,32,32,106,
    77,77,420
12  649 DATA 116,32,32,32,32,32,
    32,32,340
E4  650 DATA 32,32,32,32,32,32,3
    2,32,256
BF  651 DATA 32,32,32,32,32,32,3
    2,32,256
62  652 DATA 32,32,32,32,32,32,3
    2,32,256
EC  653 DATA 32,32,32,32,32,106,
    78,78,422
AD  654 DATA 76,111,111,111,111,
    111,111,111,853
62  655 DATA 111,111,111,111,111
    ,111,111,111,888
E1  656 DATA 111,111,111,111,111
    ,111,111,111,888
C0  657 DATA 111,111,111,111,111
    ,111,111,111,888
9D  658 DATA 111,111,111,111,111
    ,122,77,77,831
2E  659 DATA 78,77,78,77,78,77,7
    8,77,620
29  660 DATA 78,77,78,77,78,77,7
    8,77,620
B0  661 DATA 78,77,78,77,78,77,7
    8,77,620
B3  662 DATA 78,77,78,77,78,77,7
    8,77,620
64  663 DATA 78,77,78,77,78,77,7
    8,32,575
F6  664 DATA 32,32,32,32,32,32,3
    2,32,256
71  665 DATA 32,32,32,32,32,32,3
    2,32,256
74  666 DATA 32,32,32,32,32,32,3
    2,32,256
4F  667 DATA 32,32,32,32,32,32,3
    2,32,256
F2  668 DATA 32,32,32,32,32,32,3
    2,32,256
DD  669 DATA 32,32,32,32,32,32,3
    2,32,256
90  670 DATA 32,32,32,32,32,32,3
    2,32,256
```

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CB 671 DATA 32,32,32,32,32,32,3
2,32,256
DE 672 DATA 32,32,32,32,32,32,3
2,32,256
1B 673 DATA 32,32,32,32,32,32,3
2,255,479
C1 674 DATA 255,255,255,255,255
,255,255,255,2040
0A 675 DATA 255,255,255,255,255
,255,255,41,1826
E7 676 DATA 42,43,44,45,46,47,4
8,0,315
14 677 DATA 0,0,0,0,0,0,0,0
5B 678 DATA 0,0,0,0,0,0,0,0
5A 679 DATA 0,0,0,0,0,0,0,0
59 680 DATA 0,0,0,0,0,0,0,0
67 681 DATA 0,0,0,14,14,14,14,0
,56
1F 682 DATA 0,0,0,0,0,0,0,0
1B 683 DATA 0,0,1,1,1,1,1,1
15 684 DATA 1,1,1,1,1,1,1,1
1E 685 DATA 1,1,0,0,0,0,0,3
43 686 DATA 0,0,0,0,0,0,0,0
42 687 DATA 0,0,0,0,0,0,0,0
C0 688 DATA 0,0,1,0,14,14,14,14
,57
48 689 DATA 14,14,14,14,14,14,1
4,14,112
29 690 DATA 14,0,1,0,0,0,0,0,15

13 691 DATA 0,0,0,0,14,14,14,0,
42
85 692 DATA 0,0,0,0,0,0,0,0
82 693 DATA 0,0,1,1,0,2,0,6
C3 694 DATA 0,2,0,2,0,2,1,2,9
C8 695 DATA 0,1,1,0,0,0,0,2
C9 696 DATA 0,0,0,0,0,0,0,0
C8 697 DATA 0,0,0,0,0,0,0,0
E2 698 DATA 0,0,0,1,0,14,14,14,
43
6A 699 DATA 14,14,14,14,14,14,1
4,14,112
0D 700 DATA 0,1,0,0,0,0,0,1
0C 701 DATA 0,0,0,0,0,0,0,0
33 702 DATA 0,0,0,0,0,0,0,0
3A 703 DATA 0,0,1,1,2,1,2,1,8
39 704 DATA 2,1,2,0,2,0,2,0,9
36 705 DATA 2,1,1,0,0,0,0,4
77 706 DATA 0,0,0,0,0,0,0,0
76 707 DATA 0,0,0,0,0,0,0,0
EC 708 DATA 0,0,1,0,14,14,14,14
,57
3C 709 DATA 14,14,14,14,14,14,1
4,14,112
25 710 DATA 14,0,1,0,0,0,0,0,15

3A 711 DATA 0,0,0,0,0,0,0,0
39 712 DATA 0,0,0,0,0,0,0,0
3E 713 DATA 0,0,1,1,1,2,0,2,7
77 714 DATA 0,2,0,2,0,2,0,2,8
7C 715 DATA 1,1,1,0,0,0,0,3
7D 716 DATA 0,0,0,0,0,0,0,0
7C 717 DATA 0,0,0,0,0,0,0,0
47 718 DATA 0,0,0,0,1,0,14,14,2
9
C6 719 DATA 14,14,14,14,14,14,1
4,0,98
21 720 DATA 1,0,0,0,0,0,0,1
0A 721 DATA 0,0,0,0,0,0,14,0,14

E7 722 DATA 0,0,0,0,0,0,0,0
E2 723 DATA 0,0,0,0,1,1,1,1,4
ED 724 DATA 1,1,1,1,1,1,1,8
E4 725 DATA 1,0,0,0,0,0,0,1
AB 726 DATA 0,0,0,0,0,0,0,0
AA 727 DATA 0,0,0,0,0,0,0,0
A9 728 DATA 0,0,0,0,0,0,0,0
AC 729 DATA 1,1,1,1,1,0,0,5
6F 730 DATA 0,0,0,0,0,0,0,0
6E 731 DATA 0,0,0,0,0,0,0,1,1
65 732 DATA 1,1,1,1,1,1,1,8
64 733 DATA 1,1,1,1,1,1,1,8
9B 734 DATA 1,1,1,1,1,1,1,8
9A 735 DATA 1,1,1,1,1,1,1,8

99 736 DATA 1,1,1,1,1,1,1,1,8
EC 737 DATA 6,6,6,6,6,6,6,6,48
2B 738 DATA 6,6,6,6,6,6,6,6,48
2A 739 DATA 6,6,6,6,6,6,6,6,48
29 740 DATA 6,6,6,6,6,6,6,6,48
D7 741 DATA 6,6,6,6,6,6,1,1,38
5B 742 DATA 6,0,0,0,0,0,0,0,6
9A 743 DATA 0,0,0,0,0,0,0,0,0
9D 744 DATA 1,1,1,1,0,0,0,0,4
98 745 DATA 0,0,0,0,0,0,0,0,0
49 746 DATA 0,0,0,0,0,6,1,1,8
9E 747 DATA 6,0,0,0,0,0,0,0,6
5D 748 DATA 0,0,0,0,0,0,0,0,0
26 749 DATA 7,7,7,7,0,0,0,0,28
83 750 DATA 0,0,0,0,0,0,0,0,0
94 751 DATA 0,0,0,0,0,6,1,1,8
17 752 DATA 6,14,14,14,14,14,1
,14,104
DF 753 DATA 14,14,14,14,0,0,0,(
,56
14 754 DATA 0,0,0,0,0,14,14,14
42
02 755 DATA 14,14,14,14,14,14,
4,14,112
8D 756 DATA 14,14,14,0,0,6,1,1
50
84 757 DATA 6,0,0,0,0,0,0,6
0B 758 DATA 0,0,0,0,0,0,0,0,0
0A 759 DATA 0,0,0,0,0,0,0,0
09 760 DATA 0,0,0,0,0,0,0,0
AE 761 DATA 0,0,0,0,0,6,1,1,8
61 762 DATA 6,14,14,14,14,14,1
,14,104
C0 763 DATA 14,14,14,14,14,14,
,0,84
1E 764 DATA 0,0,0,0,0,14,14,14,
42
C6 765 DATA 14,14,14,14,14,14,0
,0,84
05 766 DATA 0,0,0,0,0,6,1,1,8
B2 767 DATA 6,0,0,0,0,0,0,0,6
70 768 DATA 0,0,0,0,0,0,0,0,0
B7 769 DATA 0,0,0,0,0,0,0,0,0
B6 770 DATA 0,0,0,0,0,0,0,0,0
93 771 DATA 0,0,0,0,0,6,1,1,8
82 772 DATA 6,14,14,14,14,14,14
,14,104
E7 773 DATA 14,14,14,14,14,14,0
,0,84
27 774 DATA 0,0,0,0,0,14,14,14,
42
62 775 DATA 14,14,14,14,0,0,0,0
,56
9E 776 DATA 0,0,0,0,0,6,1,1,8
7F 777 DATA 6,0,0,0,0,0,0,0,6
BE 778 DATA 0,0,0,0,0,0,0,0,0
BD 779 DATA 0,0,0,0,0,0,0,0,0
BC 780 DATA 0,0,0,0,0,0,0,0,0
75 781 DATA 0,0,0,0,0,6,1,1,8
BE 782 DATA 6,6,6,6,6,6,6,6,48
BD 783 DATA 6,6,6,6,6,6,6,6,48
BC 784 DATA 6,6,6,6,6,6,6,6,48
FB 785 DATA 6,6,6,6,6,6,6,6,48
A5 786 DATA 6,6,6,6,6,6,1,1,38
2D 787 DATA 1,1,1,1,1,1,1,1,8
2C 788 DATA 1,1,1,1,1,1,1,1,8
E3 789 DATA 1,1,1,1,1,1,1,1,8
E2 790 DATA 1,1,1,1,1,1,1,1,8
EF 791 DATA 1,1,1,1,1,1,1,0,7
E8 792 DATA 0,0,0,0,0,0,0,0,0
AF 793 DATA 0,0,0,0,0,0,0,0,0
AE 794 DATA 0,0,0,0,0,0,0,0,0
AD 795 DATA 0,0,0,0,0,0,0,0,0
AC 796 DATA 0,0,0,0,0,0,0,0,0
D3 797 DATA 0,0,0,0,0,0,0,0,0
D2 798 DATA 0,0,0,0,0,0,0,0,0
D1 799 DATA 0,0,0,0,0,0,0,0,0
D0 800 DATA 0,0,0,0,0,0,0,0,0
97 801 DATA 0,0,0,0,0,0,0,0,0
96 802 DATA 0,0,0,0,0,0,0,0,0
95 803 DATA 0,0,0,0,0,0,0,0,0
EA 804 DATA 0,0,0,0,0,0,0,78,78
,
6F 805 DATA 77,78,77,78,77,78,7
7,78,620
2E 806 DATA 77,78,77,78,77,78,7
7,78,620
71 807 DATA 77,78,77,78,77,78,7
7,78,620
70 808 DATA 77,78,77,78,77,78,7
7,78,620
16 809 DATA 77,78,77,78,77,78,7
7,77,619
03 810 DATA 78,119,119,119,119,
119,119,119,912
E3 811 DATA 119,119,119,119,119
,119,119,119,952
70 812 DATA 119,119,119,119,119
,119,119,119,952
15 813 DATA 119,119,119,119,119
,119,119,119,952
4D 814 DATA 119,119,119,119,119
,80,78,78,831
D1 815 DATA 116,32,32,32,32,32,
32,32,340
3B 816 DATA 32,32,32,32,32,19,5
,3,187
EC 817 DATA 15,14,4,32,13,5,14,
21,118
47 818 DATA 32,32,32,32,32,32,3
2,32,256
EB 819 DATA 32,32,32,32,32,106,
77,77,420
9E 820 DATA 116,32,32,32,32,32,
32,32,340
C2 821 DATA 32,32,32,32,32,99,9
9,99,457
AC 822 DATA 99,99,99,99,99,99,9
9,99,792
96 823 DATA 32,32,32,32,32,32,3
2,32,256
08 824 DATA 32,32,32,32,32,106,
78,78,422
9F 825 DATA 116,32,32,32,32,32,
32,32,340
6F 826 DATA 32,32,32,32,32,32,3
2,32,256
92 827 DATA 32,32,32,32,32,32,3
2,32,256
7D 828 DATA 32,32,32,32,32,32,3
2,32,255
D9 829 DATA 32,32,32,32,32,106,
77,77,420
39 830 DATA 116,32,32,32,32,32,
48,46,371
FF 831 DATA 46,16,12,1,25,32,19
,1,152
E2 832 DATA 13,16,12,5,32,9,14,
32,133
50 833 DATA 18,5,22,5,18,19,5,3
2,124
5A 834 DATA 32,32,32,32,32,106,
78,78,422
65 835 DATA 116,32,32,32,32,32,
32,32,340
45 836 DATA 32,32,32,32,32,32,3
2,32,256
78 837 DATA 32,32,32,32,32,32,3
2,32,256
73 838 DATA 32,32,32,32,32,32,3
2,32,256
E7 839 DATA 32,32,32,32,32,106,
77,77,420
CA 840 DATA 116,32,32,32,32,32,
50,46,372
C5 841 DATA 46,3,8,1,14,7,5,32,
116
CB 842 DATA 19,16,5,5,4,32,15,6
,102
91 843 DATA 32,19,1,13,16,12,5,
32,130
5E 844 DATA 40,19,41,32,32,106,
78,78,426
33 845 DATA 116,32,32,32,32,32,
32,32,340
3B 846 DATA 32,32,32,32,32,32,3
2,32,256
0E 847 DATA 32,32,32,32,32,32,3
```

```
    2,32,256
09  848 DATA 32,32,32,32,32,32,32,3
    2,32,256
D5  849 DATA 32,32,32,32,32,32,106,
    77,77,420
54  850 DATA 116,32,32,32,32,32,32,
    51,46,373
82  851 DATA 46,13,1,14,21,1,12,
    32,140
21  852 DATA 16,12,1,25,32,40,19
    ,41,186
08  853 DATA 32,32,32,32,32,32,3
    2,32,256
DE  854 DATA 32,32,32,32,32,106,
    78,78,422
39  855 DATA 116,32,32,32,32,32,
    32,32,340
31  856 DATA 32,32,32,32,32,32,3
    2,32,256
34  857 DATA 32,32,32,32,32,32,3
    2,32,256
0F  858 DATA 32,32,32,32,32,32,3
    2,32,256
23  859 DATA 32,32,32,32,32,106,
    77,77,420
42  860 DATA 116,32,32,32,32,32,
    52,46,374
1C  861 DATA 46,3,18,15,16,32,19
    ,1,150
3F  862 DATA 13,16,12,5,32,32,32
    ,32,174
9E  863 DATA 32,32,32,32,32,32,3
    2,32,256
F0  864 DATA 32,32,32,32,32,106,
    78,78,422
07  865 DATA 116,32,32,32,32,32,
    32,32,340
37  866 DATA 32,32,32,32,32,32,3
    2,32,256
9A  867 DATA 32,32,32,32,32,32,3
    2,32,256
96  868 DATA 32,32,32,233,160,16
    0,223,32,904
D1  869 DATA 32,32,32,32,32,106,
    77,77,420
7B  870 DATA 116,32,32,32,32,32,
    53,46,375
DE  871 DATA 46,19,3,18,5,5,14,3
    2,142
DF  872 DATA 8,5,12,16,32,32,121
    ,98,324
7A  873 DATA 248,247,227,160,130
    ,153,160,227,1552
E5  874 DATA 247,248,98,121,32,1
    06,78,78,1008
CD  875 DATA 116,32,32,32,32,32,
    32,32,340
AD  876 DATA 32,32,32,32,32,32,3
    2,32,256
25  877 DATA 32,32,32,32,32,32,1
    60,160,512
4D  878 DATA 160,160,160,160,160,160
    ,160,160,160,1280
BB  879 DATA 160,160,160,160,32,
    106,77,77,932
D2  880 DATA 116,32,32,32,32,32,
    54,46,376
4D  881 DATA 46,11,9,12,12,32,19
    ,1,142
C4  882 DATA 13,16,12,5,32,32,16
    0,147,417
E0  883 DATA 148,133,144,136,133
    ,142,160,148,1144
14  884 DATA 136,143,141,160,32,
    106,78,78,874
1B  885 DATA 116,32,32,32,32,32,
    32,32,340
A3  886 DATA 32,32,32,32,32,32,3
    2,32,256
75  887 DATA 32,32,32,32,32,32,9
    9,119,410
4C  888 DATA 120,226,249,239,228
    ,228,239,249,1778
0A  889 DATA 226,120,119,99,32,1
    06,77,77,856
9C  890 DATA 116,32,32,32,32,32,
    55,46,377
EB  891 DATA 46,13,1,9,14,32,13,
    5,133
9B  892 DATA 14,21,32,32,32,32,3
    2,32,227
70  893 DATA 32,32,32,32,32,32,3
    2,32,256
26  894 DATA 32,32,32,32,32,106,
    78,78,422
A1  895 DATA 116,32,32,32,32,32,
    32,32,340
B9  896 DATA 32,32,32,32,32,32,3
    2,32,256
BC  897 DATA 32,32,32,32,32,32,3
    2,32,256
57  898 DATA 32,32,32,32,32,32,3
    2,32,256
1B  899 DATA 32,32,32,32,32,106,
    77,77,420
EE  900 DATA 116,32,32,32,32,32,
    32,32,340
BB  901 DATA 32,32,32,32,32,32,3
    2,32,256
B3  902 DATA 32,32,32,32,32,32,3
    2,32,256
66  903 DATA 32,32,32,32,32,32,3
    2,32,256
F8  904 DATA 32,32,32,32,32,106,
    78,78,422
29  905 DATA 76,111,111,111,111,
    111,111,111,853
3E  906 DATA 111,111,111,111,111
    ,111,111,111,888
5D  907 DATA 111,111,111,111,111
    ,111,111,111,888
5C  908 DATA 111,111,111,111,111
    ,111,111,111,888
31  909 DATA 111,111,111,111,111
    ,122,77,77,831
72  910 DATA 78,77,78,77,78,77,7
    8,77,620
AD  911 DATA 78,77,78,77,78,77,7
    8,77,620
94  912 DATA 78,77,78,77,78,77,7
    8,77,620
07  913 DATA 78,77,78,77,78,77,7
    8,77,620
2B  914 DATA 78,77,78,77,78,77,7
    8,32,575
4A  915 DATA 32,32,32,32,32,32,3
    2,32,256
15  916 DATA 32,32,32,32,32,32,3
    2,32,256
48  917 DATA 32,32,32,32,32,32,3
    2,32,256
43  918 DATA 32,32,32,32,32,32,3
    2,32,256
F6  919 DATA 32,32,32,32,32,32,3
    2,32,256
71  920 DATA 32,32,32,32,32,32,3
    2,32,256
74  921 DATA 32,32,32,32,32,32,3
    2,32,256
4F  922 DATA 32,32,32,32,32,32,3
    2,32,256
F2  923 DATA 32,32,32,32,32,32,3
    2,32,256
DD  924 DATA 32,32,32,32,32,32,3
    2,32,256
90  925 DATA 32,32,32,32,32,32,3
    2,32,256
CB  926 DATA 32,32,32,32,32,32,3
    2,32,256
DE  927 DATA 32,32,32,32,32,32,3
    2,32,256
D9  928 DATA 32,32,32,32,32,32,3
    2,32,256
FE  929 DATA 32,32,32,32,32,32,3
    2,255,479
C0  930 DATA 255,255,255,255,255
    ,255,255,255,2040
0F  931 DATA 255,255,255,255,255,255
    ,255,255,41,1826
EA  932 DATA 42,43,44,45,46,47,4
    8,1,316
53  933 DATA 1,1,1,1,1,1,1,1,8
52  934 DATA 1,1,1,1,1,1,1,1,8
51  935 DATA 1,1,1,1,1,1,1,1,8
50  936 DATA 1,1,1,1,1,1,1,1,8
17  937 DATA 1,1,1,1,1,1,1,1,8
F2  938 DATA 6,6,6,6,6,6,6,6,48
F1  939 DATA 6,6,6,6,6,6,6,6,48
F0  940 DATA 6,6,6,6,6,6,6,6,48
9F  941 DATA 6,6,6,6,6,6,6,6,48
91  942 DATA 6,6,6,6,6,6,1,1,38
9D  943 DATA 6,6,6,6,6,6,6,6,48
AD  944 DATA 6,6,6,6,6,2,2,2,36
BC  945 DATA 2,2,2,2,2,2,2,2,16
DA  946 DATA 6,6,6,6,6,6,6,6,48
86  947 DATA 6,6,6,6,6,6,1,1,38
44  948 DATA 6,0,0,0,0,0,0,0,6
C9  949 DATA 0,0,0,0,0,1,1,1,3
C2  950 DATA 1,1,1,1,1,1,1,1,8
C9  951 DATA 0,0,0,0,0,0,0,0,0
6E  952 DATA 0,0,0,0,0,6,1,1,8
CF  953 DATA 6,0,0,0,0,0,0,0,6
0E  954 DATA 0,0,0,0,0,0,0,0,0
0D  955 DATA 0,0,0,0,0,0,0,0,0
0C  956 DATA 0,0,0,0,0,0,0,0,0
C5  957 DATA 0,0,0,0,0,6,1,1,8
9B  958 DATA 6,0,14,14,14,14,14,
    14,90
F3  959 DATA 14,14,14,14,14,14,1
    4,14,112
58  960 DATA 14,14,14,14,14,14,1
    4,14,112
63  961 DATA 14,14,14,14,14,14,1
    4,0,98
50  962 DATA 0,0,0,0,0,6,1,1,8
35  963 DATA 6,0,0,0,0,0,0,0,6
74  964 DATA 0,0,0,0,0,0,0,0,0
3B  965 DATA 0,0,0,0,0,0,0,0,0
3A  966 DATA 0,0,0,0,0,0,0,0,0
5F  967 DATA 0,0,0,0,0,6,1,1,8
BD  968 DATA 6,0,14,14,14,14,14,
    14,90
BD  969 DATA 14,14,14,14,14,14,1
    4,14,112
3A  970 DATA 14,14,14,14,14,14,1
    4,14,112
BF  971 DATA 14,14,14,14,14,14,1
    4,14,112
78  972 DATA 14,14,14,0,0,6,1,1,
    50
E3  973 DATA 6,0,0,0,0,0,0,0,6
22  974 DATA 0,0,0,0,0,0,0,0,0
21  975 DATA 0,0,0,0,0,0,0,0,0
20  976 DATA 0,0,0,0,0,0,0,0,0
41  977 DATA 0,0,0,0,0,6,1,1,8
A5  978 DATA 6,0,0,0,0,0,14,14,3
    4
C7  979 DATA 14,14,14,14,14,14,1
    4,14,112
CC  980 DATA 14,14,14,14,14,14,1
    4,14,112
D4  981 DATA 14,14,14,14,0,0,0,0
CC  982 DATA 0,0,0,0,0,6,1,1,8
69  983 DATA 6,0,0,0,0,0,0,0,6
AB  984 DATA 0,0,0,0,0,0,0,0,0
6F  985 DATA 0,0,0,0,0,0,0,0,0
6E  986 DATA 0,0,0,0,0,0,0,0,0
5B  987 DATA 0,0,0,0,0,6,1,1,8
7B  988 DATA 6,0,0,0,0,0,14,14,3
    4
11  989 DATA 14,14,14,14,14,14,1
    4,14,112
B1  990 DATA 14,14,14,14,0,0,0,0
    ,56
DD  991 DATA -1
```

FINAL PART NEXT MONTH....

MUSIC COMPOSER

PROGRAM: MUSIC COMPOSER

```
DB  1 IFPEEK(49152)=32ANDPEEK(49
    153)=121THEN3
51  2 FORI=49152TO49531:READA:PO
    KEI,A:NEXTI
20  3 POKE53280,0:POKE53281,0:PR
    INTCHR$(142);CHR$(8):K$="Q2W
    3ER5T6Y7UI9OOP@-*£^"
B4  9 S=54272:SA=49152:LE=512:V=
    1:M=1:OC=4:DIMF(26),K(255)
FA  10 A1=0:D1=9:S1=9:R1=15:A2=0
    :D2=9:S2=9:R2=15:A3=0:D3=9:S
    3=9:R3=15:TP=5:N1=1:N=1
DB  13 F1=7040:FORI=1TO26:F(27-I
    )=F1*5.8+30:F1=F1/2^(1/12):N
    EXT
0D  17 FORI=1TOLEN(K$):K(ASC(MID
    $(K$,I,1)))=I:NEXT:SYSSA,C,L15

F5  19 DIMFQ(3,680),ST(3,680):GO
    TO4800:GOTO400
B7  20 IFV=1THENFQ(V,N)=-1:ST(V,
    N)=-1:FQ(2,1)=-1:ST(2,1)=-1:
    ST(3,1)=-1:FQ(3,1)=-1
C9  21 IFV=2ANDN=1THENST(2,1)=-1
    :ST(3,1)=-1:FQ(3,1)=-1:FQ(2,
    1)=-1
01  23 IFV=3THENFQ(V,N)=-1:ST(V,
    N)=-1:FQ(3,1)=-1:ST(3,1)=-1
74  25 IFV=3ANDN=1THENST(3,1)=-1
    :FQ(3,1)=-1
43  26 IFV=3THENFQ(V,N)=-1:ST(V,
    N)=-1
5A  27 PRINT"[CLR][OUTPUT TO [RVS
    ON]SC[RVSOFF]CREEN OR [RVSON]
    P[RVSOFF]RINTER"
C2  28 GETA$:IFA$<>"S"ANDA$<>"P"
    THEN28
2A  29 NU=4:IFA$="S"THENNU=3
2B  30 OPEN3,NU:PRINT#3:FORW=1TO
    3:N6=1:N7=1:C=1
7B  31 PRINT"[CLR,SSPC,SPC12,RVS
    ON]VOICE";W;"[RVSOFF]"
13  32 PRINT#3,"[SO,CY4,SP,CY7,S
    P,CY7,SP,CY7,SP]"
A5  33 PRINT#3,"[CG]NOTE[CN]HIGH
    [SPC3,CN]LOW[SPC4,CN]LENGTH
    [CN]"
C8  34 PRINT#3,"[SL,CP4,S@,CP7,S
    @,CP7,S@,CP7,S@]"
ED  35 FORI=1TO18:PRINT#3,"[CH,S
    PC4,CN,SPC7,CN,SSPC,SPC6,CN,
    SPC7,CN]":NEXT:PRINT#3,"[HOM
    E,DOWN4]";
DA  37 IFFQ(W,C)=-1THEN52
1F  38 FR=FQ(W,C):HF%=FR/256:LF%
    =FR-256*HF%
0D  39 PRINTTAB(1)N6TAB(6)HF%TAB
    (16)LF%;:LW=1
B7  41 IFST(W,LW+C)=0THENLW=LW+1
    :GOTO41
0E  44 PRINTTAB(26)LW:C=C+LW:N6=
    N6+1
57  45 N7=N7+1:IFN7=18THENN7=1:G
    OTO48
F3  46 LW=1:GOTO37
67  47 H
DC  48 POKE198,0:WAIT198,1
DA  49 GOTO31
20  52 POKE198,0:WAIT198,1
11  54 NEXTW:CLOSE3:GOTO4800
48  400 PRINT"[SU,S*14,SI]
F3  410 PRINT"[SB,SPC3,RVSON]2ND
    MODE[RVSOFF,SPC3,SB]
8A  420 PRINT"[SB]FREQ. DISPLAY
    [SB]
E3  421 PRINT"[SB]CHANGE ATTACK
    [SB]
52  422 PRINT"[SB]CHANGE DECAY
    [SB]
00  423 PRINT"[SB]CHANGE SUSTAIN
    [SB]
5F  424 PRINT"[SB]CHANGE RELEASE
    [SB]
AA  425 PRINT"[SB]CHANGE TEMPO
    [SB]
58  426 PRINT"[SB,SPC14,SB]
57  427 PRINT"[SB,SPC14,SB]
56  428 PRINT"[SB,SPC14,SB]
0A  429 PRINT"[SB]NOTE NO=";N1;T
    AB(15)"[SB]"
5D  430 PRINT"[SJ,S*14,SK]
82  440 A$="[RIGHT16]"
57  450 PRINT"[HOME,DOWN]"A$"[SU
    ,S*13,SI]"
B0  460 PRINTA$"[SB,SPC4,RVSONJM
    ODE[RVSOFF,SPC5,SB]"
74  470 PRINTA$"[SB]DELETE NOTE
    [SB]"
E2  480 PRINTA$"[SB]PLAY MUSIC
    [SSPC,SB]"
FD  490 PRINTA$"[SB]SAVE MUSIC[S
    PC3,SB]"
F6  500 PRINTA$"[SB]EXIT MODE[SP
    C4,SB]"
36  510 PRINTA$"[SB]NEXT VOICE[S
    PC3,SB]"
4D  520 PRINTA$"[SB]LOAD MUSIC[S
    PC3,SB]"
6F  530 PRINTA$"[SJ,S*13,SK]"
74  540 PRINTA$"[SU,S*13,SI]"
79  550 PRINTA$"[SB]OCTAVE =";OC
    ;"  [SB]"
95  560 PRINTA$"[SB]VOICE  =";V;
    "  [SB]"
47  570 PRINTA$"[SJ,S*13,SK]"
4B  575 PRINT"[SU,S*25,SI]"
72  580 PRINT"[SB,RVSON] [RIGHT]I
    [RIGHT] [SB] [RIGHT] [RIGHT
    ] [RIGHT] [SB] [RIGHT] [RIGH
    T] [SB] [RIGHT] [RIGHT] [RVS
    OFF,SB]"
1C  590 PRINT"[SB,RVSON] [RIGHT]I
    [RIGHT] [SB] [RIGHT] [RIGHT
    ] [RIGHT] [SB] [RIGHT] [RIGH
    T] [SB] [RIGHT] [RIGHT] [RVS
    OFF,SB]"
16  600 PRINT"[SB,RVSON] [RIGHT]I
    [RIGHT] [SB] [RIGHT] [RIGHT
    ] [RIGHT] [SB] [RIGHT] [RIGH
    T] [SB] [RIGHT] [RIGHT] [RVS
    OFF,SB]"
90  610 PRINT"[SB,RVSON] [RIGHT]I
    [RIGHT] [SB] [RIGHT] [RIGHT
    ] [RIGHT] [SB] [RIGHT] [RIGH
    T] [SB] [RIGHT] [RIGHT] [RVS
    OFF,SB]"
97  620 PRINT"[SB,RVSON] [SB] [S
    B] [SB] [SB] [SB] [SB] [SB]
    [SB] [SB] [SB] [SB] [SB] [RV
    SOFF,SB]"
56  630 PRINT"[SB,RVSON]O[SB]WS[S
    B]E[SB]R[SB]IT[SB]Y[SB]U[SB]I
    [SB]O[SB]P[SB]@[SB]*[SB]^[RV
    SOFF,SB]"
64  640 PRINT"[YELLOW,SB,RVSON]C
    [SB]D[SB]E[SB]F[SB]G[SB]A[SB
    ]B[SB]C[SB]D[SB]E[SB]F[SB]G[
    SB]A[RVSOFF,WHITE,SB]"
A3  645 PRINT"[SJ,S*25,SK]"
6A  650 A$="[RIGHT31]"
5D  660 PRINT"[HOME,DOWN]"A$"[SU
    ,S*7,SI]";
DB  670 PRINTA$"[SB]F1-MODE[SB]";
    ;
F1  680 PRINTA$"[SB]F3-2ND [SB]"
    ;
C0  690 PRINTA$"[SB,SPC3]MODE[SB
    ]";
E3  700 PRINTA$"[CQ,S*7,CW]";
25  710 PRINTA$"[SB] , & . [SB]"
    ;
32  720 PRINTA$"[SB]DEC/INC[SB]"
    ;
77  730 A$="[RIGHT28]"
40  740 PRINT"[HOME,DOWN14]"A$"[S
    U,S*10,SI]";
CD  750 PRINTA$"[SB]TO  PLAY A[S
    B]";
D8  760 PRINTA$"[SB]NOTE,PRESS[S
    B]";
F5  770 PRINTA$"[SB]ANY KEY[SPC3
    ,SB]";
C9  780 PRINTA$"[SB]FROM THE  [S
    B]";
16  790 PRINTA$"[SB]FIRST ROW.[S
    B]";
6F  800 PRINTA$"[SJ,S*10,SK]";
29  810 A$="[RIGHT31]"
33  820 PRINT"[HOME,DOWN8]"A$"[S
    B]LENGTH.[SB]";
92  830 PRINTA$"[CQ,S*7,CW]";
ED  840 PRINTA$"[SB]: & ;  [SB]"
    ;
BD  850 PRINTA$"[SB]DEC/INC[SB]"
    ;
76  860 PRINTA$"[SB]OCTAVE.[SB]"
    ;
23  870 PRINTA$"[SJ,S*7,SK]";
AF  880 A$="[RIGHT27]"
7B  885 PRINT"[HOME,DOWN21]"A$"[
    SU,S*11,SI]";
40  890 PRINTA$"[SB]LENGTH S12 [
    SB]";
46  895 PRINTA$"[SJ,S*11,SK]";
AB  898 SYSSA,V1,WS,A(A1),D(D1),
    S(S1),R(R1):SYSSA,U2,WS,A(A2
    ),D(D2),S(S2),R(R2)
25  899 SYSSA,V3,WS,A(A3),D(D3),
    S(S3),R(R3)
07  900 GETA$:IFA$=""THEN900
3D  901 IFA$="[F3]"THEN6000
43  905 IFA$=" "THENGOSUB2300:GO
    TO900
99  910 IFA$="[F1]"THENGOSUB1200
    :GOTO900
13  920 IFA$="":"ORA$=";"THENGOSU
    B1900:GOTO900
2E  925 IFA$=",",ORA$=".."THENGOSU
    B1800:GOTO900
F5  930 F1=F(K(ASC(A$)))/M:F1=IN
    T(F1)
26  935 IFF1=0THEN900
92  940 SYSSA,V1,F(F1)
15  950 L2%=LE/128:IFL2%=1THENFQ
    (V,N)=F1:ST(V,N)=1:N=N+1:N1=
    N1+1:GOTO980
0D  960 FQ(V,N)=F1:ST(V,N)=1:N=N
    +1:N1=N1+1
5B  970 FORJ=1TOL2%-1:FQ(V,N)=F1
    :ST(V,N)=0:N=N+1:IFN=689THEN
    4020
50  975 NEXT
6D  980 FORJ=1TO200:NEXTJ:SYSSA,
    C:GOSUB1700:GOTO900
49  1200 E=1:GOTO1250
3F  1240 GETA$:IFA$<>"[DOWN]"ANDA
    $<>CHR$(13)THEN1240
43  1243 IFA$=CHR$(13)THEN1370
B8  1245 E=E+1:IFE=7THENE=1
43  1250 IFE=1THENPRINT"[HOME,DO
    WN3,RVSON,RIGHT17]DELETE NOT
    E[RVSOFF]":GOTO1310
44  1260 IFE=2THENPRINT"[HOME,DO
    WN4,RVSON,RIGHT17]PLAY MUSIC
    [RVSOFF]":GOTO1320
3E  1270 IFE=3THENPRINT"[HOME,DO
    WN5,RVSON,RIGHT17]SAVE MUSIC
    [RVSOFF]":GOTO1330
27  1280 IFE=4THENPRINT"[HOME,DO
    WN6,RVSON,RIGHT17]EXIT MODE[
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```
    RVSOFF]":GOTO1340
D6  1290 IFE=5THENPRINT"[HOME,DO
    WN7,RVSON,RIGHT17]NEXT VOICE
    [RVSOFF]":GOTO1350
41  1300 IFE=6THENPRINT"[HOME,DO
    WN8,RVSON,RIGHT17]LOAD MUSIC
    [RVSOFF]":GOTO1360
F1  1310 PRINT"[HOME,DOWN8,RIGHT
    17]LOAD MUSIC":GOTO1240
6A  1320 PRINT"[HOME,DOWN3,RIGHT
    17]DELETE NOTE":GOTO1240
B1  1330 PRINT"[HOME,DOWN4,RIGHT
    17]PLAY MUSIC":GOTO1240
01  1340 PRINT"[HOME,DOWN5,RIGHT
    17]SAVE MUSIC":GOTO1240
91  1350 PRINT"[HOME,DOWN6,RIGHT
    17]EXIT MODE":GOTO1240
F2  1360 PRINT"[HOME,DOWN7,RIGHT
    17]NEXT VOICE":GOTO1240
69  1370 ONEGOTO2000,1500,4000,4
    900,2100,4500
17  1500 ST(1,0)=1:FQ(1,0)=FQ(1,
    100):NS=0
3E  1510 NS=NS+1:IFFQ(1,NS)=-1OR
    NS>NTHEN1560
C4  1520 IFST(1,NS)=1THENSYSSA,U
    1,FC(FQ(1,NS))
E7  1530 IFST(2,NS)=1THENSYSSA,U
    2,FC(FQ(2,NS))
57  1540 IFST(3,NS)=1THENSYSSA,U
    3,FC(FQ(3,NS))
27  1550 FORT=1TOTP*10:NEXTT:GOT
    O1510
DF  1560 PRINT"[HOME,DOWN4,RIGHT
    17]PLAY MUSIC":SYSSA,C:RETUR
    N
33  1700 PRINT"[HOME,DOWN11,RIGH
    T17]OCTAVE =";O
34  1710 PRINT"[HOME,DOWN12,RIGH
    T17]VOICE  =";V
97  1720 PRINT"[HOME,DOWN22,RIGH
    T28]LENGTH[SPC5,LEFT4]";
A1  1730 PRINT"[LEFT]"LE
29  1740 PRINT"[HOME,DOWN12,RIGH
    T9]";N1;"[LEFT] ":RETURN
37  1800 IFA$="."ANDLE<1096THENL
    E=LE+64:GOSUB1700:RETURN
5E  1820 IFA$="."ANDLE>128THENLE
    =LE-64:GOSUB1700:RETURN
57  1900 IFA$=";"ANDOC<5THENOC=O
    C+1:M=M/2:GOSUB1700:RETURN
69  1920 IFA$="."ANDOC>0THENOC=O
    C-1:M=M*2:GOSUB1700:RETURN
A2  2000 IFN1=1THEN2030
0D  2010 N1=N1-1
8E  2020 FQ(V,N)=0:ST(V,N)=0:N=N
    -1:IFST(V,N)=1THENFQ(V,N)=0:
    ST(V,N)=0:GOTO2030
FD  2025 GOTO2020
BF  2030 PRINT"[HOME,DOWN3,RIGHT
    17]DELETE NOTE":GOSUB1700:RE
    TURN
06  2100 FQ(V,N)=-1:ST(V,N)=-1
07  2120 V=V+1:IFV=4THENV=1:GOTO
    4000
4B  2125 N1=1:N=1:GOSUB1700
B1  2130 PRINT"[HOME,DOWN7,RIGHT
    17]NEXT VOICE":RETURN
1B  2300 L2%=LE/128:FORT=NTON+L2
    %:FQ(V,T)=0:ST(V,T)=0:NEXTT:
    N1=N1+1:N=N+L2%
C2  2320 GOSUB1700:RETURN
5B  3090 IFFQ(W,C)=-1THEN3180
4D  3100 FR=FQ(W,C):HF%=FR/256:L
    F%=FR-256*HF%
A8  3110 PRINTIAB(1)NGIAB(6)HF%I
    AB(16)LF%;:LW=1
0B  3120 IFST(W,LW+C)=0THENLW=LW
    +1:GOTO3120
4B  3130 PRINTIAB(26)LW:C=C+LW:N
    6=N6+1
54  3140 N7=N7+1:IFN7=18THENN7=1
    :GOTO3160
B9  3150 LW=1:GOTO3090
B3  3160 GETA$:IFA$=""THEN3160
6D  3170 GOTO3030
11  3180 GETA$:IFA$=""THEN3180
FA  3190 NEXTW:GOTO4800
CE  4000 FORJ=1TO3:FQ(J,N)=-1:ST
    (J,N)=-1:NEXT
87  4020 PRINT"[CLR,RIGHT11,RVSO
    N]SAVE MUSIC[RVSOFF,DOWN3]"
30  4050 INPUT"FILENAME";F$:IFF$
    =""THEN4800
F7  4060 F$=LEFT$(F$,16)
2B  4070 PRINT"[DOWN2]TAPE OR DI
    SK (T/D)?"
9A  4080 GETA$:IFA$<>"T"ANDA$<>"
    D"THEN4080
50  4090 IFA$="T"THEN4110
29  4100 OPEN1,8,4,"@:"+F$+",W":
    C=1:GOTO4120
BB  4110 OPEN1,1,1,F$:C=1
74  4120 PRINT#1,FQ(1,C):PRINT#1
    ,ST(1,C)
3B  4125 IFFQ(1,C)=-1THENC=1:GOT
    O4130
7F  4126 C=C+1:GOTO4120
E2  4130 PRINT#1,FQ(2,C):PRINT#1
    ,ST(2,C)
2E  4135 IFFQ(2,C)=-1THENC=1:GOT
    O4140
52  4136 C=C+1:GOTO4130
E4  4140 PRINT#1,FQ(3,C):PRINT#1
    ,ST(3,C)
5F  4145 IFFQ(3,C)=-1THEN4150
F5  4146 C=C+1:GOTO4140
D5  4150 CLOSE1:PRINT"[DOWN2]OK"
    :FORI=1TO200:NEXT
55  4160 GOTO4800
C1  4500 PRINT"[CLR,SPC12,RVSON]
    LOAD MUSIC[RVSOFF,DOWN3]"
E2  4530 INPUT"FILENAME";F$:IFF$
    =""THEN4800
A1  4540 F$=LEFT$(F$,16)
52  4550 PRINT"[DOWN2]TAPE OR DI
    SK (T/D)?";
43  4560 GETA$:IFA$<>"T"ANDA$<>"
    D"THEN4560
F2  4570 IFA$="T"THEN4590
CE  4580 OPEN1,8,4,F$+",R":C=1:G
    OTO4600
1A  4590 OPEN1,1,0,F$:C=1
3D  4600 INPUT#1,FQ(1,C):INPUT#1
    ,ST(1,C)
28  4605 IFFQ(1,C)=-1THENC=1:GOT
    O4610
9B  4606 C=C+1:GOTO4600
74  4610 INPUT#1,FQ(2,C):INPUT#1
    ,ST(2,C)
19  4615 IFFQ(2,C)=-1THENC=1:GOT
    O4620
FF  4616 C=C+1:GOTO4610
F6  4620 INPUT#1,FQ(3,C):INPUT#1
    ,ST(3,C)
C2  4625 IFFQ(3,C)=-1THEN4630
6E  4626 C=C+1:GOTO4620
D9  4630 CLOSE1:PRINT"[DOWN2]OK"
    :FORI=1TO200:NEXTI:N=C:C=0
37  4640 GOTO4800
9F  4800 PRINT"[CLR,WHITE,SPC15,
    RVSON]MUSIC COMPOSER[RVSOFF]
    ":GOTO400
BB  4900 PRINT"[HOME,DOWN6,RIGHT
    17]EXIT MODE":RETURN
E9  5000 GOSUB5010:GOTO5050
FB  5010 PRINT"[CLRJA B C D E F
    G H I J K L M N O"
5B  5020 PRINT"1 2 3 4 5 6 7 8 9
    10 11 12 13 14 15"
27  5030 PRINT"[DOWN3]WHICH VOIC
    E? (1-3)"
61  5040 GETA$:IFA$<>"1"ANDA$<>"
    2"ANDA$<>"3"THEN5040
4C  5045 AZ=VAL(A$):RETURN
9E  5050 PRINT"[DOWN4]ENTER ATTA
    CK RATE (A-O)"
49  5060 GETA$:IFA$=""THEN5060
09  5065 X=ASC(A$)-64:IFX<10RX>1
    5THEN5060
73  5070 IFAZ=1THENA1=X
E3  5080 IFAZ=2THENA2=X
E7  5090 IFAZ=3THENA3=X
F2  5100 GOTO4800
FC  5150 GOSUB5010:PRINT"[DOWN4]
    ENTER DECAY RATE (A-O)"
A7  5210 GETA$:IFA$=""THEN5210
7D  5212 X=ASC(A$)-64:IFX<10RX>1
    5THEN5210
F7  5220 IFAZ=1THEND1=X
0F  5230 IFAZ=2THEND2=X
17  5240 IFAZ=3THEND3=X
AB  5250 GOTO4800
11  5300 GOSUB5010:PRINT"[DOWN4]
    ENTER SUSTAIN LEVEL (A-O)"
93  5360 GETA$:IFA$=""THEN5360
69  5370 X=ASC(A$)-64:IFX<10RX>1
    5THEN5360
F9  5380 IFAZ=1THENS1=X
C5  5390 IFAZ=2THENS2=X
B9  5400 IFAZ=3THENS3=X
CA  5410 GOTO4800
8A  5450 GOSUB5010:PRINT"[DOWN4]
    ENTER RELEASE RATE (A-O)"
8B  5510 GETA$:IFA$=""THEN5510
9E  5520 X=ASC(A$)-64:IFX<10RX>1
    5THEN5520
2F  5530 IFAZ=1THENS1=X
9F  5540 IFAZ=2THENS2=X
4B  5550 IFAZ=3THENS3=X
40  5560 GOTO4800
7E  5600 PRINT"[CLR,SPC13,RVSON]
    TEMPO (SPEED)[RVSOFF]"
21  5620 PRINT"[DOWN]J : VERY SL
    OW":PRINT"I : BROAD":PRINT"H
    : SLOW":PRINT"G : QUITE SLO
    W
E8  5630 PRINT"F : MODERATELY SL
    OW":PRINT"E : MODERATE SPEED
    ":PRINT"D : QUITE FAST"
59  5640 PRINT"C : MERRY AND FAS
    T":PRINT"B : FAST":PRINT"A :
     VERY FAST"
6C  5660 GETA$:IFA$=""THEN5660
79  5670 A=ASC(A$)-64:IFA<1ORA>1
    0THEN5660
2A  5690 TP=A:GOTO4800
53  6000 E1=1:GOTO6040
9B  6010 GETA$:IFA$<>"[DOWN]"AND
    A$<>CHR$(13)THEN6010
6C  6020 IFA$=CHR$(13)THEN6200
6A  6030 E1=E1+1:IFE1=7THENE1=1
32  6040 IFE1=1THENPRINT"[HOME,D
    OWN3,RIGHT,RVSON]FREQ. DISPL
    AY[RVSOFF]":GOTO6100
4B  6050 IFE1=2THENPRINT"[HOME,D
    OWN4,RIGHT,RVSON]CHANGE ATTA
    CK[RVSOFF]":GOTO6110
44  6060 IFE1=3THENPRINT"[HOME,D
    OWN5,RIGHT,RVSON]CHANGE DECA
    Y[RVSOFF]":GOTO6120
76  6070 IFE1=4THENPRINT"[HOME,D
    OWN6,RIGHT,RVSON]CHANGE SUSA
    TIN[RVSOFF]":GOTO6130
7F  6080 IFE1=5THENPRINT"[HOME,D
    OWN7,RIGHT,RVSON]CHANGE RELE
    ASE[RVSOFF]":GOTO6140
A8  6090 IFE1=6THENPRINT"[HOME,D
    OWN8,RIGHT,RVSON]CHANGE TEMP
    O[RVSOFF]":GOTO6150
8F  6100 PRINT"[HOME,DOWN8,RIGHT
    ]CHANGE TEMPO":GOTO6010
87  6110 PRINT"[HOME,DOWN3,RIGHT
    ,RVSOFF]FREQ. DISPLAY":GOTO6
    010
5E  6120 PRINT"[HOME,DOWN4,RIGHT
    ]CHANGE ATTACK":GOTO6010
93  6130 PRINT"[HOME,DOWN5,RIGHT
    ]CHANGE DECAY":GOTO6010
23  6140 PRINT"[HOME,DOWN6,RIGHT
    ]CHANGE SUSAIN":GOTO6010
67  6150 PRINT"[HOME,DOWN7,RIGHT
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    )CHANGE RELEASE":GOTO6010
63  6200 ONE1GOTO20,5000,5150,53
    00,5450,5600
CB  9000 DATA32,121,0,208,3,76,2
    41,192,201,44,240,3,76,67,19
    3,32,115,0
19  9005 DATA162,8,221,76,193,24
    0,6,202,16,248,76,67,193,138
    ,10,170,189,85
2C  9010 DATA193,133,251,189,86,
    193,133,252,32,50,192,76,0,1
    92,108,251,0,32
3E  9015 DATA55,193,201,1,144,4,
    201,4,144,3,76,72,193,202,14
    2,114,193,96
56  9020 DATA32,55,193,10,10,10,
    10,141,123,193,173,120,193,4
    1,15,13,123,193
D2  9025 DATA141,120,193,96,32,5
    5,193,141,123,193,173,120,19
    3,41,240,13,123,193
B7  9030 DATA141,120,193,96,32,5
    5,193,10,10,10,10,141,123,19
    3,173,121,193,41
84  9035 DATA15,13,123,193,141,1
    21,193,96,32,55,193,141,123,
    193,173,121,193,41
C3  9040 DATA240,13,123,193,141,
    121,193,96,32,115,0,162,3,22
    1,103,193,240,6
24  9045 DATA202,16,248,76,67,19
    3,224,1,240,6,32,115,0,76,19
    6,192,32,44
B0  9050 DATA193,192,16,144,3,76
    ,72,193,142,117,193,140,118,
    193,162,1,189,107
63  9055 DATA193,141,119,193,96,
    32,44,193,142,115,193,140,11
    6,193,96,32,55,193
77  9060 DATA141,122,193,96,169,
    0,162,24,157,0,212,202,16,25
    0,169,0,141,115
A7  9065 DATA193,141,116,193,76,
    115,0,173,115,193,208,5,173,
    116,193,240,37,174
44  9070 DATA114,193,189,111,193
    ,133,251,169,212,133,252,160
    ,6,185,115,193,145,251
04  9075 DATA136,16,248,160,4,17
    3,119,193,9,1,145,251,173,12
    2,193,141,24,212
3F  9080 DATA96,165,122,208,2,19
    8,123,198,122,76,121,0,32,16
    6,173,32,247,183
67  9085 DATA166,20,164,21,96,32
    ,44,193,152,208,11,224,16,17
    6,7,138,96,162
B6  9090 DATA11,76,58,164,162,14
    ,208,249,86,65,68,83,82,87,7
    0,76,67,53
43  9095 DATA192,72,192,94,192,1
    12,192,134,192,152,192,203,1
    92,213,192,220,192,78
48  9100 DATA80,83,84,128,64,32,
    16,0,7,14,0,0,0,0,0,0,0,0,0,
    0

FX EDITOR

PROGRAM: BASIC LOADER

E8   10 M1=32768:M2=40960
E4   11 PRINTCHR$(147)
4C   12 POKE53280,0:POKE53281,0:PR
     INT"{YELLOW,CLR,RIGHT11}FX-ED
     ITOR V1.1"
C4   13 PRINT"{RED,RIGHT11}-------
     == ----"
8D   14 PRINT"{DOWN,CYAN,SPC4}WRIT
     TEN BY ARCHIE 'JOC' LYNCH"
20   15 PRINT"{DOWN,PURPLE,SPC8}DE
     SIGN BY MIKE 'FAX' ELSE"
C4   16 PRINT"{DOWN,C11}(C)COPYRIGH
     T 1988  DIGITAL DEVELOPMENTS"
BF   17 PRINT"{DOWN3} IN CONJUNCTIO
     N WITH YOUR COMMODORE 64{GREE
     N,DOWN3}"
DD   18 READCODE$
E8   33 LB=ASC(RIGHT$(CODE$,1))-48
     :IFLB>9THENLB=LB-7
CF   34 HB=ASC(LEFT$(CODE$,1))-48:
     IFHB>9THENHB=HB-7
B7   35 PRINTSPC(5)"READING MEMORY
     BLOCK ...";M1:PRINTCHR$(145)
     ;
9E   36 POKEM1,HB*16+LB:M1=M1+1:IF
     M1<M2THEN32
FD   37 SYS65126
1C   38 :
AF   39 ::::::::LES ALLAN - 13.09.
     86:::::::
12   40 :
33   41 DATA 4C,72,8F,EA,EA,EA,EA,
     A9,40,8D,8A,02,20,84,FF,A9
B0   42 DATA 05,8D,85,02,A9,93,20,
     D2,FF,A9,18,8D,18,D0,A9,00
07   43 DATA 8D,54,8F,8D,20,D0,8D,
     21,D0,A9,08,8D,15,D0,A9,0E
93   44 DATA 8D,22,D0,A9,0E,8D,23,
     D0,A2,A0,BD,80,91,9D,FF,03
43   45 DATA CA,D0,F7,A9,00,A2,93,
     85,FB,86,FC,A0,02,B1,FB,C9
B0   46 DATA FF,F0,0B,20,D2,FF,C8,
     D0,F4,E6,FC,4C,4D,80,20,86
35   47 DATA B7,20,1E,BB,20,A6,BE,
     20,75,BB,20,7B,B0,20,C6,B1
20   48 DATA AD,54,8F,D0,97,20,43,
     B1,4C,6A,B0,AD,C8,83,8D,C7
0B   49 DATA 83,18,69,40,8D,00,70,
     A0,C7,83,0A,0A,0A,0A,A8,A2
88   50 DATA 00,B9,7D,7E,9D,31,81,
     C8,E8,E0,10,D0,F4,A2,0B,A0
46   51 DATA C6,18,20,F0,FF,A9,02,
     8D,86,02,A2,00,A0,00,E0,31
4E   52 DATA B1,20,FA,B0,20,E5,B0,
     E8,E0,08,30,F2,A2,0C,A0,07
F1   53 DATA 18,20,F0,FF,A2,09,BD,
     31,81,20,FA,B0,20,E5,B0,E8
9D   54 DATA E0,0F,30,F2,A2,0F,A0,
     0E,18,20,F0,FF,AD,C7,83,20
A7   55 DATA FA,B0,4C,E5,B0,AD,30,
     81,20,D2,FF,AD,2F,81,20,D2
BD   56 DATA FF,A9,10,20,D2,FF,20,
     D2,FF,60,48,4A,4A,4A,4A,A9
F2   57 DATA 0F,8D,2D,81,68,29,0F,
     8D,2E,81,AC,2D,81,B9,1D,81
C9   58 DATA 8D,30,81,AC,2E,81,B9,
     1D,81,8D,2F,81,60,30,31,32
07   59 DATA 33,34,35,36,37,38,39,
     41,42,43,44,45,46,00,00,30
B2   60 DATA 30,00,00,00,00,00,00,
     00,00,00,00,00,00,00,00,00
6A   61 DATA 00,20,20,A2,00,A0,00,
     B0,05,20,AA,81,0A,0A,0A
33   62 DATA 0A,99,B7,81,8D,45,05,
     20,AA,81,29,0F,18,7F,81,99
D3   63 DATA B7,81,E8,E8,E8,E8,C8,
     C0,28,D0,DC,A2,00,A0,00,BD
C2   64 DATA E7,05,20,AA,81,0A,0A,
     0A,0A,99,BF,81,BD,E8,05,20
FC   65 DATA AA,81,29,0F,19,BF,81,
     99,BF,81,E8,E8,E8,E8,C8,C0
1F   66 DATA 07,D0,DC,AD,C7,83,0A,
     0A,0A,0A,AA,A0,00,B9,B7,81
E4   67 DATA 9D,7D,7E,E9,C8,C0,10,
     D0,F4,60,2C,B6,81,F0,01,60
22   68 DATA 29,0F,18,69,09,60,30,
     F0,11,15,67,81,1F,09,2F,40
36   69 DATA 41,81,16,1F,01,FE,AE,
     70,82,BD,71,82,8D,5C,8A,60
54   70 DATA 8F,82,18,69,05,8D,5D,
     8A,8D,A2,82,18,69,C0,8D,5E
0B   71 DATA 8A,20,E4,FF,C9,89,F0,
     4B,C9,8A,F0,72,C9,8B,F0,6B
89   72 DATA C9,8C,F0,67,C9,87,F0,
     47,C9,85,F0,3D,C9,8F,F0,42
1B   73 DATA C9,11,F0,60,C9,1D,F0,
     5F,C9,91,F0,5E,C9,9D,F0,51
54   74 DATA C9,0D,F0,31,C9,2B,F0,
     1E,C9,2D,F0,20,C9,85,F0,35
04   75 DATA C9,5E,F0,22,C9,5A,F0,
     24,C9,BB,F0,26,C9,51,F0,3D
63   76 DATA 4C,DE,82,4C,E8,8F,4C,
     9B,83,4C,16,87,4C,AB,83,4C
F5   77 DATA D9,8A,4C,B9,83,60,20,
     43,8A,4C,C6,81,20,4C,8A,4C
2E   78 DATA C6,81,4C,9D,8D,4C,C9,
     83,4C,5C,8D,4C,19,8D,4C,E7
44   79 DATA 8C,4C,86,83,4C,3D,83,
     4C,61,83,4C,73,83,4C,8F,8F
07   80 DATA 0D,3E,45,5E,66,7E,86,
     9E,A6,BE,C6,DE,E6,FE,06,1E
E1   81 DATA 26,4E,56,6E,76,8E,96,
     AE,B6,CE,D6,EE,F6,0E,16,70
E7   82 DATA 72,70,70,70,70,70,70,
     70,70,70,70,70,70,70,70,70
49   83 DATA 90,90,90,90,90,90,90,
     90,90,90,90,90,00,00,00,00
46   84 DATA 00,00,00,00,00,00,00,
     00,00,00,01,01,01,00,00,00
62   85 DATA 00,00,00,00,00,00,00,
     00,00,01,01,A2,00,DD,2D,83
3B   86 DATA F0,0B,E8,E0,10,D0,F5,
     4C,C6,81,4B,AE,70,82,8D,F1
81   87 DATA 82,A8,BD,0F,83,AA,18,
     20,F0,FF,E8,20,D2,FF,4C,C6
3E   88 DATA 81,05,06,09,0A,0D,0E,
     11,12,15,16,19,1A,1D,1E,21
5F   89 DATA 22,07,09,0B,0C,0F,10,
     13,14,17,18,1B,1C,1F,20,08
F6   90 DATA 08,08,08,08,08,08,08,
     08,08,08,08,08,08,08,08,0C
5F   91 DATA 0C,0C,0C,0C,0C,0C,0C,
     0C,0C,0C,0C,0C,0C,30,31,32
A3   92 DATA 33,34,35,36,37,38,39,
     41,42,43,44,45,46,A0,70,82
88   93 DATA C9,01,F0,04,C9,00,D0,
     09,18,69,10,8D,70,82,4C,C6
86   94 DATA 81,AD,70,82,C9,10,10,
     06,18,69,0E,8D,70,82,4C,C6
62   95 DATA 81,EE,70,82,AD,70,82,
     C9,1E,D0,F3,A9,00,8D,70,82
31   96 DATA 4C,C6,81,AD,70,82,C9,
     10,30,E4,AD,70,82,38,E9,0E
C9   97 DATA 8D,70,82,4C,C6,81,C6,
     70,82,AD,70,82,C9,FF,D0,CE
F8   98 DATA A9,1D,8D,70,82,4C,C6,
     81,EE,C8,83,AD,C8,83,C9,10
FA   99 DATA D0,05,A9,20,8D,C8,83,
     60,CE,C8,83,AD,C8,83,C9,FF
25  100 DATA D0,F5,A9,0F,8D,C8,83
    ,60,00,AD,8A,02,49,C0,8D,8A
BD  101 DATA 02,4C,C6,81,60,00,00
    ,00,00,A9,05,8D,85,02,A2,0F
9A  102 DATA A0,1A,18,20,F0,FF,A2
    ,00,BD,AE,84,20,D2,FF,E8,E0
73  103 DATA 07,D0,F5,AD,5C,8A,8D
    ,F0,7F,AD,5D,8A,8D,F1,7F,AD
A6  104 DATA 5E,8A,8D,F2,7F,A9,FF
    ,8D,1D,D8,A9,2E,8D,5C,8A,A9
1B  105 DATA AD,8D,5D,8A,A9,C1,8D
    ,5E,8A,A9,02,8D,B6,02,A9,20
73  106 DATA 8D,BC,84,8D,BD,84,A9
    ,00,8D,BF,84,20,99,84,20,54
B0  107 DATA FF,F0,F8,A2,00,DD,20
    ,83,F0,0B,E8,E0,10,D0,F6,4C
90  108 DATA 1B,84,AC,BF,84,99,BC
    ,84,EE,BF,84,AD,BF,84,C9,02
7B  109 DATA D0,D9,20,99,84,20,54
    ,FF,F0,FB,C9,14,F0,CD,C9,0D
5F  110 DATA F0,03,4C,45,84,AD,BC
    ,84,20,AA,81,0A,0A,0A,0A,8D
19  111 DATA BF,84,AD,BD,84,20,AA
    ,81,29,0F,0D,BF,84,A8,AD,F0
0F  112 DATA 7F,8D,5C,8A,AD,F1,7F
    ,8D,5D,8A,AD,F2,7F,8D,5E,8A
89  113 DATA A9,FE,8D,1D,D0,AD,73
    ,8B,F0,05,A9,00,8D,73,8B,60
26  114 DATA 9B,0A,0A,0A,0A,A8,4C
    ,8F,80,A2,0F,A0,23,18,20,F0
F6  115 DATA FF,AD,BC,84,20,D2,FF
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,AD,BD,84,20,D2,FF,60,45,46
AE 116 DATA 46,45,53,54,20,20,42
,41,4E,4B,20,20,30,30,20,00
34 117 DATA A0,00,A0,B6,02,4B,A9
,0B,80,B6,02,A9,4E,8D,5C,8A
A7 118 DATA A9,00,8D,FF,03,A0,10
,D0,29,FE,8D,5E,8A,A0,1D,D0
E2 119 DATA 29,FE,8D,1D,D0,A9,C5
,8D,5D,8A,AD,15,D0,09,01,8D
F4 122 DATA 15,D0,AD,17,B9,29,10
,D0,0B,A9,0B,8D,BB,02,4C,06
21 121 DATA 85,A9,04,8D,BB,02,20
,E4,FF,F0,E7,C9,1D,D0,2D,A9
E1 122 DATA 01,8D,FF,03,A9,E6,8D
,5C,8A,4C,F2,84,C9,9D,D0,0D
F4 123 DATA A9,00,8D,FF,03,A9,4E
,8D,5C,8A,4C,F2,84,C9,0D,F0
73 124 DATA 14,C9,5E,D0,05,20,43
,8A,4C,F2,84,C9,5A,D0,83,20
94 125 DATA 4C,8A,4C,F2,84,AD,B8
,89,D0,08,A9,11,8D,FE,85,4C
57 126 DATA 57,85,A9,12,8D,FE,85
,22,50,85,4C,C0,86,AD,FF,03
5E 127 DATA 29,03,A8,E9,B3,B6,8D
,97,85,89,B6,B6,8D,98,85,B8
F2 128 DATA B0,B6,8D,C0,85,B9,8A
,B6,8D,A8,85,B3,8D,B6,8D,A9
2A 129 DATA 85,A2,0B,A9,2E,9D,9C
,85,CA,10,FA,A9,00,8D,15,B6
73 130 DATA 4C,FD,85,AC,15,B6,B9
,20,40,8D,5C,8A,A0,BE,B6,B0
32 131 DATA 5D,8A,A0,10,D0,20,F6
,19,00,4D,8D,5E,8A,20,E4,FF
C4 132 DATA F0,E1,C9,0D,D0,01,60
,C9,14,D0,20,AD,15,B6,C9,00
D1 133 DATA D0,0E,A9,2E,AC,15,B6
,99,9C,B6,4C,FD,85,AC,15,B6
AE 134 DATA A9,2E,99,9C,B6,CE,15
,B6,4C,FD,85,A2,00,DD,16,B6
76 135 DATA F0,0B,E8,E0,37,DC,F5
,4C,83,B6,AC,15,B6,99,9C,B6
C3 136 DATA EE,15,B6,AD,15,B6,C9
,0C,D0,03,CE,15,B6,A2,12,A0
0B 137 DATA 1A,18,20,F0,FF,A2,00
,BD,9C,B6,20,D2,FF,E8,E0,0C
BE 138 DATA D0,F5,4C,83,B6,00,41
,42,43,44,45,46,47,48,49,4A
75 139 DATA 4B,4C,4D,4E,4F,50,51
,52,53,54,55,56,57,58,59,5A
80 140 DATA 32,31,32,33,34,35,36
,37,38,39,21,23,24,25,26,27
C3 141 DATA 28,29,3A,3B,2E,2C,3F
,2F,2A,20,2B,20,22,5E,EE,FE
C3 142 DATA F5,07,0F,17,1F,27,2F
,37,3F,47,4E,5E,5E,6E,6E,7E
C6 143 DATA 7E,8E,8E,9E,9E,AE,AE
,4E,5E,5E,6E,6E,7E,7E,8E,8E
55 144 DATA 9E,9E,AE,AE,00,00,00
,00,00,00,00,00,00,00,00,00
72 145 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,C5,00
2C 145 DATA 00,00,00,01,01,01,01
,01,01,01,01,01,2E,2E,2E,2E
E4 147 DATA 2E,2E,2E,2E,2E,2E,2E
,2E,2E,2E,2E,2E,2E,2E,2E,2E
24 148 DATA 07,1A,07,5A,4D,67,B6
,B6,B6,00,74,8F,B1,B6,B6,B6
BF 149 DATA AD,B8,83,AC,B8,B9,F0
,09,C9,32,D0,02,A5,FF,18,65
B7 150 DATA 01,8D,B9,B5,A2,B8,20
,99,8A,B6,F8,B8,18,65,40,B5
D9 151 DATA FC,AD,FF,03,10,A5,10
,F8,18,65,A5,F8,A5,FC,65
55 152 DATA 00,85,FC,4C,02,87,A5
,FB,18,69,07,85,FB,4C,ED,B6
B9 153 DATA A0,0B,B9,9C,B5,B5,3F
,91,FB,88,10,F6,68,B2,B6,02
3D 154 DATA A9,04,8D,B9,02,60,A2
,0F,A0,1A,18,20,F0,FF,A9,05
18 155 DATA 8D,B5,02,A2,00,BD,B5
,84,20,D2,FF,E8,E0,07,D0,F5
87 156 DATA 20,C2,84,AD,FF,03,F0
,05,A9,33,4C,3F,87,A9,30,18
31 157 DATA 6D,74,B5,A2,10,20,99
,8A,B5,F8,18,69,48,B5,FC,AD
0F 158 DATA C7,B3,0A,0A,0A,0A,AA
,A0,00,BD,7D,73,91,FB,E8,CB
D0 159 DATA C0,0F,D0,F5,91,FB,60
33 160 DATA A9,05,8D,B5,85,EE,EC
,87,AD,BC,B7,C9,0B,D0,05,A5
5A 161 DATA 00,8D,BC,B7,A9,BD,8D
,87,BD,27,D0,E2,00,00,05,0E
12 162 DATA 0C,01,0C,0B,0E,04,7B
,AD,B8,B7,8D,14,03,AD,BC,B7
F6 163 DATA BD,15,03,A2,02,8E,2E
,DC,E8,8E,1A,D0,A9,02,8D,12
17 164 DATA D0,AD,11,D0,29,7F,8D
,11,D0,58,60,8D,B7,A9,01,8D
FB 165 DATA 19,D0,8D,1A,D0,EE,78
,BB,AD,7B,B8,C9,03,D0,05,A9
62 166 DATA 00,8D,7B,B8,AA,8D,72
,BB,8D,12,D0,8D,75,B8,8D,E9
43 167 DATA B7,8D,78,B8,8D,EA,B7
,7B,20,43,B8,58,4C,31,EA,A5
FA 168 DATA 1F,8D,11,D0,A9,18,8D
,18,D0,A9,D8,8D,16,D0,20,EC
3B 169 DATA 8B,20,1B,B8,60,A5,18
,8D,11,D0,20,67,B7,20,06,70
B3 170 DATA 60,AD,41,8A,F0,08,A9
,00,8D,41,8A,4C,08,8A,AD,42
DB 171 DATA 8A,F0,08,A9,20,8D,42
,8A,4C,D8,B9,60,AD,1A,B9,F0
17 172 DATA 11,AD,19,B9,8D,7C,B8
,AD,18,B9,8D,17,B9,A9,00,8D
69 173 DATA 1A,B9,60,AD,11,D0,29
,F0,0D,7C,B8,8D,11,D0,8D,FF
E9 174 DATA 9F,AD,17,B9,8D,18,D0
,A9,C8,8D,16,D0,AD,5C,8A,8D
E1 175 DATA 00,D0,AD,5D,8A,8D,01
,D0,AD,5E,8A,8D,10,D0,20,11
64 176 DATA 88,60,30,8E,FE,EF,05
,43,87,88,88,02,07,A2,00,BD
35 177 DATA A8,05,9D,D0,0A,BD,F8
,06,20,0B,E8,E0,D0,D0,EF
E7 178 DATA AD,18,B9,49,30,8D,18
,B9,AD,A8,0A,38,E9,01,C9,FF
8A 179 DATA D0,02,A9,32,8D,74,8B
,60,A2,00,BD,A8,0A,9D,D0,06
BE 180 DATA BD,F8,0A,9D,20,07,E8
,E0,D0,D0,EF,AD,1B,B9,49,30
09 181 DATA 8D,1B,B9,AD,A8,05,3B
,E9,01,C9,FF,D0,02,A9,32,8D
2A 182 DATA 74,8B,60,A2,00,BD,D0
,06,9D,A8,0A,BD,20,07,9D,F8
AB 183 DATA 0A,E8,E0,D0,D0,EF,AD
,1B,B9,49,30,8D,1B,B9,AD,A8
F1 184 DATA 0A,8D,74,8B,60,A2,00
,BD,D0,0A,9D,A8,05,BD,20,0B
35 185 DATA 9D,F8,06,E8,E0,D0,D0
,EF,AD,1B,B9,49,30,8D,1B,B9
FC 186 DATA AD,A8,06,8D,74,8B,60
,1B,18,07,00,AD,1A,B9,F0,01
16 187 DATA 60,AD,C5,B3,D0,01,60
,AD,C6,B3,D0,03,4C,CA,B9,4C
A0 188 DATA B3,B9,A9,01,8D,B8,B9
,EE,19,B9,AD,19,B9,C9,0B,D0
79 189 DATA 30,29,07,8D,19,B9,A9
,00,8D,C5,B3,CE,B8,B3,AD,B8
4A 190 DATA B3,C9,FF,D0,05,A9,32
,8D,B8,B3,EA,AD,18,B9,20,D0
16 191 DATA F0,09,2D,7D,B8,EE,42
,8A,4C,71,B5,20,A8,B8,EE,42
31 192 DATA 8A,EE,1A,B9,60,A9,00
,8D,B8,B9,CE,19,B9,AD,19,B9
6B 193 DATA C9,FF,D0,30,29,07,8D
,19,B9,A9,00,8D,C5,B3,EE,B8
BC 194 DATA B3,AD,B8,B3,C9,33,D0
,05,A9,00,8D,B8,B3,EA,AD,18
68 195 DATA B9,29,10,F0,09,20,D3
,8B,EE,41,8A,4C,71,B5,20,F5
C9 196 DATA B8,EE,41,8A,EE,1A,B5
,60,00,AD,B8,B9,C9,00,D0,07
0F 197 DATA 20,32,B9,EE,C5,B3,60
,4C,32,B9,AD,B8,B9,C9,01,D0
95 198 DATA 07,20,75,B9,EE,C5,B3
,60,4C,75,B9,EA,AD,B8,B3,A2
07 199 DATA 28,20,99,8A,B5,F8,98
,18,69,40,85,FC,A9,06,8D,03
AD 200 DATA 8A,AD,17,B9,29,10,F0
,05,A9,0A,8D,03,8A,A0,27,B1
2C 201 DATA F9,99,A8,0A,88,10,F8
,60,EA,AD,B8,B3,18,69,07,C9
42 202 DATA 33,30,03,3E,E9,33,A2
,28,20,99,8A,B6,F8,B4,FC,98
6B 203 DATA 18,69,40,85,FC,A9,07
,8D,3C,8A,AD,17,B9,29,10,F0
F7 204 DATA 05,A9,0B,8D,3C,8A,A0
,27,B1,F8,99,C0,07,88,10,F8
E7 205 DATA 60,00,00,A9,00,8D,C6
,83,EE,C5,83,60,A9,01,8D,C6
EE 206 DATA 83,EE,C5,83,60,48,78
,A8,D8,18,00,30,06,75,C1,78
BC 207 DATA A9,F0,8D,1A,D0,A9,01
,8D,0E,DC,A9,1B,8D,11,D0,A9
EC 208 DATA 31,8D,14,03,A9,EA,8D
,15,03,A9,00,8D,FE,03,A9,04
76 209 DATA 8D,88,02,A9,01,8D,27
,D0,A9,18,8D,18,D0,A9,00,8D
EC 210 DATA 15,D0,A9,C8,8D,16,D0
,58,60,8E,D7,8A,8D,D8,8A,A9
54 211 DATA 00,8D,D6,8A,8D,D4,8A
,8D,D5,8A,00,0B,4E,D8,8A,30
00 212 DATA 13,AD,D4,8A,18,6D,D7
,8A,8D,D4,8A,AD,D5,8A,6D,D6
B1 213 DATA 8A,8D,D5,8A,0E,D7,8A
,2E,D6,8A,8B,D0,DF,AE,D4,8A
AA 214 DATA AC,D5,8A,60,18,01,28
,00,00,A2,0F,A0,1A,18,20,F0
C3 215 DATA FF,A9,05,8D,86,02,A2
,00,8D,B5,84,20,D2,FF,E8,E0
5E 216 DATA 07,D0,F5,A9,02,8D,86
,02,EE,73,8B,20,E3,83,98,A2
0B 217 DATA 10,20,99,8A,86,F8,98
,18,69,48,85,FC,AD,C7,83,A0
42 218 DATA 00,B1,FB,99,31,81,C8
,C0,10,D0,F6,4C,5D,8D,A2,0F
47 219 DATA 8D,64,8B,9D,02,D0,CA
,10,F7,A9,FF,8D,15,D0,A2,07
55 220 DATA A9,0E,9D,F8,07,9D,F8
,0B,9D,27,D0,CA,D0,F2,A9,0D
7D 221 DATA 8D,F8,07,8D,F8,0B,A9
,FE,8D,1D,D0,8D,1C,D0,A9,06
24 222 DATA 8D,26,D0,A9,03,8D,25
,D0,A2,80,8D,7F,9F,9D,40,03
3B 223 DATA CA,10,F7,60,18,8E,48
,BE,78,BE,A8,BE,DB,BE,09,BE
76 224 DATA 2B,BE,C0,00,00,A2,27
,BD,98,B8,9D,80,DA,9D,A8,DA
25 225 DATA 9D,D0,DA,9D,F8,DA,9D
,20,DB,9D,48,DB,9D,70,DB,9D
21 226 DATA 98,DB,9D,C0,DB,CA,10
,DF,60,00,00,02,05,05,02,00
F3 227 DATA 0B,0B,0B,0B,0B,0B,0B
,0B,0B,0B,0B,0B,00,00,02,05
5A 228 DATA 05,02,00,0B,0B,0B,0B
,0B,0B,0B,0B,0B,0B,0B,0B,A9
C7 229 DATA 05,8D,86,02,20,5F,8A
,EE,54,8F,A9,01,8D,15,D0,A9
11 230 DATA 13,20,D2,FF,A2,00,BD
,61,BC,20,D2,FF,E8,E0,0C,D0
2E 231 DATA F5,A9,0B,8D,86,02,A9
,66,8D,00,D0,A9,40,8D,01,D0
53 232 DATA A9,21,8D,15,D0,A9,00
,8D,81,BC,A2,12,A9,2D,9D,6D
A7 233 DATA BC,CA,10,FA,20,5B,BC
,20,E4,FF,A2,00,DD,82,BC,F0
02 234 DATA 10,E8,E0,39,D0,F6,C9
,14,F0,20,C9,3D,F0,3D,4C,07
67 235 DATA 8C,AE,81,8C,9D,6D,BC
,20,B8,BC,AD,81,8C,C9,13,F0
C2 236 DATA D6,EE,81,8C,20,D1,BC
,4C,07,BC,AC,81,BC,A9,2D,99
44 237 DATA 6D,BC,88,A9,2D,99,6D
,BC,20,BB,BC,AD,81,8C,C9,00
46 238 DATA F0,B5,CE,81,8C,20,DB
,BC,4C,07,BC,A9,00,8D,15,D0
F4 239 DATA 60,0D,0D,46,43,4C,45
,4E,41,4D,45,2D,3E,42,41,4E
EB 240 DATA 4B,2D,2D,2D,2D,2D,2D
,2D,2D,2D,2D,2D,2D,2D,2D,2D
49 241 DATA 20,0A,40,30,31,32,33
,34,35,36,37,38,39,41,42,43
CB 242 DATA 44,45,46,47,48,49,4A
,4B,4C,4D,4E,4F,50,51,52,53
D2 243 DATA 54,55,56,57,58,59,5A
,21,23,24,25,26,27,28,29,28
01 244 DATA 2A,3A,3B,2C,2E,3C,3E
,3F,3D,5C,20,A0,0A,A2,02,18
73 245 DATA 20,F0,FF,A2,00,BD,6D
,BC,20,D2,FF,E8,E0,13,D0,F5
26 246 DATA 60,AD,00,D0,18,69,0B
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,8D,00,D0,60,AD,00,D0,38,E9
6C  247 DATA 08,8D,00,D0,60,6D,8C
    ,A2,00,BD,12,8D,20,D2,FF,E8
53  248 DATA E0,07,D0,F5,20,BF,8B
    ,A9,08,AA,A8,20,BA,FF,AC,E6
BF  249 DATA BC,AE,E5,BC,AD,81,BC
    ,20,BD,FF,A9,00,20,D5,FF,4C
59  250 DATA 60,97,93,9E,00,4C,4F
    ,41,44,A2,00,BD,50,8D,20,D2
0A  251 DATA FF,EB,E0,0C,D0,F5,20
    ,BF,8B,A9,08,AA,A8,20,BA,FF
0B  252 DATA AC,E6,BC,AE,E5,BC,AD
    ,81,BC,20,BD,FF,A9,40,85,FC
E4  253 DATA A9,00,85,FB,A2,FF,A0
    ,4F,A9,FB,20,DB,FF,4C,60,97
53  254 DATA 93,9E,00,53,41,56,45
    ,20,42,41,4E,4B,A2,00,BD,93
13  255 DATA 8D,20,D2,FF,E8,E0,0A
    ,D0,F5,20,BF,8B,A9,0E,AA,A8
E3  256 DATA 20,BA,FF,AC,E6,BC,AE
    ,E5,BC,AD,81,BC,20,BD,FF,A9
F9  257 DATA 72,85,FC,A9,7D,85,FB
    ,A2,7D,A0,73,A9,FB,20,DB,FF
A2  258 DATA 4C,60,97,93,9E,00,53
    ,41,56,45,20,46,58,A9,05,8D
F3  259 DATA 86,02,A2,0F,A0,15,18
    ,20,F0,FF,A2,00,B0,11,8F,20
83  260 DATA D2,FF,E8,E0,0C,D0,F5
    ,EE,73,8B,20,E3,E3,BC,1D,8F
1E  261 DATA 20,5F,8A,20,1E,8F,A5
    ,CB,8D,15,D0,A2,00,B0,93,8D
62  262 DATA 20,D2,FF,E8,E0,0A,D0
    ,F5,20,BF,8B,A9,00,85,3F,A9
3B  263 DATA 70,85,40,A9,7D,85,41
    ,A9,73,85,42,A9,00,85,FE,AD
64  264 DATA 1D,8F,85,FF,20,DF,8E
    ,20,60,97,4C,55,8F,A9,00,8D
52  265 DATA 74,8E,A9,33,8D,75,8E
    ,A9,40,85,FC,A9,00,85,FB,AD
28  266 DATA 74,8E,4A,4A,4A,4A,29
    ,0F,AA,8D,3E,8E,8D,79,8E,AD
28  267 DATA 74,8E,29,0F,AA,8D,3E
    ,8E,8D,7A,8E,AD,75,8E,4A,4A
67  268 DATA 4A,4A,29,0F,AA,8D,3E
    ,8E,8D,8C,8E,AD,75,8E,29,0F
8E  269 DATA AA,8D,3E,8E,8D,8D,8E
    ,AD,74,8E,8D,76,8E,A0,00,85
11  270 DATA 7B,8E,91,FB,C8,C0,28
    ,D0,F6,A5,FB,18,69,28,85,FB
DB  271 DATA A5,FC,69,00,85,FC,EE
    ,74,8E,EE,75,8E,AD,74,8E,C9
D1  272 DATA 33,D0,9C,60,33,66,32
    ,20,1B,33,32,1D,20,2E,2E,2E
1F  273 DATA 2E,2E,2E,2E,2E,2E,2E
    ,2E,2E,20,20,1B,3B,35,1D,20
1F  274 DATA 2E,2E,2E,2E,2E,2E,2E
    ,2E,2E,2E,2E,2E,20,20,31
BD  275 DATA 32,33,34,35,36,37,3B
    ,38,01,02,03,04,05,06,A0,00
85  276 DATA A5,E0,85,FF,A9,00,85
    ,FE,81,FE,91,FE,E6,FE,D0,F8
32  277 DATA E5,FF,D0,F4,A9,FE,8D
    ,1B,F6,8D,8C,F7,A9,FF,8D,20
9C  278 DATA F6,8D,91,F7,A9,FC,8D
    ,8E,F7,A9,FD,8D,8E,F7,60,A9
07  279 DATA 35,85,01,A9,01,A2,08
    ,A0,01,20,BA,FF,A0,81,8C,AE
D3  280 DATA E5,BC,AC,E5,8C,20,BD
    ,FF,AE,41,A4,42,A9,3F,20,DB
D9  281 DATA FF,90,03,8D,AC,02,20
    ,B7,FF,8D,AD,02,A9,37,85,01
1B  282 DATA 00,45,58,20,53,41,55
    ,45,20,41,44,44,52,00,A9,70
20  283 DATA A2,00,85,FC,86,FB,AC
    ,00,81,FB,C9,70,30,0E,C9,74
94  284 DATA 12,0A,81,FB,E8,0F,18
    ,6D,1D,8F,91,FB,A5,FB,18,69
74  285 DATA 01,85,FB,A5,FC,69,00
    ,85,FC,C9,72,D0,DE,A5,FB,C9
F1  286 DATA 48,D0,D5,60,00,A2,20
    ,8D,21,92,9D,00,7D,BD,21,93
57  287 DATA 9D,00,71,E8,D0,F1,ED
    ,21,94,9D,00,72,E8,E0,7D,D0
65  288 DATA F5,60,A2,79,A9,00,85
    ,FB,A9,04,85,FC,A0,00,A9,00
5C  289 DATA 91,FB,C8,D0,FB,E6,FC
    ,CA,D0,F6,20,55,BF,20,FD,8D
15  290 DATA A2,08,A9,A0,85,FB,A9
    ,94,85,FC,A9,00,85,FD,A9,20
A5  291 DATA 85,FE,A0,00,81,FB,91
    ,FD,CB,D0,F9,E6,FC,E6,FE,CA
1D  292 DATA DC,F2,A2,27,A9,39,9D
    ,EB,22,CA,10,FB,4C,03,80,EE
A2  293 DATA 54,BF,20,5F,8A,A9,1E
    ,8D,16,D0,A9,68,85,FB,A9,9C
B1  294 DATA 85,FC,A0,00,B1,FB,CE
    ,FF,F0,0B,20,D2,FF,C8,D0,F4
72  295 DATA E6,FC,4C,D4,BF,20,E4
    ,FF,F0,FB,E0,20,5F,8A,EE,54
56  296 DATA BF,A8,C8,BD,1E,D0,4C
    ,D0,96,EA,EA,EA,EA,EA,EA,EA
9B  297 DATA 13,0D,0D,0D,0D,97,3F
    ,3F,3F,3F,3F,3F,3F,3F,3F,3F
CC  298 DATA 3F,3F,3F,3F,3F,3F,3F
    ,3F,3F,3F,3F,3F,3F,3F,3F,3F
0F  299 DATA 3F,3F,3F,3F,3F,3F,3F
    ,3F,3F,3F,3F,3F,3F,3F,0D,9C
5A  300 DATA 1D,1D,1D,1D,1D,5C,49
    ,54,43,4B,31,20,20,5C,49,54
04  301 DATA 43,4B,32,20,57,41,56
    ,45,20,20,41,44,53,5E,20,20
1C  302 DATA 20,5C,49,0D,97,1D,1D
    ,1D,1D,B0,C0,C0,C0,C0,C0,C0
A7  303 DATA C0,C0,C0,C0,C0,C0,C0
    ,C0,C0,C0,C0,C0,C0,C0,C0,C0
D3  304 DATA C0,C0,C0,C0,C0,C0,C0
    ,C0,AE,0D,1D,1D,1D,1D,DD,96
A5  305 DATA 1D,1D,1D,1D,1D,1D,1D
    ,1D,1D,1D,1D,1D,1D,1D,1D,1D
92  306 DATA 1D,1D,1D,1D,1D,1D,1D
    ,1D,1D,1D,1D,1D,1D,1D,97,DD
BD  307 DATA 0D,97,1D,1D,1D,1D,AD
    ,C0,C0,C0,C0,C0,C0,C0,C0,C0
AA  308 DATA C0,C0,C0,C0,C0,C0,C0
    ,C0,C0,C0,C0,C0,C0,C0,C0,C0
48  309 DATA C0,C0,C0,C0,C0,C0,0D
    ,1D,1D,1D,1D,1D,1D,9C,53
BB  310 DATA 50,20,20,57,41,55,45
    ,20,53,20,20,50,53,20,20,4C
7D  311 DATA 45,4E,47,54,48,20,20
    ,52,44,0D,97,1D,1D,1D,1D,1D
11  312 DATA 1D,B0,C0,C0,C0,C0,C0
    ,C0,C0,C0,C0,C0,C0,C0,C0,C0
7D  313 DATA C0,C0,C0,C0,C0,C0,C0
    ,C0,C0,C0,C0,AE,0D,1D,1D
1F  314 DATA 1D,1D,1D,1D,DD,96,1D
    ,1D,1D,1D,1D,1D,1D,1D,1D,1D
33  315 DATA 1D,1D,1D,1D,1D,1D,1D
    ,1D,1D,1D,1D,1D,1D,1D,1D,1D
1E  316 DATA 97,DD,0D,97,1D,1D,1D
    ,1D,1D,1D,AD,C0,C0,C0,C0,C0
31  317 DATA C0,C0,C0,C0,C0,C0,C0
    ,C0,C0,C0,C0,C0,C0,C0,C0,C0
76  318 DATA C0,C0,C0,C0,C0,C0,0D
    ,11,1D,1D,1D,1E,46,59,20,4E
52  319 DATA 55,4D,42,45,52,20,3A
    ,20,1D,1D,1D,1D,1D,1D,43,4F
36  320 DATA 50,59,20,4E,55,4D,42
    ,45,52,20,3A,20,1D,1D,0D,0D
B1  321 DATA FF,20,20,20,20,20,20
    ,20,20,20,C0,C1,C2,20,20,20
3B  322 DATA 20,20,20,20,20,20,20
    ,20,20,EB,EC,ED,EE,EF,20,20
3B  323 DATA 20,20,20,20,20,20,20
    ,20,20,20,20,20,20,20,20,20
0A  324 DATA 20,20,C3,C4,C5,C6,C7
    ,C8,C9,CA,CB,CC,CD,CE,E7,EB
B0  325 DATA E9,EE,EF,F0,F5,F6,F7
    ,FB,20,20,20,20,20,20,20,20
0B  326 DATA 20,20,20,20,20,20,20
    ,20,20,C0,C1,C2,20,20,20,20
DB  327 DATA 20,20,20,20,20,20,20
    ,20,EA,20,F1,F2,20,20,20,20
3E  328 DATA 20,20,20,20,20,20,20
    ,20,20,20,20,20,20,20,20,20
BB  329 DATA 20,C3,C4,C5,CF,D0,D1
    ,D2,D3,D4,D5,D6,D7,D8,D9,DA
74  330 DATA D2,DC,DD,DE,DF,E0,E1
    ,E2,E3,20,20,20,20,20,20,20
CC  331 DATA 20,FF,FF,FF,4C,36,71
    ,A9,1F,BD,18,D4,AD,F3,71,49
CC  332 DATA 01,8D,F3,71,A2,02,8E
    ,34,72,BD,30,72,8D,35,72,A8
D5  333 DATA BD,00,70,0A,90,03,4C
    ,2F,71,10,03,4C,48,71,DE,F7
B3  334 DATA 71,30,03,4C,CC,70,BD
    ,09,72,9D,F7,71,DE,18,72,BD
F5  335 DATA 12,72,AB,B9,35,72,8D
    ,52,70,B9,3E,72,8D,53,70,8D
47  336 DATA F4,71,B9,4B,93,AC,35
    ,72,C9,FF,D0,07,A9,00,8D,F4
FD  337 DATA 71,F0,EC,10,12,BD,24
    ,72,8D,21,72,BD,2A,72,8D,27
DA  338 DATA 72,FE,F4,71,4C,4E,70
    ,FE,F4,71,C9,01,F0,07,C9,02
B9  339 DATA F0,1F,4C,B9,70,18,BD
    ,21,72,7D,FA,71,8D,21,72,99
E3  340 DATA 00,D4,BD,27,72,7D,FD
    ,71,99,27,72,99,01,D4,4C,B5
CE  341 DATA 70,3B,BD,21,72,FD,FA
    ,71,99,21,72,99,00,D4,BD,27
7A  342 DATA 72,FD,FD,71,9D,27,72
    ,99,01,D4,1B,BD,FA,71,7D,00
6D  343 DATA 72,9D,FA,71,BD,FD,71
    ,7D,33,72,9D,FD,71,BD,0E,72
CD  344 DATA 10,13,AD,F3,71,29,01
    ,F0,06,BD,0C,72,4C,E1,70,BD
E7  345 DATA 1E,72,9D,2D,72,BD,05
    ,72,0A,1C,1C,BD,15,72,F0,09
B0  346 DATA DE,15,72,BD,0F,72,4C
    ,03,71,BD,06,72,29,BF,9D,06
BF  347 DATA 72,BD,1E,72,29,20,72
    ,BD,18,72,0D,0D,A9,00,99,04
AE  348 DATA D4,A9,FF,9D,00,70,4C
    ,2F,71,BD,18,72,4A,0D,18,72
B5  349 DATA B0,06,BD,20,72,4C,2C
    ,71,BD,2D,72,29,FE,99,04,D4
09  350 DATA CA,30,03,4C,15,70,60
    ,AA,BC,30,72,A9,FF,9D,00,70
51  351 DATA A9,00,99,04,D4,99,05
    ,D4,99,06,D4,60,A9,00,9D,F4
0B  352 DATA 71,BD,17,D4,9D,F7,71
    ,99,04,D4,99,06,D4,BD,00,70
6E  353 DATA 29,0F,9D,00,70,0A,0A
    ,0A,0A,A8,BC,33,72,B9,7D,72
53  354 DATA 9D,FA,71,B9,7E,72,9D
    ,FD,71,B9,8A,72,9D,00,72,B9
C2  355 DATA 8B,72,9D,03,72,B9,85
    ,72,9D,06,72,29,0F,9D,09,72
B6  356 DATA B9,86,72,9D,0C,72,B9
    ,87,72,9D,0F,72,B9,88,72,4B
20  357 DATA 4A,4A,4A,4A,9D,12,72
    ,68,29,0F,9D,15,72,B9,89,72
F2  358 DATA 9D,18,72,9D,1B,72,B9
    ,81,72,9D,1E,72,B9,84,72,0A
19  359 DATA 18,69,8E,9D,21,72,9D
    ,24,72,B9,84,72,0A,18,69,AF
7B  360 DATA 9D,27,72,AE,33,72,AC
    ,35,72,A9,05,8D,33,72,8D,7D
07  361 DATA 72,99,00,D4,E8,C8,CE
    ,33,72,10,F3,AC,35,72,AE,34
A4  362 DATA 72,4C,2F,71,00,00,00
    ,00,00,00,00,00,00,00,00,00
E3  363 DATA 00,00,00,00,00,00,00
    ,00,00,00,00,00,00,00,00,00
EA  364 DATA 00,00,00,00,00,00,00
    ,00,00,00,00,00,40,52,8F,00
E1  365 DATA 00,00,00,00,00,00,00
    ,00,00,00,00,00,00,00,00,00
AC  366 DATA 00,00,07,0E,00,00,00
    ,46,4D,4F,56,59,5B,65,6A,72
CB  367 DATA 72,72,72,72,72,72,72
    ,01,01,01,01,02,FF,01,FF
14  368 DATA 01,01,01,01,01,80,FF
    ,02,01,FF,03,FF,01,01,01,01
66  369 DATA 01,02,02,02,02,02,FF
    ,02,02,80,FF,01,01,01,01,02
69  370 DATA 02,FF,20,20,20,20,20
    ,20,20,20,20,20,20,02,01,EA
3F  371 DATA 3C,66,6E,6E,70,72,3C
    ,00,7C,C6,C6,FE,E6,E6,E6,00
7A  372 DATA FC,C6,C6,FC,E6,E6,E6,FC
    ,00,7C,C6,C0,E0,E0,E6,7C,00
AC  373 DATA FC,C6,C6,E6,E6,E6,E6,FC
    ,00,FE,C0,C0,F8,E0,E0,FE,00
DE  374 DATA FE,C0,C0,F8,E0,E0,E0,E0
    ,00,7C,C6,C0,EE,E6,E6,7C,00
28  375 DATA C6,C6,C6,C6,FE,EE,E6,E6
    ,00,18,18,18,38,38,38,3C,00
3A  376 DATA 3E,4B,06,0E,0E,0E,7C
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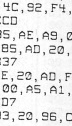
,00,C6,CC,FB,FC,FB,EC,EE,00
68 377 DATA C0,C0,C0,E0,E0,E0,FE
,00,C6,EE,FE,FB,E6,E6,E6,00
1E 378 DATA C6,E6,F6,FE,EE,E6,E6
,00,7C,C6,C6,E6,E6,E6,7C,00
F7 379 DATA FC,C6,C6,FC,E0,E0,E0
,00,7C,C6,C6,E6,E6,7C,0E,00
22 380 DATA FC,C6,C6,FC,FB,EC,E6
,00,7C,C6,C0,7C,0E,C6,7C,00
9B 381 DATA 7E,18,18,3B,3B,3B,3B
,00,C6,C6,C6,E6,E6,E6,7C,00
19 382 DATA C6,C6,C6,E6,E6,7C,3B
,00,C6,C6,C6,F6,FE,EE,E6,00
1E 383 DATA C6,C6,7C,3B,7C,E6,E6
,00,C6,C6,C6,7C,3B,3B,3B,00
87 384 DATA FE,06,0C,3B,7C,E0,FE
,00,3C,3C,3C,3C,3C,3C,3C,00
7D 385 DATA 0C,12,30,7C,30,62,FC
,00,3C,0C,0C,0C,0C,3C,00,00
D7 386 DATA 00,18,3C,7E,18,18,18
,18,00,10,3C,7F,7F,3C,10,00
3B 387 DATA 00,00,00,00,00,00,00
,00,0C,0C,18,18,00,30,30,00
BB 388 DATA 66,66,66,00,00,00,00
,00,66,66,FF,66,FF,EE,EE,00
AA 389 DATA 18,3E,58,3C,05,7C,18
,00,62,66,0C,18,30,66,46,00
BD 390 DATA 3C,66,3C,38,67,66,3F
,00,06,0C,18,00,00,00,00,00
C7 391 DATA 0C,18,30,30,30,18,0C
,00,30,18,0C,0C,0C,18,30,00
9F 392 DATA 00,0C,3B,EA,6A,19,04
,00,00,18,18,7E,18,18,00,00
4C 393 DATA 00,00,00,00,00,18,18
,30,00,00,00,7E,00,00,00,00
B0 394 DATA 00,00,00,00,00,66,66
,00,00,03,06,0C,18,30,60,00
F0 395 DATA 7E,66,6E,76,75,75,7E
,00,0C,0C,0C,1C,1C,1C,1C,00
36 396 DATA 7E,06,06,7E,70,70,7E
,00,7E,06,06,1E,0E,0E,7E,00
72 397 DATA 66,66,66,7E,0E,0E,0E
,00,7E,60,60,7E,0E,0E,7E,00
0D 398 DATA 7E,60,60,7E,7E,7E,7E
,00,7E,06,06,1E,0E,0E,0E,00
B9 399 DATA 7E,66,66,7E,7E,7E,7E
,00,7E,66,66,7E,0E,0E,7E,00
03 400 DATA 00,00,18,00,00,18,18
,00,00,00,18,00,00,18,18,30
8C 401 DATA 06,18,30,70,30,18,06
,00,00,00,7E,00,7E,00,00,00
49 402 DATA 60,18,0C,0E,0C,18,60
,00,00,FF,AA,55,AA,FF,AA,55
E7 403 DATA 00,00,FF,AA,AA,55,00
,00,00,00,00,00,00,00,00,00
8A 404 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
89 405 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
E1 406 DATA AD,86,02,BD,81,97,A9
,05,8D,86,02,A9,93,20,D2,FF
32 407 DATA A9,30,85,FC,A9,02,85
,FD,A9,00,85,90,A9,24,85,FB
F7 408 DATA A9,FB,85,BB,A9,00,85
,BC,A5,FD,85,B7,A9,08,85,BA
B4 409 DATA A5,60,85,B9,20,D5,F3
,A5,BA,20,B4,FF,A5,B9,20,96
FB 410 DATA FF,A4,90,DD,48,A0,06
,B4,FB,20,E4,FF,C9,20,D0,07
23 411 DATA 20,E4,FF,C9,20,D0,F9
,20,A5,FF,A6,FC,85,FC,A4,90
34 412 DATA D0,2E,A4,FB,98,D0,E0
,A4,FC,20,CD,BD,A9,20,20,D2
32 413 DATA FF,20,A5,FF,A5,90,D0
,1B,AA,F0,06,20,D2,FF,4C,41
1B 414 DATA 97,A9,D0,20,D2,FF,A5
,C5,C9,3F,F0,24,A0,24,D0,E7
9B 415 DATA 20,42,F6,A9,02,8D,86
,02,A9,0D,20,D2,FF,A9,00,85
79 416 DATA 90,A9,08,85,BA,20,B4
,FF,A9,6F,85,B9,20,96,FF,A4
72 417 DATA 90,D0,0A,20,A5,FF,20
,D2,FF,C9,00,D0,F2,20,AB,FF
3E 418 DATA A9,06,8D,85,02,A2,00
,BD,B2,97,C9,FF,F0,07,20,D2
1A 419 DATA FF,E8,4C,97,97,20,E4
,FF,F0,FB,AD,B1,97,8D,86,02
3D 420 DATA E0,02,D0,12,20,48,A9
,54,20,41,20,43,45,53,20,46
C6 421 DATA 4F,52,20,46,58,20,45
,44,49,54,4F,52,20,92,FF,00
9B 422 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
9F 423 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
9E 424 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
AE 425 DATA 00,00,00,00,0F,0F,0F
,0F,39,39,3B,3A,3A,35,00,00
7B 426 DATA 00,00,FF,A9,A9,55,39
,3B,00,00,00,00,00,00,00,00
F0 427 DATA 00,00,3F,3A,3A,39,39
,39,00,00,00,00,00,00,00,00
22 428 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
21 429 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
20 430 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
A7 431 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00
46 432 DATA 00,00,00,00,00,00,00
,00,00,00,00,00,F0,F0,F0,F0
E0 433 DATA 0F,0F,0F,0F,00,00,00
,00,39,39,F9,A6,A6,55,00,00
AC 434 DATA F0,F0,F0,F0,00,00,00
,00,00,00,00,00,00,00,00,00
1D 435 DATA C3,99,91,91,8F,8D,C3
,FF,83,39,39,01,19,19,19,FF
3E 436 DATA 03,39,39,39,03,19,19,03
,FF,83,39,3F,1F,1F,19,83,FF
1B 437 DATA 03,39,39,19,19,19,03
,FF,01,3F,3F,07,1F,1F,01,FF
5A 438 DATA 01,3F,3F,07,1F,1F,1F
,FF,83,39,3F,11,19,19,83,FF
60 439 DATA 39,39,39,01,19,19,19
,FF,E7,E7,E7,C7,C7,C7,C3,FF
41 440 DATA 81,39,F9,F1,F1,31,83
,FF,39,39,07,0F,1F,19,19,FF
34 441 DATA 3F,3F,3F,1F,1F,1F,01
,FF,39,11,01,09,19,19,19,FF
EB 442 DATA 39,19,09,01,11,19,19
,FF,83,39,39,19,19,19,83,FF
07 443 DATA 03,39,39,03,1F,1F,1F
,FF,83,39,39,19,19,83,F1,FF
68 444 DATA 03,39,39,03,07,13,19
,FF,83,39,3F,83,F1,31,83,FF
BF 445 DATA 81,E7,E7,C7,C7,C7,C7
,FF,39,39,39,19,19,19,83,FF
79 446 DATA 39,39,39,19,19,83,C7
,FF,3B,39,39,09,01,11,19,FF
7A 447 DATA 39,39,83,C7,C7,83,19
,FF,3B,39,83,C7,C7,C7,C7,FF
6C 448 DATA 01,F9,F3,C7,BF,1F,01
,FF,C3,CF,CF,CF,CF,C3,C3,FF
BF 449 DATA F3,ED,CF,83,CF,9D,03
,FF,C3,F3,F3,F3,F3,F3,C3,FF
A5 450 DATA FF,E7,C3,81,E7,E7,E7
,E7,FF,EF,CF,80,80,CF,EF,FF
89 451 DATA FF,FF,FF,FF,FF,FF,FF
,FF,F3,F3,E7,E7,FF,CF,CF,FF
2A 452 DATA 99,99,99,FF,FF,FF,FF
,FF,99,99,00,99,00,11,11,FF
54 453 DATA E7,C1,9F,C3,F9,83,E7
,FF,9D,99,F3,E7,CF,99,B9,FF
8A 454 DATA C3,99,C3,C7,B8,99,C0
,FF,F9,F3,E7,FF,FF,FF,FF,FF
49 455 DATA F3,E7,CF,CF,CF,E7,F3
,FF,CF,E7,F3,F3,F3,E7,CF,FF
D7 456 DATA FF,99,C3,00,C3,99,FF
,FF,FF,E7,E7,81,E7,E7,FF,FF
81 457 DATA FF,FF,FF,FF,FF,E7,E7
,CF,FF,FF,FF,81,FF,FF,FF,FF
35 458 DATA FF,FF,FF,FF,FF,99,99
,FF,FF,FC,F9,F3,E7,CF,9F,FF
23 459 DATA 81,99,91,89,99,89,81
,FF,F3,F3,F3,E3,E3,E3,E3,FF
C3 460 DATA 81,F3,F9,81,8F,8F,81
,FF,81,F9,F9,E1,F1,F1,81,FF
FE 461 DATA 99,99,99,81,F1,F1,F1
,FF,81,9F,8F,81,F1,F1,81,FF
E1 462 DATA 81,9F,9F,81,89,89,81
,FF,81,F9,F9,E1,F1,F1,F1,FF
6B 463 DATA 81,99,99,81,89,89,81
,FF,81,99,99,81,F1,F1,81,FF
2F 464 DATA FF,FF,E7,FF,FF,E7,E7
,FF,FF,FF,E7,FF,FF,E7,E7,CF
CB 465 DATA F9,E7,CF,8F,CF,E7,F9
,FF,FF,FF,81,FF,81,FF,FF,FF
6B 466 DATA 9F,E7,F3,F1,F3,E7,9F
,FF,C3,99,F9,F3,E7,FF,E7,FF
D5 467 DATA 00,00,00,00,00,00,01
,01,00,00,7F,7F,00,00,FB,FB
74 468 DATA 00,00,F0,F0,FB,00,00,0C
,18,03,03,07,07,0F,0F,1F
B2 469 DATA F0,F0,E0,E0,C0,C0,81
,FF,18,30,31,61,63,C3,87,07
BB 470 DATA FC,00,FB,FB,F1,F1,E3
,E3,7F,00,FC,FC,F9,F8,F1,FF
10 471 DATA F1,00,03,03,E7,C7,8F
,8F,FB,00,F0,F0,E0,E0,C0,C0
11 472 DATA FF,00,1F,1F,3F,3F,7E
,7E,FC,00,80,80,01,01,03,03
11 473 DATA 7F,00,FC,FC,FF,FB,F0
,F0,FB,00,31,31,E3,E3,C7,C7
04 474 DATA FC,00,FB,FB,F0,F0,E0
,FF,FF,00,FB,FE,F0,F0,E0,FF
72 475 DATA E6,00,06,03,03,03,01
,01,1F,00,3F,3F,7E,7E,FC,FC
0E 476 DATA 67,00,0F,0F,1F,1F,3F
,3F,FF,00,C0,F0,80,80,01,F9
CB 477 DATA 3F,00,7E,7E,FC,FC,F8
,FF,01,00,03,03,07,07,0F,CF
AE 478 DATA FF,00,F0,F0,E1,E1,C2
,FE,C7,00,8F,8F,1F,1F,3F,3F
BA 479 DATA FF,00,C2,C2,84,FC,00
,00,0F,00,1F,1F,3F,3F,7E,7E
0E 480 DATA C1,00,87,9C,01,01,03
,03,F1,00,E3,C3,87,87,0F,0F
46 481 DATA FF,00,F0,FC,E0,E0,C0
,FE,C7,00,0F,0F,1F,1F,3F,3F
7C 482 DATA E0,00,F1,F1,9B,9B,0E
,0E,DF,00,C3,83,07,07,0F,0F
6E 483 DATA FF,00,F0,F0,E0,E0,C0
,C0,8F,00,1F,1F,00,00,00,7F
72 484 DATA FF,00,80,FF,3F,3F,7E
,FE,E0,00,00,80,00,00,00,7E
D4 485 DATA 00,00,00,00,00,00,00
,01,00,00,00,00,00,80,40
FF 486 DATA 00,00,00,00,00,00,00
,01,05,1A,20,C0,00,00,00,00
69 487 DATA 40,20,20,22,25,15,09
,01,C8,15,22,20,20,40,40,40
F3 488 DATA 80,00,00,00,00,00,00
,00,00,00,00,00,80,80,43,42
1C 489 DATA 00,00,00,82,62,32,1A
,AF,00,00,00,00,08,10,20,40
68 490 DATA 34,08,00,00,00,00,00
,00,57,0F,0F,17,27,42,82,02
B1 491 DATA 90,28,A5,4A,8A,CA,64
,30,02,00,00,00,00,00,00,00
DA 492 DATA 10,08,00,00,00,00,00
,00,00,00,00,00,00,00,00,01
0B 493 DATA 00,00,00,00,00,00,80
,40,02,82,64,18,00,00,00,00
CA 494 DATA 20,10,0C,02,01,00,00
,00,00,00,20,50,88,05,02,00
0F 495 DATA 00,00,00,C6,39,06,00
,00,93,1D,1D,1D,97,B0,C0,C0
E6 496 DATA C0,C0,C0,C0,C0,C0,C0
,C0,C0,C0,C0,C0,C0,C0,C0,C0
69 497 DATA C0,C0,C0,C0,C0,C0,C0
,C0,C0,C0,C0,C0,C0,C0,AE,0D
F0 498 DATA 1D,1D,1D,1D,20,20,46
,58,3D,45,44,54,47,52,20
23 499 DATA 51,55,49,43,48,20,52
,45,46,45,52,45,4E,43,45,20
44 500 DATA 43,41,52,44,20,97,DD
,0D,1D,1D,1D,97,AD,C0,C0,C0
69 501 DATA C0,C0,C0,C0,C0,C0,C0
,C0,C0,C0,C0,C0,C0,C0,C0,C0
C7 502 DATA C0,C0,C0,C0,C0,C0,C0
,C0,C0,C0,C0,C0,C0,80,0D,20
80 503 DATA 97,80,C0,C0,C0,C0,AE
,1D,1D,1D,1D,1D,1D,1D,1D,1D
1F 504 DATA 1D,1D,1D,1D,1D,1D,80
,C0;C0,C0,AE,0D,20,DD,1C,20
FC 505 DATA 45,31,20,97,DD,20,1E
,43,4F,50,59,52,49,47,48,54
55 506 DATA 2E,2E,1D,1D,97,DD,20
,1C,46,32,20,97,DD,20,1E,44
```

```
7E  507 DATA 49,52,45,43,54,4F,52
    ,59,2E,2E,0D,20,97,AD,C0,C0
DF  508 DATA C0,C0,BD,1D,1D,1D,1D
    ,1D,1D,1D,1D,1D,1D,1D,1D,1D
BD  509 DATA 1D,AD,C0,C0,C0,C0,C0,BD
    ,0D,20,97,B0,C0,C0,C0,C0,AE
A7  510 DATA 1D,1D,1D,1D,1D,1D,1D,1D
    ,1D,1D,1D,1D,1D,1D,B0,C0
CA  511 DATA C0,C0,C0,AE,0D,20,0D,DD
    ,1C,20,46,33,20,97,DD,20,1E
92  512 DATA 46,5B,20,54,4F,20,42
    ,41,4E,4B,2E,1D,1D,97,DD,20
6F  513 DATA 1C,4E,34,20,97,DD,20
    ,1E,4C,4F,41,44,20,44,41,54
25  514 DATA 41,2E,2E,0D,20,97,AD
    ,C0,C0,C0,C0,BD,1D,1D,1D,1D
6F  515 DATA 1D,1D,1D,1D,1D,1D,1D,1D
    ,1D,1D,1D,AD,C0,C0,C0,C0,BD
56  516 DATA 0D,20,97,B0,C0,C0,C0,C0
    ,C0,AE,1D,1D,1D,1D,1D,1D,1D
FF  517 DATA 1D,1D,1D,1D,1D,1D,1D,1D
    ,B0,C0,C0,C0,C0,AE,0D,20,0D
BA  518 DATA 1C,20,46,35,20,97,DD
    ,20,1E,42,41,4E,4B,20,54,4F
45  519 DATA 20,46,5B,2E,1D,1D,97
    ,DD,20,1C,46,3E,20,97,DD,20
A9  520 DATA 1E,53,41,56,45,20,46
    ,5B,27,53,2E,2E,0D,20,97,AD
AF  521 DATA C0,C0,C0,C0,BD,1D,1D
    ,1D,1D,1D,1D,1D,1D,1D,1D,1D
32  522 DATA 1D,1D,1D,AD,C0,C0,C0,C0
    ,C0,BD,0D,20,97,B0,C0,C0,C0
EF  523 DATA C0,AE,1D,1D,1D,1D,1D,1D
    ,1D,1D,1D,1D,1D,1D,1D,1D,1D
1F  524 DATA B0,C0,C0,C0,C0,AE,0D
    ,20,DD,1C,20,46,37,20,97,DD
DC  525 DATA 20,1E,53,41,56,45,20
    ,50,4C,41,59,45,52,1D,1D,97
1D  526 DATA DD,20,1C,46,3B,20,97
    ,DD,20,1E,53,41,56,45,20,42
BD  527 DATA 41,4E,4B,2E,2E,0D,20
    ,97,AD,C0,C0,C0,C0,BD,1D,1D
9B  528 DATA 1D,1D,1D,1D,1D,1D,1D,1D
    ,1D,1D,1D,1D,AD,C0,C0,C0,C0
FA  529 DATA C0,BD,0D,11,20,97,B0
    ,C0,C0,C0,C0,C0,AE,20,20,20
4C  530 DATA 20,20,20,20,20,20,20,20
    ,20,20,20,B0,C0,C0,C0,C0,C0
8B  531 DATA AE,0D,20,DD,2A,1C,5A
    ,2F,5B,20,97,DD,20,1E,20,2F
CB  532 DATA 2B,20,42,41,4E,4B,20
    ,20,20,20,97,DD,20,1C,2B,2F
D2  533 DATA 20,20,97,DD,2A,1E,2B
    ,2F,2D,20,45,4E,4B,45,43,54
A5  534 DATA 0D,20,97,AD,C0,C0,C0
    ,C0,C0,BD,20,20,20,20,20,20
26  535 DATA 20,20,20,20,20,20,20,20
    ,AD,C0,C0,C0,C0,C0,BD,0D,20
B6  536 DATA 97,B0,C0,C0,C0,AE,20
    ,20,20,20,20,20,20,20,20,20
99  537 DATA 20,20,20,20,20,20,B0,C0
    ,C0,C0,C0,AE,0D,20,0D,20
F5  538 DATA 1C,5F,97,20,0D,20,1E
    ,41,55,54,4F,20,4F,4E,2F,4F
4D  539 DATA 46,46,20,20,20,97,DD
    ,20,2C,52,45,54,20,97,DD,20
BD  540 DATA 1E,50,4C,41,59,20,45
    ,58,27,53,0D,20,97,AD,C0,C0
65  541 DATA C0,BD,20,20,20,20,20
    ,20,20,20,20,20,20,20,20,20
26  542 DATA 20,AD,C0,C0,C0,C0,C0,C0
    ,BD,0D,1D,1D,1D,1D,1D,1D,1D
48  543 DATA 1D,9F,50,52,45,53,53
    ,20,41,4E,59,20,4B,45,59,20
09  544 DATA 54,4F,20,52,45,54,55
    ,52,4E,FF,EA,EA,EA,EA,EA,FF
A3  545 DATA E0,00,80,20,00,80,20
    ,00,80,20,00,80,20,00,80,20
FA  546 DATA 00,80,20,00,80,20,00
    ,80,20,00,80,20,00,FF,E0,00
1A  547 DATA 00,00,00,00,00,00,00,00
    ,00,00,00,00,00,00,00,00,00
19  548 DATA 00,00,00,00,00,00,00,00
    ,00,00,00,00,00,00,00,00,00
08  549 DATA 00,00,55,55,55,AA,AA
    ,AA,FF,FF,FF,AA,AA,AA,55,55
0F  550 DATA 55,AA,AA,AA,FF,FF,FF
    ,00,00,00,00,00,00,00,00,00

1E  551 DATA 00,00,00,00,00,00,00
    ,00,00,00,00,00,00,00,00,00
1D  552 DATA 00,00,00,00,00,00,00
    ,00,00,00,00,00,00,00,00,00
```

C16 DISK MONITOR



PROGRAM: CHECK LOADER

```
10 DATA 0600
20 DATA A9,00,20,D2,FF,20,AD,FA,
A5,F2,F0,03,4C,92,F4,A5,F1,F0,02
,D0,02,A9,0CCD
30 DATA 03,85,AE,A9,00,20,BD,FF,
A9,00,85,AC,85,AD,20,C0,FF,A9,00
,20,C9,FF,0837
40 DATA B0,4E,20,AD,FA,20,5B,FB,
20,AD,FA,A0,00,A5,A1,85,D3,18,A5
,A2,65,D3,08D7
50 DATA 85,D3,20,96,CF,45,D3,85,
D3,C8,C0,50,F0,0D,18,20,96,CF,65
,D3,85,D3,0C4F
60 DATA C8,C0,50,D0,E7,20,FB,FA,
A5,D3,20,05,FB,18,A5,A1,69,50,90
,02,E6,A2,0C6D
70 DATA 85,A1,A5,A2,C5,F2,90,C1,
F0,02,B0,06,A5,A1,C5,F1,90,B7,20
,3E,90,A9,0CF7
80 DATA 00,20,C3,FF,20,CC,FF,4C,
95,F4,00,00,00,00,00,00,00,00,00
,00,00,00,05A2
90 DATA END
63000 READAD$:AD=DEC(AD$)
63010 DO:CK=0:FORX=0TO21:READM$:
IFM$="END"THENEXIT:ELSEM=DEC(M$)
:POKEAD+X,M:CK=CK+M
63020 NEXTX:READCH$:IFDEC(CH$)<>
CKTHENPRINT"ERROR IN";PEEK(63)+2
56*PEEK(64):GOTO63040
63030 AD=AD+22:LOOP:PRINT"OK....
":END
63040 PRINT"L  ";PEEK(63)+256*PEE
K(64)
63050 POKE239,4:POKE1319,145:POK
E1320,145:POKE1321,145:POKE1322,
13:END
```

C16 DISK MONITOR

PROGRAM: MONITOR M/C

```
01000 FA 0B 10 0A 00 9E 34 31 31 32 00 00 00 00 00 00
01010 4C 24 1D A9 00 2C A9 01 2C A9 02 2C A9 03 2C A9
01020 04 2C A9 05 8D 71 1C 20 5F 14 A9 00 8D BA 17 A9
01030 01 8D B9 17 20 27 13 20 CB 12 20 EA 12 20 C5 16
01040 A9 00 8D B9 17 20 99 13 4C 74 16 20 27 13 20 EA
01050 12 A2 0D 20 C6 FF A0 00 20 CF FF 99 00 3F C8 D0
01060 F7 20 99 13 4C 74 16 AD 00 3F F0 0C 8D DA 12 AD
01070 01 3F 8D D9 12 20 4B 10 4C 49 11 20 27 13 20 EA
01080 12 A2 0D 20 C9 FF A0 00 99 00 3F 20 D2 FF C8 D0
01090 F7 20 99 13 20 22 13 4C 74 16 20 5B FB A0 00 20
010A0 FB 23 B0 09 A5 F1 91 A1 C8 C0 08 90 F2 20 4F FF
010B0 1B 4F 91 00 20 3A FB A9 3E 20 D2 FF A5 A1 20 05
010C0 FB 20 A5 F5 A9 08 4C 96 FB 20 5B FB 20 FB 23 90
010D0 13 A5 A1 C9 F9 90 04 A9 F8 85 A1 85 F1 A5 A2 85
010E0 F2 4C F4 10 A0 3F 84 F8 A5 F1 C5 A1 90 E3 A5 A1
010F0 C9 F9 B0 DD 20 64 FB 4A 66 F1 4A 66 F1 4A 66 F1
01100 A9 00 85 F2 20 E1 FF F0 1A 20 3A FB A9 3E 20 D2
01110 FF A5 A1 20 05 FB 20 A5 F5 A9 08 20 96 FB 20 72
01120 FB B0 E1 60 28 5B 3E 4D 52 57 9A 10 C9 10 4B 10
01130 7B 10 00 00 20 CF 11 AD 33 11 8D DA 12 AD 32 11
01140 8D D9 12 4C 49 11 20 0B FB 20 6F 12 20 3A FB A2
01150 00 86 F3 20 CF FF 8D 00 02 E8 C9 0D D0 F5 CA 86
01160 F4 20 3F FB F0 E3 C9 20 F0 F7 C9 50 F0 0C A2 05
01170 DD 24 11 F0 0B CA 10 F8 30 CC 4C E6 35 E0 00 F0
01180 07 E0 00 D0 12 4C 67 10 AD 00 12 8D 33 11 AD D9
01190 12 8D 32 11 00 D9 1D CA CA BA 0A AB B9 28 11 00
011A0 56 B9 2A 11 85 55 E0 02 B0 0D 00 FB 23 A0 3F 84
011B0 F2 20 54 00 4C 00 11 20 FB 23 A5 F1 F0 88 8D DA
011C0 00 20 FB 23 A5 F1 8D D9 12 20 54 00 4C 49 11 20
011D0 8B D8 20 4F FF 43 55 52 52 45 4E 54 20 54 52 41
011E0 43 4B 20 26 20 53 45 43 54 01 00 20 31 32 20 30
011F0 30 0D 4E 45 58 54 20 54 52 41 43 4B 20 26 20 53
01200 45 43 54 00 52 20 20 20 20 31 32 20 30 31 0D 55
01210 4E 49 54 20 30 3B 20 20 44 52 49 56 45 20 30 30
01220 0D 1C 10 C0 FF C0 FF C0 FF 20 01 04 C0 C0 C0 00
01230 41 41 41 C0 C0 C0 C0 C0 C0 C0 C0 C0 C0 C0 C0 09
01240 C0 00 05 94 09 09 09 89 09 00 C0 F0 50 40 21 00
01250 90 41 00 41 21 11 81 11 21 41 41 41 11 46 05 60
01260 AD EB 07 C9 13 D0 05 06 00 00 00 00 00 02 08 02
01270 00 12 20 20 0F 0F 3F 8D FF 0C 8A 29 3F 8D 18 0C
01280 AD D9 12 20 20 FF FF FF FF 8D 1A 0C 8A 29 3F 8D 1B
01290 0C AD 00 3F 20 20 FB 29 3F 8D 3F 0C 8A 29 3F 8D
012A0 40 0C AD 01 3F 20 20 FB 29 3F 8D 42 0C 8A 29 3F
012B0 8D 43 0C AD DC 12 20 20 FB 29 3E 8D 55 0C 8A 8D
012C0 56 0C 29 3F AD DB 12 8D 60 0C 60 A9 01 2C A9 00
012D0 8D D9 12 A9 12 8D DA 12 60 00 00 30 08 55 31 3A
012E0 31 33 20 30 20 30 30 20 30 30 A9 31 8D DE 12 A2
012F0 0F 20 CF FF AD DA 12 20 77 13 8E E5 12 00 E6 12
01300 AD D9 12 20 77 13 8E E8 12 8D E9 12 AD DB 12 8D
01310 E3 12 A2 00 BD DD 12 20 D2 FF E8 E0 0D D0 F5 4C
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>01320 99 13 A9 32 4C EC 12 20 42 13 A9 0D A8 AE DC 12:
>01330 20 BA FF A9 01 A0 13 A2 74 20 BD FF 20 C0 FF 4C:
>01340 99 13 AD DB 12 8D 76 13 A9 0F A8 AE DC 12 20 BA:
>01350 FF A9 02 A0 13 A2 75 20 BD FF 20 C0 FF 4C 99 13:
>01360 A9 0F A8 AE DC 12 20 BA FF A9 00 20 BD FF 20 C0:
>01370 FF 4C 99 13 23 49 30 A0 30 C9 64 B0 0D A2 30 38:
>01380 E9 0A 90 03 E8 B0 F9 69 3A 60 E9 64 90 03 C8 B0:
>01390 F9 69 64 4C 7D 13 4C CC FF A9 0A A0 14 85 7A 84:
>013A0 7B 20 CC FF A2 0F 20 C6 FF B0 2B 20 04 CD AD 0A:
>013B0 14 C9 32 90 E1 20 74 16 20 E7 FF A0 14 A9 09 20:
>013C0 88 90 20 3A FB 20 DB 8A A9 00 8D B9 17 8D BA 17:
>013D0 20 90 16 4C D9 1D AA CA BA 48 20 CC FF 20 74 16:
>013E0 20 E7 FF 68 20 53 86 20 3A FB 20 0B FB A0 00 B1:
>013F0 24 48 29 7F 20 D2 FF C8 68 10 F4 20 4F FF 20 45:
>01400 52 52 4F 52 20 00 4C C2 13 0D 20 20 20 20 20 20:
>01410 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20:
>01420 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20:
>01430 20 20 00 42 2D 50 3A 31 33 20 30 30 30 20 77 13:
>01440 8C 3A 14 8E 3B 14 8D 3C 14 A2 0F 20 C9 FF A2 00:
>01450 BD 33 14 20 D2 FF E8 E0 0A D0 F5 20 CC FF 60 20:
>01460 4F FF 93 41 20 54 4F 20 41 42 4F 52 54 20 20 20:
>01470 20 20 20 20 20 20 20 20 20 20 44 20 46 4F 52 20:
>01480 41 20 44 49 52 45 43 54 4F 52 59 0D 20 20 20 20:
>01490 20 20 20 41 4E 59 20 4B 45 59 20 54 4F 20 43 4F:
>014A0 4E 54 49 4E 55 45 00 A9 00 8D 12 15 20 E4 FF D0:
>014B0 FB 20 E4 FF F0 FB C9 41 D0 03 68 68 60 C9 44 D0:
>014C0 06 20 AF 15 4C 5F 14 20 4F FF 0D 00 45 4E 54 45:
>014D0 52 20 46 49 4C 45 4E 41 4D 45 00 00 00 A2 00 20:
>014E0 CF FF C9 0D F0 08 9D 14 15 E8 E0 10 D0 F1 8E 13:
>014F0 15 CA BD 14 15 C9 2A D0 06 EE 12 15 4C 0E 15 E0:
>01500 0F F0 09 E8 A9 A0 9D 14 15 4C FF 14 A2 10 8E 13:
>01510 15 60 00 00 20 20 20 20 20 20 20 20 20 20 20 20:
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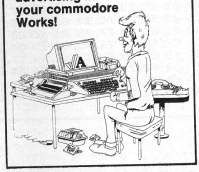

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If you have typed in one of our programs and despite much checking, you still can't get it to run, then send us the following:

Two copies of your program on tape or disk.
A description of your problem.
If possible a listing of your work (you may omit this).
A stamped, self-addressed envelope for return of the program to you.

Should any of the above be missing then we will not be able to deal with your query.

We will try to point out where you have made errors and place a corrected copy of the program back on to your tape or disk before we return it to you.

Do not send a program to us as soon as it stops working, please check it several times first.

We do get a large number of queries and so it may take a while for us to deal with yours personally.

Note: we can only deal with problems relating to programs published in *Your Commodore*.

Commodore Where Are You?

At the *Your Commodore* office we are repeatedly asked for the address and telephone number of Commodore U.K. Many people, after referring to their computer manuals, believe them to be based in Corby.

The Commodore plant at Corby was closed down some time ago. Reproduced here you will find the correct address for Commodore U.K.

We suggest that you write this correct address in the front of your computers manual for future reference.

Commodore Business Machine, (UK),
Commodore House,
The Switchback,
Gardner Road,
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Berks SL6 7XA.

Oops

Correction to Easy Basic Toolkit (June '88).
Saver Program:
The last data item in line 90 should be 144 NOT 137.
Tape users should type POKE40715,1 after running.
All users should then type SYS40704 to start the save.
Code program: The following lines were miss-printed,
Line 110 DATA 83, 84, 65, 82, 84, 44, 83, 84, 69, 80, 13, 13, 32, 32, 32, 32, 912
line 4340 DATA
32, 40, 186, 230, 253, 76,184,196,166,2,224, 4,208,11,32,59,1903
line 4430 DATA
166,20,32,205,189,169,52,160, 197,32,30,171,165,21,3,2,135,1776

At the *Your Commodore* office we receive hundreds of letters from readers every month. We do try and answer each individually but sometimes this is impossible due to pressure of work. If you have written to us and not received a personal reply, we apologise for this but we cannot promise to reply to every item of mail we receive. If you feel that your question or letter really needs an answer, then inclusion of an s.a.e. will guarantee a reply, although this may still take time to arrive.

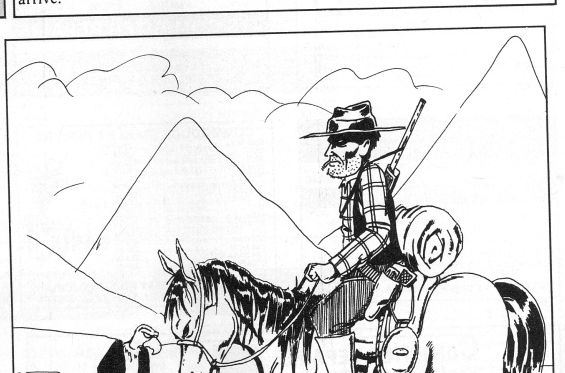
Two puzzles for you to try and solve this month, with a prize of a binder for each. You can enter for both by using the same envelope but please write your entries on a separate piece of paper. Normal *Your Commodore* rules apply. Good luck!
Closing day Sept 30th 1988.

A

A cowboy rode into the town of Dead Man's Gulch on Tuesday. There was only one hotel in the town and Fast Fingered Freddy booked himself for one night only. He left town on Thursday. How do you explain this apparently anomalous state of affairs?

B

A man stands on a tower that is 500 feet high. A few miles to the north is a tall mountain range. To the west is the sea and eastwards is an endless desert. Looking south, he can see a small town with a large forest beyond. What we want to know is, on a clear day, how far (in miles) can the man see?



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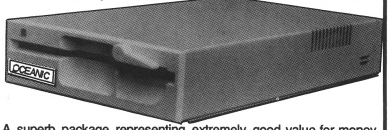

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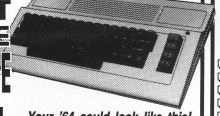

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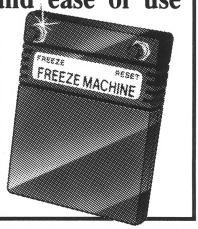

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