

Guitar Tuner

Christopher Visco



Need a pitch pipe to tune your guitar? Try using your computer instead. "Guitar Tuner" helps you tune your 6- or 12-string guitar to perfect concert pitch. The program was originally written for the TI-99/4A (either BASIC), and we've added versions for the Commodore 64, Plus/4, 16, Atari, and IBM PC/PCjr.

Now an accurately tuned guitar is just a few key-presses away. "Guitar Tuner" plays a tone for each string on your

6- or 12-string guitar, freeing your hands to adjust the tuning pegs by ear.

To tune a 6-string guitar, run the program and play the tones by pressing the corresponding letter keys: E for the low (bass) E string; A for the A string; D for the D string; G for the G string; B for the B string; and CTRL-E for the high E string. To tune a 12-string guitar, press the SHIFT (or SHIFT LOCK) key for the second set of strings. This raises the tones by one octave (except for the B and high E strings, which are tuned to the same octave, of course).

If you aren't too familiar with the sound capabilities of your computer, you can learn a lot by studying these simple programs. Notice the DATA numbers at the end of each program; these are the tone values for the sound statements. Some programs convert these numbers with a formula to produce the proper tones. All the tones were verified with a quartz guitar-tuning meter calibrated for standard concert pitch.

A Note About Notes

The accuracy of any note produced by a computer tone generator (or synthesizer) is measured in the number of bits of *frequency resolution*. The more bits, the better. (Don't confuse this with the number of bits handled by the computer's main microprocessor—a 16-bit computer might still have a sound chip with only 8-bit frequency resolution, or vice versa.)

For example, the standard pitch for a middle A note is defined by musicians as 440 hertz (cycles per second). Let's say a certain computer's sound chip is limited to 8-bit frequency resolution. The most accurate A note it could generate might be 437.8 hertz. That's close enough to 440 for some people, but it would sound slightly flat to those with a good sense of pitch.

The TI-99/4A, IBM PC, and PCjr have 12-bit frequency resolution (in fact, the TI and PCjr both use the same Texas Instruments sound chip). Twelve-bit resolution is about the minimum required for people with a good sense of pitch. The Commodore 64 has 16-bit frequency resolution, so it's even more accurate. Commodore's new Plus/4 and 16 have 10-bit resolution, which provides passable results. The VIC-20 has only 8-bit frequency resolution, so Guitar Tuner isn't practical on the VIC. The program is easy to write on the VIC, but the tones are too far out of tune for musicians.

Atari computers also have 8-bit frequency resolution (the slightly flat A note described above is produced by the Atari). However, the Atari version of Guitar Tuner takes advantage of a little-known feature that lets you combine two of the 8-bit tone generators to make one 16-bit generator. This improves the accuracy of an A note from 437.8 to 439.97 hertz—close enough for almost anybody. (For more information on this technique, see "Perfect Pitch," *COMPUTE!'s Second Book of Atari*.)

Program 1: TI Guitar Tuner

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```

100 DIM PITCH(12)
110 FOR T=0 TO 12
120 READ PITCH(T)
130 NEXT T
140 CALL CLEAR
150 CALL SCREEN(15)
160 PRINT TAB(10); "Guitar Tuner":
:
170 PRINT "Release the ALPHA-LOCK key.":
180 PRINT "Use the E/A/D/G/B/CTRL-E":
:
190 PRINT "keys for a six-string":
200 PRINT "guitar.":
210 PRINT "Depress the ALPHA-LOCK key":
220 PRINT "to tune the second set of":
:
230 PRINT "strings for a twelve-string":
240 PRINT "guitar.":
250 CALL KEY(0,K,S)
260 IF S=0 THEN 250
270 A$=CHR$(K)
280 A=- (A$="e")-2*(A$="a")-3*(A$="d")-4*(A$="g")-5*(A$="b")-6*(A$=CHR$(133))-7*(A$="E")-8*(A$="A")-9*(A$="D")-10*(A$="G")-11*(A$="B")
290 CALL SOUND(1500,PITCH(A),2)
300 GOTO 250
310 DATA 40000,165,220,294,392,494,659
320 DATA 330,440,588,784,494,659

```

Program 2: Commodore 64 Guitar Tuner

Version by Gregg Peele, Assistant Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```

8 DIMHI(12),LO(12),NO$(12) :rem 115
10 PRINT"{N}{CLR}{13 RIGHT}GUITAR TUNER":
FOR T=0 TO 300:NEXT :rem 55
15 PRINT"{HOME}{4 DOWN}{7 RIGHT}USE THE E/A/D/G/B/CTRL-E":
:rem 140
16 PRINT"{3 DOWN}{5 RIGHT}KEYS FOR A SIX-STRING GUITAR.":
:rem 82
17 PRINT"{3 DOWN}{6 RIGHT}DEPRESS THE SHIFT LOCK KEY":
:rem 161
18 PRINT"{3 DOWN}{7 RIGHT}TO TUNE THE SECOND SET OF":
:rem 53
19 PRINT"{3 DOWN}{2 RIGHT}STRINGS FOR A TWELVE-STRING GUITAR.":
:rem 207
20 S=54272:FOR T=0 TO 23:POKES+T,0:NEXT:POKES+24,12:POKES+5,17:POKES+6,243
:rem 94
70 FOR T=1 TO 11:READ HI,LO:HI(T)=HI:LO(T)=LO:NEXTT
:rem 32
80 GET A$:IF A$="" THEN 80 :rem 243
90 A=- (A$="E")-2*(A$="A")-3*(A$="D")-4*(A$="G")-5*(A$="B")-6*(A$=CHR$(5))
:rem 171
95 A=A-7*(A$="E")-8*(A$="A") :rem 62
97 A=A-9*(A$="D")-10*(A$="G")-11*(A$="B")

```

```

:rem 34
100 POKES,LO(A):POKES+1,HI(A) :rem 211
150 POKES+4,17:FORI=0 TO 2000:NEXTI:POKES+4,16 :rem 183
175 POKE198,0:GOTO80 :rem 165
200 DATA 10,143,14,24,18,209,25,30,31,165,42,62,21,31,28,49,37,162,50,60,31,165 :rem 20
5

```

Program 3: Atari Guitar Tuner

Version by Gregg Peele, Assistant Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```

AG 5 DIM A(14)
HG 10 GRAPHICS 2+16
FG 20 POSITION 3,5: ? #6:"guitar Tuner"
DO 30 FOR T=0 TO 3000:NEXT T
EJ 40 GRAPHICS 0:POKE 752,1
GM 50 POSITION 6,4: ? "Use the E/A/D/G/B/CONTROL-E"
GH 60 POSITION 6,7: ? "keys for a six-string guitar."
HN 70 POSITION 9,10: ? "Depress the shift key"
OE 80 POSITION 3,13: ? "to tune the second set of strings"
CB 90 POSITION 6,16: ? "for a twelve-string guitar."
EB 120 FOR T=0 TO 12
FC 130 READ TUNE:A(T)=TUNE:NEXT T
CP 135 B=PEEK(764)
JF 137 PNTR=1*(B=42)+2*(B=63)+3*(B=58)+4*(B=61)+5*(B=21)+6*(B=170)+7*(B=106)
HO 138 PNTR=PNTR+8*(B=127)+9*(B=122)+10*(B=125)+11*(B=85)+12*(B=234)
KF 139 IF PNTR=0 THEN 135
DN 141 P2=INT((1789790/(2*A(PNTR))-7)/256)
FE 142 P1=INT(1789790/(2*A(PNTR))-7-256*P2+0.5)
AN 143 POKE 53768,80:POKE 53760,P1:POKE 53762,P2:POKE 53763,(16*10)+10
GC 156 FOR I=1 TO 3000:NEXT I
NI 157 POKE 764,0:SOUND 0,0,0,0: SOUND 1,0,0,0
GM 163 GOTO 135
FP 170 DATA 0,165,220,294,392,494,659,330,440,588,784,494,659

```

Program 4: PC/PCjr Guitar Tuner

Version by Gregg Peele, Assistant Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```

LG 10 CLS:KEY OFF
AB 20 WIDTH 80:DIM PITCH(12):DEF SEG = 0:POKE 1047,0
JH 30 LOCATE 1,34:PRINT"Guitar Tuner"
EE 40 LOCATE 4,28:PRINT"Use the E/A/D/G/B/CTRL-E"
JF 50 LOCATE 7,26:PRINT "keys for a six-string guitar."

```



```

EN 60 LOCATE 10,28:PRINT"Depress the C
aps Lock key"
GE 70 LOCATE 13,28:PRINT"to tune the s
econd set of"
BN 80 LOCATE 16,24:PRINT"strings for a
twelve-string guitar."
GH 90 FOR T= 0 TO 12:READ PITCH:PITCH(
T)=PITCH:NEXT
PL 100 LOCATE 20,33:IF PEEK(1047) AND
64 THEN PRINT"CAPS LOCK ON "ELS
E PRINT"CAPS LOCK OFF"
BF 110 A$= INKEY$:IF A$=""THEN 100
MJ 120 A=-(A$="e")+2*-(A$="a")+3*-(A$=
"d")+4*-(A$="g")+5*-(A$="b")+6*
-(A$=CHR$(5))+7*-(A$="E")+8*-(A
$="A")+9*-(A$="D")+10*-(A$="G")
+11*-(A$="B")
GI 130 SOUND PITCH(A),20
BP 140 GOTO 110
CG 150 DATA -32767,165,220,294,392,494
,659
CI 160 DATA 330,440,588,784,494,659

```

Program 5: Commodore Plus/4 & 16 Guitar Tuner

Version by Gregg Peele, Assistant Programming Supervisor

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```

10 DIMNO(12)
20 PRINT"{N}{CLR}{13 RIGHT}GUITAR TUNER":

```

```

FOR T= 0 TO 300:NEXT
30 PRINT"{HOME}{4 DOWN}{7 RIGHT}USE THE E
/A/D/G/B/CTRL-E"
40 PRINT"{3 DOWN}{5 RIGHT}KEYS FOR A SIX-
STRING GUITAR."
50 PRINT"{3 DOWN}{6 RIGHT}DEPRESS THE SHI
FT LOCK KEY"
60 PRINT"{3 DOWN}{7 RIGHT}TO TUNE THE SEC
OND SET OF"
70 PRINT"{3 DOWN}{2 RIGHT}STRINGS FOR A T
WELVE-STRING GUITAR."
80 FOR T=0TO12:READ NO:NO(T)=NO:NEXTT
90 GET A$:IF A$=""THEN 90
100 A=-(A$="E")+2*-(A$="A")+3*-(A$="D")+4
*-(A$="G")+5*-(A$="B")+6*-(A$=CHR$(5)
)
110 A=A+7*-(A$="E")+8*-(A$="A")
120 A=A+9*-(A$="D")+10*-(A$="G")+11*-(A$=
"B")
130 IF A=0THEN 90
140 VOL 7:SOUND 1,NO(A),180
150 GOTO90
160 DATA 0,345,516,643,739,798,854,685,77
0,834,881,798,854

```

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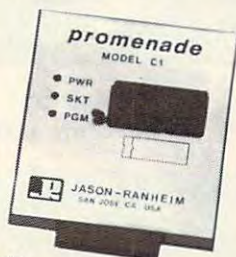
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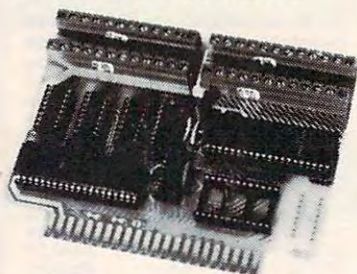
Sequential Circuits Music Sequencer For Commodore 64

Richard Mansfield, Senior Editor

Requirements: Commodore 64; cassette or disk drive recommended.

With your computer, the Sequential Circuits Sequencer package, and a music synthesizer, you've got more musical power at your fingertips than anyone would have believed possible even a few years ago.

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A synthesizer is something like an electric organ, except it's far more powerful. It's a computer that plays music. Through its keyboard, you can sometimes come amazingly close to the sounds of acoustic instruments. And because you are able to control all the elements of a sound, you can also create instruments that have never been heard before. It's a remarkably fertile environment and musicians are just beginning to tap its potential.

Why Buy An Organ?

Now that quality synthesizers are relatively inexpensive, more and more people are considering them as an alternative to the traditional home organ or piano. After all, why buy an organ when it will always—no matter what button you press—sound like an organ? A synthesizer has all those organ sounds, but also has a harpsichord sound that you cannot distinguish from the real thing, as well as dozens of other sounds which more or less duplicate traditional instruments.

When you've got a whole orchestra at your disposal, one of the first things you want to do is *orchestrate*. That's where a sequencer comes in.

Historically, very few people have had the talent or the luck to be able to experiment with orchestration: combining

various instruments into a musically pleasant arrangement.

Those days are over. On some synthesizers you can play a viola part, then listen to the viola playing back while you add a violin melody. Next, while listening to the viola and violin, you can lay down a harpsichord and later put in a flute or whatever. Instant chamber ensemble. You've become a one-man band.

There are two ways to layer the different sounds of a synthesizer: with a multitrack tape recorder (expensive), or with a sequencer (now inexpensive). A sequencer is like a digital tape recorder, except you've got more control than is possible with a tape recorder.

Laying Down Tracks

Here's how it works:

1. You tell the sequencer that you're about to lay down track 1.
2. You play the synthesizer keyboard, perhaps a bass guitar sound.
3. As you're playing, the sequencer is memorizing the volume, the voice, the speed, the rhythm, the individual notes, and even expression (how hard you pressed the keys, assuming your synthesizer has a velocity-sensitive keyboard).
4. You then instruct the sequencer to start playing track 1 while simultaneously recording track 2.
5. While listening to the bass line on track 1, you come in hard with a lead guitar.
6. Repeating this process, you can add up to six tracks with the Sequential Circuits Sequencer.

"The machine works in a trouble-free manner, and is really a pleasure to use."

Robert J. Burdett—Oak Park, Illinois

"I was so pleased with the ADAM that I took it to school and gave a presentation to the entire school body. When I was finished many of my peers were raving over the ADAM."

Michael DiJulio—Chicago, Illinois

"You have an excellent machine for the home user. Smart LOGO and Smart Filer are excellent...Smart Keys make it very easy to use the software, even before you read the instructions completely."

Wayne Motel—Dyer, Indiana

"Your keyboard is better than the Apple.*"

Donald Prohaska—San Diego, California

"I find the word processor and the basic programming language to be very user friendly."

Gordon R. Franke—Kirksville, Missouri

"I am more than pleased with the operation of the machine, and not having any experience with computers, I am happy that finally someone has produced a machine not only at a reasonable cost, but one that you can nearly sit down and start using without any training period."

Frederick A. Tripodi—New York, New York

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COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of COMPUTE!. Each issue contains much, much more than there's space here to list, but here are some highlights:

Home and Educational COMPUTING! (Summer 1981 and Fall 1981—count as one back issue): Exploring The Rainbow Machine, VIC As Super Calculator, Custom Characters On The VIC, Alternative Screens, Automatic VIC Line Numbers, Using The Joystick (Spacewar Game), Fast VIC Tape Locator, Window, VIC Memory Map.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032, A Fast Visible Memory Dump, Cassette Filing System, Getting To A Machine Language Program, Epidemic Simulation.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever Expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, Quadra PET: Multitasking?, Mapping Unknown Machine Language, RAM/ROM Memory, Keeping TABs on a Printer.

July 1981: Home Heating and Cooling, Animating Integer BASIC Lores Graphics, The Apple Hires Shape Writer, Adding a Voice Track to Atari Programs, Machine Language Atari Joystick Driver, Four Screen Utilities for the PET, Saving Machine Language Programs on PET Tape Headers, Commodore ROM Systems, Using TAB, SPC, And LEN.

August 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying, Adding A Programmable Sound Generator, Converting PET BASIC Programs To ASCII Files.

October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, and VIC; Budgeting on the Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train Your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

December 1981: Saving Fuel \$\$ (multiple computers), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Atari Word Processor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game, Replacing The INPUT # Command, Foreign Language Text on The Commodore Printer, File Recovery.

January 1982: Invest (multiple computers), Developing a Business Algorithm (multiple computers), Apple Addresses, Lowercase with Unmodified Apple, Cryptogram Game for Atari, Superfont: Design Special Character Sets on Atari, PET Repairs for the Amateur, Micromon for PET, Self-modifying Programs in PET BASIC, Tinymon: A VIC Monitor, VIC Color Tips, VIC Memory Map, ZAP: A VIC Game.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check,

Modifying Apple's Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artifacts, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC's 5000 Bytes.

August 1982: The New Wave Of Personal Computers, Household Budget Manager (multiple computers), Word Games (multiple computers), Color Computer Home Energy Monitor, A VIC Light Pen For Under \$10, Guess That Animal (multiple computers), PET/CBM Inner BASIC, VIC Communications, Keyprint Compendium, Animation With Atari, VIC Curiosities, Atari Substring Search, PET and VIC Electric Eraser.

September 1982: Apple and Atari and the Sounds of TRON, Commodore Automatic Disk Boot, VIC Joysticks, Three Atari GTIA Articles, Commodore Disk Fixes, The Apple PILOT Language, Sprites and Sound on the Commodore 64, Peripheral Vision Exerciser (multiple computers), Banish INPUT Statements (multiple computers), Charades (multiple computers), PET Pointer Sort, VIC Pause, Mapping Machine Language, Commodore User-defined Functions Defined, A VIC Bug.

January 1983: Sound Synthesis And The Personal Computer, Juggler And Thunderbird Games (multiple computers), Music And Sound Programs (multiple computers), Writing Transportable BASIC, Home Energy Calculator (multiple computers), All About Commodore WAIT, Supermon 64, Perfect Commodore INPUTs, VIC Sound Generator, Copy VIC Disk Files, Commodore 64 Architecture.

May 1983: The New Low-Cost Printer/Plotters, Jumping Jack (multiple computers), Deflector (multiple computers), VIC Kaleidoscope, Graphics on the Sinclair/Time,

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Bootmaker For VIC, PET and 64, VICSTATION: A "Paperless Office," The Atari Musician, Puzzle Generator (multiple computers), Instant 64 Art, 64 Odds And Ends, Versatile VIC Data Acquisition, POP For Commodore.

June 1983: How To Buy The Right Printer, The New, Low-Cost Printers, Astrostorm (multiple computers), The Hawkmen Of Dindrin (multiple computers), MusicMaster For The Commodore 64, Commodore Data Searcher, Atari Player/Missile Graphics Simplified, VIC Power Spirals, UnNEW For The VIC and 64, Atari Fast Shuffle, VIC Contractor, Commodore Supermon Q & A.

July 1983: Constructing The Ideal Computer Game, Techniques For Writing Your Own Adventure Game, SpeedSki And Time Bomb (VIC), Castle Quest And Roadblock (Atari), RATS! And Goblin (64), How To Create A Data Filing System (multiple computers), How To Back Up Disks For VIC And 64, Atari Artifacts, All About The Commodore USR Command, TI Mailing List.

August 1983: Weather Forecaster (multiple computers), First Math And Clues (multiple computers), Converting VIC And 64 Programs To PET, Atari Verify, Apple Bytechanger, VIC And 64 Escape Key, Banish Atari INPUT Statements, Mixing Graphics Modes On The 64, VICplot, VIC/64 Translations: Reading The Keyboard, Musical Atari Keyboard, VIC Display Messages.

September 1983: Games That Teach, Caves Of Ice, Diamond Drop, Mystery Spell, and Dots (multiple computers), VIC Pilot, Ultrasort (VIC, 64, PET), Easy Atari Page Flipping, Computer Aided Design On The TI, Relative Files On the VIC/64, Atari Fontbyter, TI

Sprite Editor, All About Interrupts (multiple computers), Cracking The 64 Kernal, Making Change On The Timex/Sinclair, Build Your Own Random File Manager (multiple computers).

October 1983: Computer Games By Phone, Coupon File (multiple computers), Dragon Master And Moving Maze (multiple computers), Merging Programs From Commodore Disks, Atari Master Disk Directory, Sprites In TI Extended BASIC, Commodore EXEC, Multicolor Atari Character Editor, High Speed Commodore Mazer, Apple Sounds, Extra Instructions (multiple computers), Commodore DOS Wedges, Invisible Disk Directory For VIC And 64.

February 1984: What Makes A Good Game, Circus (multiple computers), Quatrainment (multiple computers), Commodore 3-D Drawing Master (Apple version also included), Speedy BASIC For VIC And 64, Dr. Video 64.

March 1984: All About Adding Peripherals, Modern Memory: The Future Of Storage Devices, Roader (multiple computers), Barrier Battle (multiple computers), Programming The TI: File Processing, Sound Shaper (multiple computers), Commodore Floating Subroutines, Big Buffer For Atari.

April 1984: Apple's Macintosh Unveiled, Securities Analysis (multiple computers), Worm Of Bemer (multiple computers), Programming The TI: File Processing, Part 2, 1540/1541 Disk Housekeeping, Hidden Atari DOS Commands, Function Keys For The Apple, TI Tricks And Tips, Super Directory (multiple computers).

May 1984: The Digital Palette: Fundamentals Of Computer Graphics, The Inside Story: How Graphics

Tablets And Light Pens Work, Picture Perfect For Atari And Commodore 64, 64 Hi-Res Graphics Editor, Snertle (multiple computers), Pentominos: A Puzzle-Solving Program (multiple computers), A BASIC Cross-Reference (PET, 64).

June 1984: Choosing The Right Printer: The Easy Way To Hard Copy, Pests (multiple computers), Olympiad (multiple computers), Programming The TI: TI Graphics, MacroDOS For Atari, Part 1, Apple Variable Save, Programming 64 Sound, Part 1, Apple Input And Menu Screens.

July 1984: Evolutionary To The Core: The Apple IIc Heads For Home, The ABC's Of Data Bases, Statistics For Nonstatisticians (multiple computers), Bunny Hop (multiple computers), Blueberries (multiple computers), Atari Artist, Applesoft Lister, Program Conversion With Sinclair BASIC And TI BASIC, Commodore 64 ROM Generations.

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To make things even easier, the music industry has accomplished something that has thus far eluded the computer industry: a standardized interface. Called MIDI, it allows you to connect most synthesizers to each other, and allows them to communicate a great variety of musical information. It is through this interface that the sequencer controls one or more synthesizers.

If you use two synthesizers, you can record two voices simultaneously. Also, Sequential Circuits makes a synthesizer called the Six-Trak which can play different voices simultaneously when you add its *Sequencer Expansion Software* package.

Even by itself, the unexpanded sequencer has many attractive features. You can record and play back a musical line on one of the six tracks in the digital recorder. If your synthesizer

is polyphonic (can play more than one note at a time), the sequencer will memorize as many notes as you play. Many synthesizers, however, do limit you to playing a single voice, such as a trumpet, at one time.

The six layered tracks, memorized by the sequencer, can be individually edited. Tracks can be looped, erased, copied, or transposed to a new key. You can also change the tempo of your piece after it's recorded—without affecting the pitch.

The combined sound of all six tracks is called a *sequence*. Up to eight different sequences can be chained together to form a complete song, and sequences or songs can be saved on tape or disk.

A Special Autocorrection Feature

One of the most extraordinary features of this powerful music software is called Autocorrection. Any track or song can be automatically brought to greater

rhythmic accuracy. In practice, this means that if you're not always quite on the beat, you can have the computer adjust the rhythm to suit your tastes. What's more, you define the degree of accuracy: anything from a quarter note to a thirty-second triplet degree of resolution. That way you can decide how much correction to apply. If things are too perfectly timed, the music can begin to sound mechanical and cold. If they're too loose, it sounds amateurish, untalented.

If you've ever wanted to try composing music, conducting an orchestra, or running a recording studio, the Sequential Circuits Sequencer, a synthesizer, and your Commodore 64 will now give you the essential tools. You'll probably be surprised at the quality of the music you can invent with a little help from these friends.

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Sunburst Educational Software

Glenn M. Kleiman and Susan Keyes

Requirements: Atari, Apple II series, Commodore 64, IBM PC/PCjr, TRS-80 Color Computer, or TRS-80 Models I/III/4. Not all the programs reviewed are available for all computers; see notes at end of review for specific system requirements. The versions reviewed here were for the Atari, but all versions are similar.

Educators are finding the search for classroom software to be time-consuming, difficult, and frustrating. There are hundreds of packages available, and publishers are expending a great deal of effort marketing them to schools. Yet teachers tell us that

most of the software they see does not meet their needs.

Teachers are looking for high-quality software—software that is easy to use, holds students' interest, and helps students learn. They need software that fits into the curriculum and also expands upon what can be done with books, slides, and films. They want programs that make good use of the flexibility and interactivity of computers.

Most schools have a very limited number of computers. Teachers therefore need programs that each child can use for a short time, or that groups of children can use together.

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Since each classroom contains children with a variety of interests and abilities, teachers also need programs with several levels so students do not become frustrated with tasks that are too difficult, or bored with tasks that are too easy.

Teachers want supporting print materials that provide students with the background information necessary to make good use of their time on the computer. They also want materials that help them relate the computer program to other lessons and activities. In addition, they need reasonably priced software packages that contain a backup copy of the disk.

When we ask teachers where they find software that meets these requirements, one company, Sunburst Communications, is mentioned more than any other. Sunburst's software packages contain well-designed programs that address curriculum objectives and provide enjoyable, worthwhile activities for students. They also contain supporting print materials for both teachers and students.

Here we'll review four products that are good examples of the quality and diversity of Sunburst products. *SemCalc* is a math program, *M-ss-ng L-nks* is a language arts program, and *The Factory* and *The Incredible Laboratory* are logic/problem-solving programs.

Sunburst software is available in both classroom and home versions. Aside from packaging, the only differences are that classroom versions cost more (\$55 to \$95) and include a thorough teacher's guide, a backup disk, and a lifetime warranty. Home versions come with a smaller parent's guide and a 90-day warranty and retail for \$39.95. However, *SemCalc* is not available in a home version, and the only edition of *M-ss-ng L-nks* for home use is "Young People's Literature."

SemCalc

SemCalc, which is short for Semantic Calculator, was developed by Judah Schwartz. This program helps students analyze arithmetic story problems into their critical components. The program provides the student with an onscreen "pad" to record the elements of a problem, line by line, in terms of quantity ("How many?") and kind ("Of what?"). When the student tries to add different kinds of things (for example, apples and oranges), the program responds: "Can apples be converted to oranges—or can oranges be converted to apples?" When, as in this case, the answer is no, the program asks: "Apples and oranges are both what?" The student then supplies an appropriate category. In cases where one term can be converted into the other, as with hours and minutes, the student supplies the appropriate formula for making the conversion. Similar prompts and aids are provided for multiplication and division problems.

SemCalc was designed to help students determine solutions, not simply to provide correct answers. For example, if the student enters "pollywogs" as the common category for apples and oranges, the program will indicate that 7 apples plus 8 oranges equals 15 pollywogs. If the student indicates that there are 60 hours in a minute, the program will multiply the number of minutes by 60, add this quantity to the hours, and indicate the sum as the correct answer in hours. Thus it is up to the student to specify, and therefore understand, the correct relationships among the elements of a problem.

SemCalc comes with a tutorial on disk that, though somewhat repetitive, clearly describes how to use the program, and guides the student through some sample problems. The tu-

torial also illustrates that the program itself cannot "think," but merely responds faithfully to student input regardless of its factual accuracy. It is a valuable reminder for adults as well as children that the quality of the output is dependent on the quality of the input.

SemCalc is an interesting, useful, and unusual product. Given the difficulty many children have in extracting and organizing relevant data from story problems, it can serve as a useful tool in a variety of classroom applications.

M-ss-ng L-nks

M-ss-ng L-nks is a language arts program designed by Carol Chomsky and Judah Schwartz. It provides a series of puzzles in which the student fills in blanks to complete words in a passage. By solving these puzzles, the student develops reading and vocabulary skills while discovering patterns in the structure of language. This program is modeled on the "cloze procedure" used by many reading teachers and some standardized reading tests.

M-ss-ng L-nks is based on excerpts from written materials and comes in several editions: "Young People's Literature," "Classics, Old and New," and "MicroEncyclopedia." We reviewed the "Young People's Literature" program, which provides a selection of nine passages from each of nine books. Included are such favorites as *The Wind in the Willows*, *Charlie and the Chocolate Factory*, and *The Lion, the Witch, and the Wardrobe*. A separate editor program is available for teachers, parents, or children who want to create their own texts and puzzles.

When using *M-ss-ng L-nks*, students first select a passage. Then they select one of the nine available puzzle formats. These range from a format with all the vowels deleted to a format with

no clues at all. The options are displayed in a cleverly designed menu, in which the first five choices are shown as:

- A. Wh-ch f-rm-t d- y-- w-nt?
- B. W-i-h -o-m-t -o -o- w-n-?
- C. W---- f----- d- y-- w---?
- D. Which ----- do --- want?
- E. --i-- -o--a- -o -ou -a--?

M-ss-ng L-nks can be used by one or two children. The players can set limits on the number of guesses allowed for each letter (from 1 to 5) and, for the two-player mode, the number of guesses per turn (from 3 to 15).

We played *M-ss-ng L-nks* with several different passages and a variety of formats. We were pleased to discover how engaging the activity is and how much knowledge about the structure of the English language and spelling is brought to bear while completing the passages. *M-ss-ng L-nks* can provide many hours of enjoyable, worthwhile activity.

The Factory

The Factory, designed by Marge Kosel and Mike Fish, is one of Sunburst's most popular problem-solving programs. Within this program, factories can be created, using machines that perform three types of operations upon a square object: Punch, Rotate, and Stripe. Punch machines can be set to make one, two, or three round or square punches. Rotate machines can turn the object 45, 90, 135, or 180 degrees. Stripe machines can draw thin, medium, or thick lines. Each machine is represented by a well-designed computer illustration.

A factory can have up to eight machines in any sequence. When a factory makes an object, the computer shows a square moving through each machine in turn, as if it were on an invisible conveyor belt. Clever animation shows each machine

operating on the square, thereby providing a clear picture of what is happening during each step of the process.

For example, a factory could consist of a Stripe machine, a Rotate machine set for 90 degrees, and a second Stripe machine. When this factory makes an object, first it draws a stripe, then rotates the object 90 degrees, and then draws a second stripe. When the process is completed, the finished object is displayed. The object produced by this example factory would have two stripes drawn at right angles to each other.

During the first segment of the program, "Test A Machine," students select machines one by one to see what effect each produces using each of the available options. In the second section, "Build A Factory," students make their own factories to create novel products.

In the third section, "Make A Product," students are assigned target products and asked to reproduce them by assembling appropriate sets of machines. The need to understand the effects of rotations—both the correct angle of rotation and the correct timing of a rotation—can make for very challenging problems. In fact, this aspect of the program makes *The Factory* one of the best exercises in spatial reasoning that we have seen.

The Factory is well designed and very easy to use. It provides good problem-solving practice for students working individually or in small groups, and it can be used within the time limits of typical classroom situations. However, if students have time to really explore the program, they are likely to want machines that can do more things, such as a Punch machine that lets them position the hole or a Stripe machine that lets them select the color of each stripe. The addition of such

options would create more diversity and add greater depth to the program.

The Factory provides a rich set of problem-solving activities. Students gain experience making deductions, sequencing operations, and discovering multiple solutions to a common goal. More than that, the program is fun. It will make a welcome addition to any school software library.

The Incredible Laboratory

The Incredible Laboratory, designed by Marge Kosel and Jay Carlson, is a problem-solving program in much the same spirit as *The Factory*. This program contains three levels: Novice, Apprentice, and Scientist. All levels include both a Play and a Challenge mode.

The Novice level illustrates the basic play activity. It presents a list of six chemicals. The student's task is to determine which chemical controls each of the six components of a monster: head, eyes, body, arms, legs, and feet. Students select chemicals to form a Monster, and then watch as the creature is slowly distilled from a large beaker. The resulting monsters have wonderfully funny and horrible features. Students repeatedly create monsters, systematically varying the chemical combinations until they determine the effect of each chemical.

At the Apprentice and Scientist levels, more chemicals are available, and students can explore how various combinations of chemicals interact.

When the chemicals and their effects are understood, the student can select the Challenge mode and, along with another player, create a chemical brew. The two players must then try to recognize the monster they have jointly created from three potential Monster candidates.

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After the players place their votes, the real Monster is identified as the imposters melt away.

In both the Novice and Apprentice levels, chemicals always produce the same results. At the Scientist level, however, chemicals produce different effects each time that level is selected. The chemical that once produced a Frankenstein-like head may now yield furry legs, or arms with claws, or evil eyes.

The Incredible Laboratory offers delightful graphic effects with a captivating set of problem-solving tasks. However, several aspects of the program can be confusing. For example, when a chemical is left out of the Monster mix, the body part it controls is randomly supplied by the program. The program may randomly substitute the exact body part that the missing chemical would have supplied. This makes the relationship between chemicals and outcomes more obscure than it need be.

We also found the Scientist section frustrating. Though we took careful notes on the effects of each chemical during the Play mode, and then verified our observations before choosing the Challenge mode, we

could never accurately predict the results of our challenge monsters. With no way to return to the Play mode, we could never refine our hypotheses or verify where the error lay—in our powers of observation or in the program. While there are several improvements we would like to see, *The Incredible Laboratory* does provide exercises that stretch the mind and results that delight the eye.

Our overall reaction to the Sunburst software we reviewed is very positive. The software packages are well-suited to classroom use and meet the criteria teachers have given for good classroom software. The programs are attractive and the activities they present are worthwhile and enjoyable.

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Modifications Or Corrections To Previous Articles

TI Disassembler

This machine language deciphering aid from the October 1984 issue (p. 159) has a number of shortcomings. First, the article incorrectly stated that the program could easily be translated to standard BASIC. Unfortunately, TI's built-in BASIC lacks the AND operator used throughout the program. The program also fails to properly decode backward jumps and some Format III opcodes, and has several other minor bugs. To correct these problems, the following lines need to be changed as indicated:

```
440 N=(H AND 11)*256 :: J=1792 :: C
    O=(L AND 240)/16 :: WR=(L AND 1
    5):: RESTORE 1040 :: Z=4 :: K=2
    56 :: GOSUB 900
485 IF L>127 THEN L=L-256
680 GOTO 630
700 RESTORE 1080 :: J=12288 :: N=(H
    AND 240)*256 :: Z=12 :: K=4096
    :: GOSUB 900
740 IF TD=12 THEN C$=",*R"&STR$(D)&
    "+" :: GOTO 770
750 IF (TD=8)AND(D=0)THEN C$=","&"@
    "&STR$(01*256+02):: A=A+2 :: IF
    TS=32 THEN C$=","&"@"&STR$(03*
    256+04)
```

Thanks to Glenn Davis, Henry Satinskas, and others who ferreted out these errors.

Spiders For IBM PC And PCjr

Some punctuation characters were garbled in printing the listing for Program 7 (p. 98) of this game from the November 1984 issue. In line 170, there should be a colon—not a period—between LOCATE 25,1 and PRINT. In line 330, the character between AX\$(Y) and CHR\$(BX) should be a comma.

TI Reflection

Line 1600 in Program 5 (p. 76) of this game from the November issue is too long to be entered in standard TI BASIC, although it can be entered if you're using Extended BASIC. To use the program with the built-in BASIC, split the line into two parts, as shown below (be sure to include the semicolon at the end of line 1600):

```
1600 PRINT A$,B$,B$,A$&" 'S",B$,B$
    &" UP",A$,B$,B$,A$,B$,B$,A$&"
    SUM",B$,B$&" X:",A$,B$,B$,A$,B
    $&" "&CHR$(128);
1605 PRINT ":",B$,A$,B$,C$;
```

64 Horse Racing

The correction listed in last month's CAPUTE! for the VIC version of "Horse Racing" actually applies to the Commodore 64 version. There are no corrections for the VIC version. ©

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THE BEGINNER'S PAGE

Tom R. Halfhill, Editor

Which Computer Language Is Best?

Most of us have heard the Biblical story about the Tower of Babel—how God made mankind speak in hundreds of different languages for daring to build a tower to heaven.

In the computer age we seem to suffer from a similar problem. We're burdened with scores of different computer programming languages. And like human languages, they're all largely incompatible with each other.

There are, however, definite reasons why we have so many human languages and computer languages. Both were invented because of the need to communicate ideas. The first language for a modern electronic computer was invented in the 1950s for a specific purpose—to make it easier for people to program computers. Today there are scores of different languages and dialects within languages.

Why, then, if computer languages are conscious inventions all conceived for the same reason, do we have so many of them? Why does one language use the word PRINT to put messages on the screen while another uses TYPE? Why weren't words and definitions standardized from the very beginning to eliminate confusion?

A Language For Every Purpose

One answer is that it's no more realistic to expect a single programming language to be suitable for all possible tasks than it is to expect one type of computer to be ideal for every possible application. Another answer is that those who write languages all have their own ideas about how computers should be programmed (or, depending on your point of view, how humans should be programmed to work with computers). In addition, some languages are hard to implement on certain types of computers, especially home computers with relatively small amounts of memory.

That leaves it up to us to sort out the confusion and decide which language to use to get the job done. Generally there are three things to consider: the suitability of the language to the task; the ease of learning and using the language; and the availability of the language on the computer

we want to use.

Here's a summary of the most popular languages available today for home and personal computers:

- **BASIC** (*Beginner's All-purpose Symbolic Instruction Code*). Invented in the early 1960s at Dartmouth College, BASIC was originally designed as a very simple language that beginners could pick up and use with only a few hours of study. Since then, there have been so many extensions and spin-off dialects that BASIC is used to program everything from videogames to powerful business applications. As a result, some people criticize BASIC as a messy, unstructured hodgepodge of commands. Others find it simple, effective, and versatile. Because BASIC has been built into nearly all microcomputers for years, it's by far the dominant language in personal computing. That doesn't seem likely to change in the near future.

- **Logo**. Designed in the 1970s especially for children, Logo is found primarily on home computers and includes *turtle graphics*, a simplified system for drawing pictures on a video screen. You control a small cursor, the turtle, which can be rotated and moved in different directions while leaving behind a colored trail. Series of commands can be grouped into procedures and executed repeatedly to create geometric patterns. Logo also helps teach logical thinking and organization.

- **PILOT** (*Programmed Instruction, Learning, Or Teaching*). This language resembles Logo and usually includes turtle graphics. It also has flexible word-matching commands that make it easier to write educational programs which ask questions and evaluate answers.

- **Pascal** (*named after Blaise Pascal, the seventeenth-century French mathematician*). Invented in the 1970s partly as a reaction to the perceived weaknesses of BASIC, Pascal is known as a *structured* language and is widely used to teach programming at the college level. Programs written in Pascal usually have a modular, organized construction. Although Pascal doesn't



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necessarily force this structure on the programmer, it strongly encourages it.

• *Forth* (so-named because it was conceived as a "fourth-generation" language). *Forth* is an unusual language, known for its speed of execution, flexibility, and reverse Polish notation arithmetic. It's used for many scientific applications, especially in astronomy, and has a vocal following among microcomputer hobbyists. *Forth* is one of the few languages that can be readily extended by the programmer. It lets you define your own commands by linking together a series of simpler commands. This new command, in turn, can be used to build commands which are even more powerful.

BASIC: Bread And Butter

For most personal computer programming, BASIC is the first choice. Not necessarily because it's the best language—BASIC certainly has its share of shortcomings. However, it does satisfy the three considerations mentioned above: It's a true general-purpose language which can do a lot of things adequately; it's fairly easy to learn and use; and, perhaps most important, it's widely available. Chances are BASIC is built right into your computer as a standard feature. If not, it's available separately at minimum cost.

BASIC runs on practically every computer because it doesn't require lots of memory. That's partly why it was the first language of its type adapted to microcomputers, back in the days when 4K of RAM was considered luxurious. Even the old Sinclair ZX-81, which came with only 1K of RAM, had a fairly powerful built-in BASIC. What's more, BASIC usually doesn't require you to buy a disk drive or other expensive peripherals. Nearly all BASICs can work with tape storage.

BASIC has other things going for it, too. The vast majority of program listings published in computer magazines and books are in BASIC. It's not that authors don't submit programs written in other languages. It's just that BASIC is the only language which editors can be sure their readers own. Publishing a program in a language like Pascal or *Forth* renders it useless to 90 percent of the readership. Unavoidably, of course, this policy solidifies BASIC's position and perpetuates its dominance.

BASIC also comes in many flavors. If the BASIC that came with your computer isn't powerful or flexible enough for your purposes, you can probably buy an *extended* or *enhanced* BASIC. For instance, the BASIC built into the Commodore 64 lacks commands to take advantage of the computer's excellent sound and graphics capabilities. If you want to easily write a program using sound and graphics, you can plug

in a *Simons' BASIC* cartridge and gain 114 more commands. Similarly, trade-offs made by the designers of Atari BASIC omitted certain features (such as string arrays) which are considered standard in the more common Microsoft BASICs. If this matters, you can buy an extended Microsoft BASIC on cartridge or disk.

Despite all the criticisms leveled at BASIC, for the foreseeable future it's here to stay.

When To Switch

All these reasons don't mean you're pinned down to BASIC by any means. Here are some situations when you might want to make your computer bilingual:

—You're writing a program that simply demands more power, speed, or flexibility than BASIC can deliver.

—You're writing programs only for yourself that won't be shared with other people or submitted to general-interest publications.

—You've run across a program so useful that it's worth your while to buy the language you need to run it.

—You'd like to introduce youngsters to computer programming without bogging them down in the picky details of BASIC.

—You're learning another language at school or work and want to practice writing programs at home with your own computer.

—You want to explore alternatives to BASIC just out of curiosity.

Second languages are available for most computers on cassettes, disks, and cartridges. Cartridges are handiest because you don't have to wait around for a long program (the language) to load—you just plug it in and switch on the computer. Cartridges are also sturdy and generally don't require a disk drive. But because the memory capacity of a cartridge is severely limited (usually no more than 16K), many languages won't fit in a cartridge and are available only on disk.

If you already know one computer language, such as BASIC, you'll find that it's easier to learn a second language—certainly much easier than learning to speak and read a second human language. Human languages have vocabularies of tens of thousands of words, and the rules of syntax are often vague and conflicting. But most computer languages have a total vocabulary of only 50 to 100 words, and the rules for using them are carefully defined. The computer even tells you when you make a mistake. Plus, the fundamental knowledge you gain by learning your first language lets you adjust fairly quickly to the rules of the new language.

The Computer's Native Tongue

You may have noticed one popular computer language missing from the list above: *assembly language* or *machine language* (for now we'll use both terms synonymously).

We deliberately omitted machine language because it isn't quite a language in the same sense as BASIC, Logo, or Pascal. True, machine language is a method of encoding your ideas so that the computer can understand and act on them. In that sense it *is* a language. But with machine language, you're dealing with the computer on a much more intimate level. You're speaking in its native tongue.

The fact is, languages such as BASIC—known as *high-level languages*—were invented for people, not for computers. They were designed for convenience, so people wouldn't have to program computers in machine language. Why? Because machine language programming can be more exacting. Sometimes it takes a dozen or more commands in machine language to do something as simple as display a message on the screen. You might accomplish the same thing in a high-level language with a single command such as PRINT.

But it's important to realize that the computer doesn't understand BASIC or any other high-level language any more than it knows English. A high-level language is really a sophisticated program which itself is written in machine language. When you use a command such as PRINT, the BASIC language translates the command into the proper sequence of machine language commands. In this form, the computer can carry them out.

Despite the extra steps required when programming directly in machine language, it's still very popular. That's because the translation process required by a high-level language takes time, and some programs demand all the speed and power that the computer can deliver. A program written in machine language bypasses this translation step and runs much faster. Sometimes it's the only way to get the job done. However, as technology advances and computers get faster and faster, it's likely that fewer programs will be written directly in machine language.

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Questions Beginners Ask

Q I've seen specifications for computers that talk about graphics modes with 320×200 pixels, 640×200 pixels, etc. But what's a pixel?

A *Pixels* (an abbreviation for *picture elements*) are the tiny dots on the screen that make up the image. If you look very closely at your computer monitor you can see the dots, although they may be too blurred to see clearly on an ordinary color TV.

All video images are composed of pixels, including regular broadcast video pictures. However, there's no standard size for pixels. They can be large or small. Size is important because the smaller the pixel, the more will fit on the screen, and therefore the more detailed the image will be.

For example, a graphics mode of 320×200 pixels means the computer can display 320 pixels horizontally and 200 pixels vertically. That's a total of 64,000 pixels. If the computer has a 640×200 graphics mode, it can display 128,000 pixels. With twice as many screen dots to work with, the picture can be twice as detailed. In video terms, the more pixels, the greater the *resolution*.

It might seem that creating superdetailed computer images would be as easy as displaying more pixels. But there are several technical obstacles to overcome.

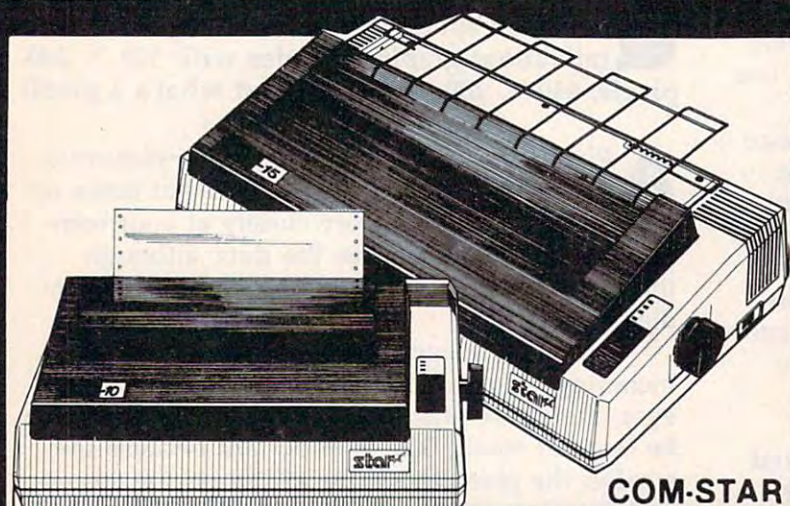
To begin with, the information which defines how each pixel will appear on the screen must be stored in the computer's memory. The computer must know where each pixel will be placed and what color it will be. The more pixels and colors you want to display, the more memory you need. For example, the IBM PCjr has a graphics mode of 640×200 pixels with four colors (SCREEN 6 in Cartridge BASIC). It requires 32K of RAM just to store all this information. A 640×200 mode with eight colors would require 64K, and a 640×200 mode with 16 colors would eat up 128K.

A related problem is computer speed. The more memory it takes to define how the screen will look, the more time it takes the computer to access that memory. An extremely high-resolution screen could bog down the computer so much that it would run programs noticeably slower. (In fact, to reduce this problem, many computers have separate microprocessors just to control the screen display.)

Finally, there's a limit to how sharply a TV set can resolve a pixel. Computers can be designed to work with special monitors (such as the Apple Macintosh), but home computers must be compatible with ordinary TV sets to reach the mass market.

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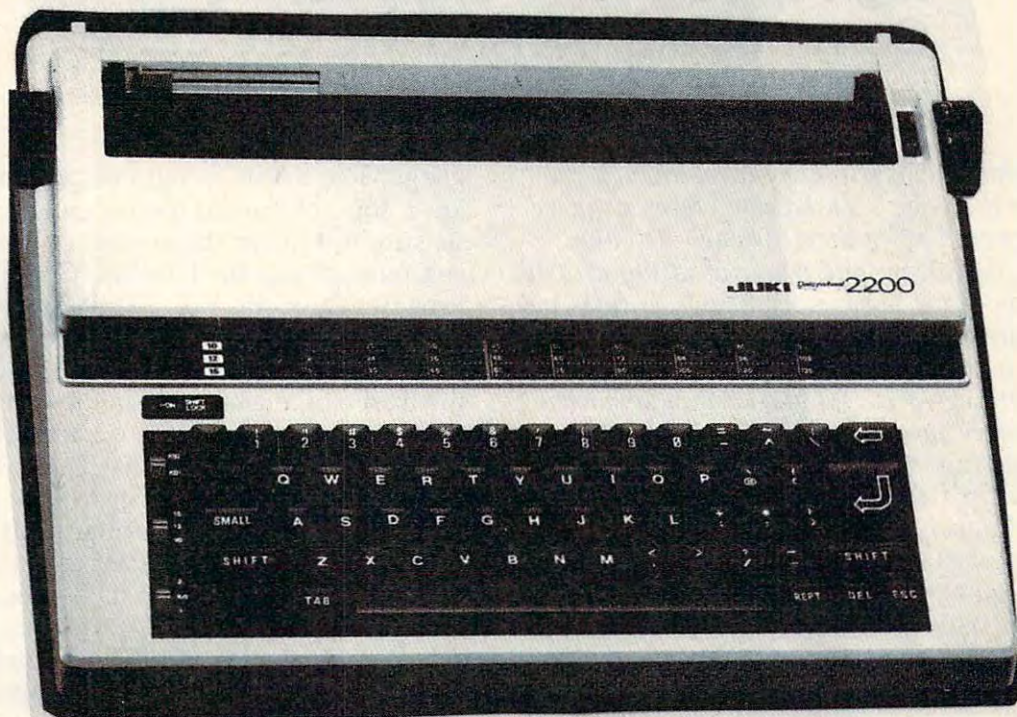
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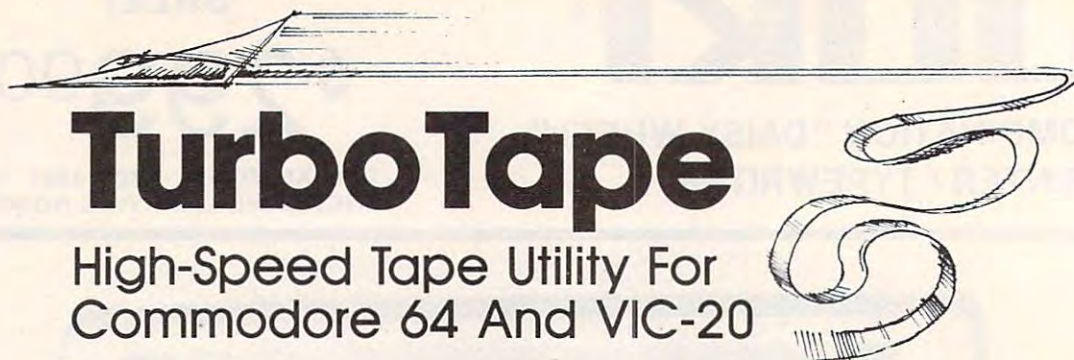
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TurboTape

High-Speed Tape Utility For Commodore 64 And VIC-20

Harrie De Ceukelaire

COMPUTE! has published many breakthrough programs over the years. "TurboTape" takes its place among the very best of them. Though it sounds impossible, this clever and powerful utility actually allows a tape drive to save, load, and verify as fast as a disk drive! You simply type TSAVE instead of SAVE and your computer stores any program on tape at lightning speed. What's even more amazing, any Turbosaved program can be loaded without the special TurboTape utility in the computer. Even after you've used TurboTape for weeks, you'll still find it hard to believe that your cassettes can save and load this fast. It works on any Commodore 64 or VIC-20. (At least 8K memory expansion is required to enter the program into the VIC.)

There are very few absolute rules in computing, but one of them has always been that tape drives are inherently slower than disk drives. Long programs that take only seconds to load into the computer with a disk drive have always required many minutes of waiting with a tape drive.

Until now.

"TurboTape" rewrites the rules. It's a utility program that turbocharges tape saving, loading, and verifying on your Commodore 64 or VIC-20. It requires no modifications to your computer or tape drive. It works with BASIC programs and machine language programs. It's easy enough for anyone to use, including beginners. It even lets you load Turbosaved tapes at TurboTape speeds without using the utility. And it's yours for the typing after reading these instructions. (Next month we'll publish the technical details explaining how TurboTape seizes control of the computer and makes it perform these startling tricks.)

If you're still as skeptical as we were, try TurboTape. Try the speed tests mentioned at the end of this article. You'll find that TurboTape is everything it claims to be.

Typing TurboTape

TurboTape is written entirely in machine lan-

guage. The BASIC programs presented here create a copy of TurboTape on either disk or tape. Be sure to type in the correct program for your computer (Program 1 for the Commodore 64 or Program 2 for the VIC-20). We recommend that you enter the program with "The Automatic Proof-reader" found elsewhere in this issue and save the TurboTape generator before running it for the first time, since the program resets important memory pointers as it runs. That way, if a typing error causes your computer to lock up, you can reset the computer by turning it off then on again, and start checking for the typo.

Since the TurboTape data goes into the area of memory where BASIC programs normally reside, you'll need to reconfigure memory before loading and running the TurboTape generator programs. For the 64, type:

```
POKE 44,14:POKE 14*256,0:NEW
```

Then hit RETURN and load Program 1.

To use Program 2 on the VIC, you'll need at least 8K of memory expansion. Before loading the program, enter the following lines in direct mode (no line number), hitting RETURN after each line:

```
POKE 44,32:POKE 32*256,0:NEW  
POKE 648,30:SYS 58648
```

Before running, check line 10. In both Programs 1 and 2, the contents of F1\$ determines the name of the copy of TurboTape that will be created. Change this if you prefer a different name. Also, if you want to create your copy of TurboTape on disk instead of tape, change the D=1 in that line to D=8. Be sure that the tape or disk on which you wish TurboTape to be stored is in the drive before you run the generator program.

Once you have used the generator program to create a copy of TurboTape on tape or disk, you do not need the generator program again. The version of TurboTape you create (called

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TURBO/64 or TURBO/VIC, unless you change the names in line 10 of the generator programs) can be loaded and run like a BASIC program. It is not necessary to use the ,1 suffix (as in LOAD "filename",8,1 or ,1,1) when loading TurboTape. Once created, VIC TurboTape can be loaded and run on a VIC with any memory configuration.

Easy To Use

Here are the main features of TurboTape:

- It will store itself safely out of the way of your normal BASIC programs.
- It protects any memory configurations you might be using. Only during the Turbosaving and Turboverifying is the Commodore 64's BASIC ROM exchanged for BASIC RAM. Following these operations, your previous configuration is restored.
- TurboTape can be used with other programming aids such as *Simons' BASIC*, *Supermon*, and *PAL*.
- TurboTape safely handles very large programs (up to 49K on the Commodore 64). However, some programs which barely fit into memory before may not fit when using TurboTape (it subtracts 639 bytes of available RAM from the VIC and 642 bytes from the 64).
- Filenames can be the usual 16 characters long.
- In addition to handling BASIC programs, TurboTape will save, load, or verify data from any part of RAM memory you wish, except for the RAM hidden beneath the Kernal ROM on the 64. RAM beneath the 64's BASIC ROM can even be saved.
- A normal LOAD command will load any Turbosaved program at TurboTape speed.

It's quite simple to use TurboTape. Reset your computer by turning it off, then on. If you want to use some additional utility like *Simons' BASIC*, load and run it first. Then type NEW.

Now load TurboTape and run it. In the 64 version, a menu will appear, offering you two optional memory locations for TurboTape:

1. In BASIC RAM. The ending address of the relocated TurboTape will be what's currently indicated as the limit of memory in the pointer in addresses 55 and 56. You may have to select this option if you want some utilities to coexist with TurboTape. *Simons' BASIC*, for example, is one. Any utility which makes use of the RAM between addresses 52606 and 53247 (for example, the "64 DOS Wedge") will require this option. (This is the only option possible on the VIC. The VIC version will always relocate to the top of memory.)

2. In the 4K RAM buffer. Using this option, you can Turbosave all RAM from 0 to 52606 in one huge block (including the RAM hidden be-

hind BASIC ROM).

To get accustomed to using TurboTape, however, let's avoid combining it with other utilities for now. Simply turn on the computer, load TurboTape, and type RUN (don't attempt to edit the BASIC portion of TurboTape). For the 64, select option 2.

Sit Back And Be Amazed

You will now see on screen where TurboTape has been located and the commands you use to activate TurboTape's features. Then type NEW to remove the TurboTape loader from memory. Write a program or load one into the computer. To Turbosave this program, type:

TURBOSAVE "filename" [press RETURN]

(Or you can abbreviate TURBOSAVE as TSAVE.) You'll then see the usual message:

PRESS RECORD & PLAY

Press those keys, then sit back and be amazed.

A header containing a special Turboload routine is written to tape. (On the 64, the screen will blank while the header is written.) Then rainbowlike colors will vibrate on screen as your program is flashed onto the tape. Finally, your screen will return to normal.

If you want to verify the TSAVE'd program, rewind the tape and type:

TURBOVERIFY "filename" [press RETURN]

(TURBOVERIFY can be abbreviated TVERIFY.) You'll see the normal message:

PRESS PLAY

Depress the PLAY key on the cassette drive. (On the 64, the screen will blank while the verification takes place.) If you should get an OUT OF MEMORY error message, simply type TVERIFY without a filename. As soon as the tape has passed the header, you get the usual message on screen. (For the 64, press the Commodore logo key.) If an error is found during TVERIFY, the screen will return to normal and you'll see the VERIFY ERROR message. If you're interested in knowing precisely where a mismatch was found, type:

?PEEK(172)+256*PEEK(173)

If there was no problem during the TVERIFY, you'll see the message: VERIFY OK.

Lightning LOADs

You won't need the TurboTape utility to load programs which have been Turbosaved. Just type LOAD normally and everything will happen as it always does, except the program will zoom into your computer.

Here are a few additional notes about TurboTape. To save machine language programs, you'll need to specify the starting and ending ad-

dresses. For example, if your machine language program resides in memory from 864 to 890, save it in the following fashion:

```
TSAVE"MACHINE PROGRAM",864,891
```

Notice that you must use the ending address *plus one*. To save the entire contents of RAM on a 64, including the RAM hidden behind BASIC ROM, type:

```
TSAVE"ALL RAM",2049,52606
```

Most other programming utilities work well with TurboTape. If you use *Simons' BASIC*, however, you should avoid the RUN/STOP-RESTORE combination, and the COLD command has no effect. If you're also using the DOS wedge, choose option 1 to locate TurboTape into BASIC RAM memory to avoid conflicts on the 64.

Because of the high speeds, you might want to use only high-quality cassettes for reliable storage. TurboTape, like the normal SAVE/LOAD, will sometimes be unable to Turboload if a program was TSAVEd using a different cassette drive. This happens when a recording head on one of the drives is out of alignment. For very important programs, you may want to make a backup copy with the normal SAVE command. Although the standard SAVE is much slower, it is extremely reliable.

Another reason for making backup copies with the normal SAVE is that 64s cannot read tapes created by VIC TurboTape, and vice versa. This is a result of differences in the Turboload machine language routine, which we'll discuss next month.

You should use LOAD and the TurboTape commands only in direct mode, not from within a running program. Also, TurboTape cannot search through several files on a cassette in search of a certain filename. If you have several Turbosaved programs on a tape, you should fast-forward past any Turbosaved programs you don't wish to load. Use the cassette drive's counter for this purpose.

No Turbosaved program will relocate itself upon loading. The address in RAM memory from which you Turbosaved will be the address where the program will later load. In effect, all Turbosaved programs act as if you're using the nonrelocating command: LOAD "filename",1,1. This is especially important if you're a VIC owner who uses several different memory configurations. For example, a BASIC program Turbosaved on an expanded VIC will not load normally into an unexpanded VIC.

How Fast Is It?

Tests here revealed that a 12K program took 34 seconds to load with a 1541 disk drive and 44

seconds to load with TurboTape. However, the TurboTape load time was actually only 28 seconds once the program header was located on the tape. We ran these tests by timing TurboTape with a completely rewound cassette, presuming that most people do not position the tape so that a program header is right in front of the tape head. If you do position your tapes exactly with the tape counter, TurboTape will indeed load programs faster than a 1541 disk drive.

Turbosaving the 12K program took 42 seconds; the 1541 disk drive took 40 seconds. Turboverify and disk verify took the same amount of time as loading a program.

TurboTape is one of the most interesting and useful utilities a cassette owner can possess. The story behind the TurboTape technique is fascinating as well. If you're interested in how TurboTape does its magic, look for "How TurboTape Works" next month in COMPUTE!

Refer to "COMPUTE's Guide For Typing In Programs" article before typing these programs in.

Program 1: TurboTape Generator For Commodore 64

```
10 FI$="TURBO/64":D=1:REM CHANGE 1 TO 8 F
   OR DISK                                     :rem 136
20 PRINT "{CLR}{3 DOWN}"TAB(11)"ENTERING
   {SPACE}TURBOTAPE{3 DOWN}"                 :rem 12
30 FOR I=2049 TO 3461                         :rem 16
40 READ A:POKE I,A:CK=CK+A:NEXT                :rem 88
50 IF CK<>143099 THEN PRINT "{2 SPACES}
   {RVS}ERROR DETECTED IN DATA STATEMENTS
   1":STOP                                     :rem 110
60 PRINTTAB(16)"{RVS}DATA OK{3 DOWN}":PRI
   NTTAB(4)"PRESS ANY KEY WHEN READY TO S
   AVE"                                         :rem 253
70 GET A$:IF A$="" THEN 70                     :rem 241
80 PRINT "{CLR}POKE 43,1:POKE 44,8:POKE 4
   5,134:POKE 46,13{2 DOWN}"                 :rem 15
90 PRINT"SAVE"CHR$(34):FI$:CHR$(34);",":D
   :rem 46
100 POKE 631,19:POKE 632,13:POKE 633,13:P
   OKE 198,3:END                               :rem 148
2049 DATA 62,8,100,0,153,34                  :rem 38
2055 DATA 147,17,17,17,34,163                :rem 151
2061 DATA 49,50,41,34,18,32                  :rem 43
2067 DATA 84,85,82,66,79,83                  :rem 79
2073 DATA 65,86,69,47,76,79                  :rem 82
2079 DATA 65,68,32,146,17,17                 :rem 113
2085 DATA 17,17,34,58,153,34                 :rem 105
2091 DATA 32,32,32,32,82,69                  :rem 47
2097 DATA 76,79,67,65,84,69                  :rem 88
2103 DATA 32,84,79,58,17,17                 :rem 58
2109 DATA 0,140,8,110,0,153                 :rem 26
2115 DATA 34,32,32,32,32,32                 :rem 31
2121 DATA 32,32,49,46,32,66                  :rem 46
2127 DATA 65,83,73,67,32,82                 :rem 62
2133 DATA 65,77,32,40,80,79                 :rem 57
2139 DATA 73,78,84,69,82,32                 :rem 72
2145 DATA 53,53,47,53,54,41                 :rem 51
2151 DATA 17,34,58,153,34,32                 :rem 96
2157 DATA 32,32,32,32,32,32                 :rem 35
2163 DATA 50,46,32,70,82,79                 :rem 55
```


2169 DATA 77,32,53,50,54,48	:rem 61	2601 DATA 32,76,79,65,68,58	:rem 71
2175 DATA 54,32,84,48,32,53	:rem 56	2607 DATA 32,76,79,65,68,32	:rem 69
2181 DATA 51,50,52,56,17,17	:rem 47	2613 DATA 40,84,85,82,66,79	:rem 69
2187 DATA 0,199,8,120,0,151	:rem 45	2619 DATA 32,78,79,84,32,78	:rem 76
2193 DATA 49,55,49,44,48,58	:rem 74	2625 DATA 69,67,69,83,83,65	:rem 81
2199 DATA 133,34,32,32,32,32	:rem 93	2631 DATA 82,89,41,34,58,153	:rem 111
2205 DATA 89,79,85,82,32,67	:rem 73	2637 DATA 34,32,32,163,163,163	:rem 199
2211 DATA 72,79,73,67,69,32	:rem 64	2643 DATA 163,163,163,163,0,0	:rem 141
2217 DATA 40,49,47,50,41,34	:rem 47	2649 DATA 0,56,165,45,133,90	:rem 107
2223 DATA 59,65,36,58,139,65	:rem 118	2655 DATA 233,130,133,95,165,46	:rem 255
2229 DATA 36,178,34,49,34,167	:rem 167	2661 DATA 133,91,233,2,133,96	:rem 150
2235 DATA 151,49,55,49,44,49	:rem 114	2667 DATA 165,171,208,6,169,0	:rem 160
2241 DATA 58,137,49,52,48,0	:rem 55	2673 DATA 162,208,208,4,165,55	:rem 207
2247 DATA 216,8,130,0,139,65	:rem 98	2679 DATA 166,56,133,88,133,174	:rem 16
2253 DATA 36,179,177,34,50,34	:rem 158	2685 DATA 134,89,134,175,32,191	:rem 9
2259 DATA 167,49,50,48,0,245	:rem 111	2691 DATA 163,230,89,165,88,166	:rem 17
2265 DATA 8,140,0,158,40,194	:rem 98	2697 DATA 89,133,193,134,194,172	:rem 67
2271 DATA 40,52,53,41,170,50	:rem 87	2703 DATA 0,3,140,166,2,172	:rem 35
2277 DATA 53,54,172,194,40,52	:rem 156	2709 DATA 1,3,140,167,2,141	:rem 39
2283 DATA 54,41,171,56,49,50	:rem 105	2715 DATA 0,3,142,1,3,164	:rem 190
2289 DATA 41,58,156,0,62,9	:rem 10	2721 DATA 171,240,4,133,55,134	:rem 190
2295 DATA 150,0,153,34,147,17	:rem 146	2727 DATA 56,162,255,32,142,251	:rem 252
2301 DATA 17,17,32,32,32,32	:rem 32	2733 DATA 32,219,252,32,219,252	:rem 249
2307 DATA 78,79,87,32,76,79	:rem 82	2739 DATA 32,209,252,176,75,160	:rem 5
2313 DATA 67,65,84,69,68,32	:rem 69	2745 DATA 0,177,172,201,190,208	:rem 248
2319 DATA 65,84,58,34,194,40	:rem 114	2751 DATA 240,232,169,32,224,6	:rem 197
2325 DATA 49,57,51,41,170,50	:rem 99	2757 DATA 240,13,224,7,208,2	:rem 96
2331 DATA 53,54,172,194,40,49	:rem 153	2763 DATA 169,157,224,11,208,5	:rem 206
2337 DATA 57,52,41,34,45,34	:rem 52	2769 DATA 169,189,44,169,162,145	:rem 75
2343 DATA 194,40,49,55,52,41	:rem 103	2775 DATA 172,200,24,177,172,101	:rem 40
2349 DATA 170,50,53,54,172,194	:rem 206	2781 DATA 193,145,172,8,200,177	:rem 2
2355 DATA 40,49,55,53,41,34	:rem 52	2787 DATA 172,201,160,240,249,40	:rem 43
2361 DATA 17,17,17,17,0,128	:rem 45	2793 DATA 101,194,145,172,224,4	:rem 251
2367 DATA 9,160,0,78,36,178	:rem 64	2799 DATA 176,188,157,170,2,232	:rem 14
2373 DATA 199,40,51,52,41,170	:rem 150	2805 DATA 136,177,172,157,168,2	:rem 6
2379 DATA 34,78,65,77,69,34	:rem 80	2811 DATA 232,169,76,157,166,2	:rem 210
2385 DATA 170,199,40,51,52,41	:rem 153	2817 DATA 208,170,96,32,121,0	:rem 146
2391 DATA 58,80,36,178,78,36	:rem 123	2823 DATA 168,32,115,0,192,148	:rem 201
2397 DATA 170,34,91,44,66,65	:rem 115	2829 DATA 208,8,190,104,0,208	:rem 150
2403 DATA 44,69,65,93,34,58	:rem 65	2835 DATA 10,108,166,2,192,149	:rem 203
2409 DATA 90,83,36,178,34,32	:rem 110	2841 DATA 208,249,190,31,0,162	:rem 197
2415 DATA 32,79,82,32,83,89	:rem 66	2847 DATA 128,108,166,2,169,0	:rem 158
2421 DATA 83,40,54,56,48,41	:rem 51	2853 DATA 133,10,32,212,225,169	:rem 243
2427 DATA 34,170,80,36,0,195	:rem 100	2859 DATA 0,32,213,255,176,56	:rem 158
2433 DATA 9,170,0,90,86,36	:rem 3	2865 DATA 162,209,142,165,3,202	:rem 249
2439 DATA 178,34,32,32,79,82	:rem 115	2871 DATA 142,167,3,169,96,141	:rem 213
2445 DATA 32,83,89,83,40,54	:rem 62	2877 DATA 209,3,32,81,3,8	:rem 213
2451 DATA 56,51,41,34,170,78	:rem 102	2883 DATA 169,145,32,210,255,32	:rem 254
2457 DATA 36,58,84,83,36,178	:rem 126	2889 DATA 216,245,40,208,8,32	:rem 160
2463 DATA 34,84,85,82,66,79	:rem 75	2895 DATA 209,252,144,3,76,141	:rem 209
2469 DATA 83,65,86,69,34,170	:rem 125	2901 DATA 225,162,28,76,55,164	:rem 208
2475 DATA 80,36,58,84,86,36	:rem 73	2907 DATA 32,14,226,32,138,173	:rem 200
2481 DATA 178,34,84,85,82,66	:rem 123	2913 DATA 32,247,183,165,20,166	:rem 254
2487 DATA 79,86,69,82,73,70	:rem 83	2919 DATA 21,96,76,249,224,169	:rem 225
2493 DATA 89,34,170,78,36,0	:rem 64	2925 DATA 188,190,200,160,1,32	:rem 194
2499 DATA 239,9,180,0,153,34	:rem 110	2931 DATA 189,255,169,1,170,168	:rem 11
2505 DATA 32,32,84,79,32,83	:rem 56	2937 DATA 32,186,255,134,171,32	:rem 1
2511 DATA 65,86,69,58,32,34	:rem 64	2943 DATA 121,0,201,34,208,32	:rem 133
2517 DATA 84,83,36,58,153,34	:rem 114	2949 DATA 136,230,122,177,122,240	:rem 92
2523 DATA 32,32,163,163,163,163	:rem 244	2955 DATA 4,201,34,208,8,198	:rem 109
2529 DATA 163,163,163,34,58,153	:rem 3	2961 DATA 171,165,171,208,240,169	:rem 102
2535 DATA 44,90,83,36,34,17	:rem 57	2967 DATA 32,190,199,1,232,224	:rem 208
2541 DATA 17,0,31,10,190,0	:rem 233	2973 DATA 17,144,242,32,121,0	:rem 141
2547 DATA 153,34,32,32,84,79	:rem 110	2979 DATA 240,86,169,34,32,255	:rem 221
2553 DATA 32,86,69,82,73,70	:rem 66	2985 DATA 174,240,79,190,87,0	:rem 169
2559 DATA 89,58,32,34,84,86	:rem 79	2991 DATA 133,78,134,79,190,87	:rem 226
2565 DATA 36,58,153,34,32,32	:rem 104	2997 DATA 0,133,80,134,81,190	:rem 155
2571 DATA 163,163,163,163,163,163	:rem 97	3003 DATA 10,1,176,230,162,9	:rem 83
2577 DATA 163,163,163,34,58,153	:rem 6	3009 DATA 190,237,0,157,44,3	:rem 96
2583 DATA 44,90,86,36,34,17	:rem 63	3015 DATA 202,16,247,162,44,160	:rem 239
2589 DATA 17,0,88,10,200,0	:rem 249	3021 DATA 3,134,193,132,194,162	:rem 241
2595 DATA 153,34,32,32,84,79	:rem 113	3027 DATA 60,134,174,132,175,70	:rem 246

Enhanced Applesoft INPUT

Dale W. Woolridge

Here's a way to make your APPLE II-family computer a little smarter and friendlier. The short routine is written in machine language, but you don't have to be an ML programmer to use it.

The loan-repayment program running on my Apple asked me a simple question:

HOW MANY MONTHLY PAYMENTS?

The loan was for 17 years, with 12 payments per year. So there I was, seated before a computer system that cost several thousand dollars, doing mental arithmetic! How nice if you could just enter the expression 17×12 .

Apple users will guess that the Applesoft INPUT command was responsible for asking the question. It's one of the most useful commands in BASIC; it prints a prompt, waits for you to respond, and then stores your answer for future use.

Unfortunately, the INPUT command has some features that can be inconvenient—such as its inability to accept even simple mathematical expressions. So I wrote a program that adds a new command, &INPUT, to Applesoft. The syntax for &INPUT is almost the same as for INPUT, but its features are different.

A Few Improvements

If &INPUT is used with a numeric variable, you

may enter any valid numeric expression. *Numeric expression* means anything that could legally appear to the right of the equals sign in a numeric assignment (LET) statement. &INPUT evaluates the expression and stores the result.

For example, if a program contains the lines:

```
100 PI = 3.1415926
110 & INPUT "GIVE ME A NUMERIC EXPRES
    SION ";A
120 PRINT "ITS VALUE IS ";A
```

you may enter something like:

SQR(PI)+PDL(0)+PEEK(127)

The PRINT statement in line 120 will show that the value of your expression is in A.

Unlike INPUT, &INPUT interprets a null expression (just pressing RETURN) as the value zero. &INPUT is smart enough to know where a numeric expression ends and a comment (or garbage) begins. If you enter something like 45 YEARS the &INPUT command knows that you really meant 45. INPUT would give you a REENTER message.

&INPUT may also be used with a string variable. Your input string may contain commas, quotes, or colons. The regular INPUT command is somewhat neurotic about these characters, in my opinion. Curiously, INPUT won't accept leading spaces in an input string, either. If you enter three spaces and a character, say, it interprets your input to be only one character long.

But the improved &INPUT accepts the leading spaces as part of the string.

&INPUT treats most escape and control characters as INPUT does; however, it treats CTRL-C differently. If you enter CTRL-C as your input, &INPUT gives you a BREAK message, like INPUT. But then you can PRINT and change the values of any variables in your program and resume program execution with the CONT command. The variable in the &INPUT statement retains its previous value, unless you changed it in immediate mode.

One feature missing from &INPUT is the multiple variable function available with INPUT. A statement such as:

```
200 &INPUT "X,Y COORDINATES? ";X,Y
```

will not work, although the comparable INPUT statement would work.

How To Use &INPUT

The program is listed as a *hex dump*—a list of hexadecimal numbers which you can enter directly into the computer's memory with the Apple's built-in machine language monitor. You *don't* need to be a machine language programmer. Just enter the monitor by typing CALL—151 and pressing RETURN. An asterisk will appear on the screen. The * is the prompt for the monitor, similar to the bracket in BASIC.

Next, type 300.3AF after the asterisk and press RETURN. A hex dump appears on the screen. You have to replace those numbers with the new numbers in the program listing.

Starting with the first line, type 300: after the asterisk, then enter the first eight numbers. Press RETURN at the end of the line. Continue until the entire program is entered.

When you've checked that all your typing is correct, save the program to disk with this command:

```
BSAVE AMPER-INPUT,A$300,L$B0
```

Then exit the monitor by pressing the RESET button. To load, run, and initialize the program, simply type:

```
BRUN AMPER-INPUT
```

Program 1: Enhanced Applesoft INPUT—Hex Dump

```
0300- A0 02 B9 0C 03 99 F5 03
0308- 88 10 F7 60 4C 0F 03 C9
0310- 84 F0 05 A2 10 4C 12 D4
0318- 20 B1 00 C9 22 F0 06 20
0320- 5A DB 4C 30 03 20 81 DE
0328- A9 3B 20 C0 DE 20 3D DB
0330- 20 E3 DF 85 85 84 86 24
0338- 11 70 42 A5 B8 A4 B9 8D
0340- AE 03 8C AF 03 20 2C D5
0348- AD 00 02 D0 0C A9 30 8D
0350- 00 02 A9 00 8D 01 02 F0
0358- 0E C9 03 D0 03 4C 63 D8
0360- A9 00 85 B8 20 59 D5 A9
0368- 00 85 B8 A9 02 85 B9 20
0370- 52 DA AD AE 03 AC AF 03
0378- 85 B8 84 B9 60 20 2C D5
0380- AD 00 02 C9 03 D0 03 4C
0388- 63 D8 E8 BD 00 02 D0 FA
0390- 8E AD 03 8A 20 52 E4 A0
0398- 00 91 83 C8 A5 71 91 83
03A0- C8 A5 72 91 83 A2 00 AD
03A8- AD 03 4C E2 E5 00 00 00
```

Program 2: Enhanced Applesoft INPUT—Source Listing

```
131 000 *-----
1010 *                AMPER-INPUT
1020 *-----
1030                .OR $300        DECIMAL 768
1040 VALTYP .EQ $0011      $00=NUMBER, $FF=STRING
1050 FRESPT .EQ $0071      PTR TO STRING (OBTAINED BY GETSPA)
1060 VARPNT .EQ $0083      PTR TO STRING DESCRIPTOR
1070 FORPNT .EQ $0085      PTR TO ADDR IN VAR TABLE
1080 CHRGET .EQ $00B1      GET NEXT CHAR, UPDATE TXTPTR
1090 TXTPTR .EQ $00B8      ADDR OF CHAR IN TEXT
1100 BUF .EQ $0200        KEYBOARD BUFFER
1110 AMPERV .EQ $03F5      AMPERSAND VECTOR
1120 ERROR .EQ $D412      APPLESOFT ERROR ROUTINE
1130 INLIN .EQ $D52C      APPLESOFT LINE INPUT
1140 TOKEN .EQ $D559      APPLESOFT TOKENIZER
1150 BREAK .EQ $D863      BREAK IN LINE...
1160 LET1 .EQ $DA52        EVALUATE EXPRESSION
1170 STRPRT .EQ $DB3D      PRINT A STRING
1180 OUTQST .EQ $DB5A      PRINT A ?
1190 STRTXT .EQ $DE81      PREPARE STRING
1200 SYNCHR .EQ $DEC0      SYNTAX CHARACTER CHECK
1210 PTRGET .EQ $DFE3      FIND ADDR OF VAR IN TABLE
1220 GETSPA .EQ $E452      GET SPACE FOR STRING
1230 MOVSTR .EQ $E5E2      MOVE A STRING
1240 *-----
1250 * INSTALL & VECTOR AT $3F5
1260 *-----
1270 BEGIN LDY #$02        MOVE 3-BYTE INSTRUCTION
1280 .1 LDA IMAGE,Y        INTO AMPERSAND VECTOR
1290 STA AMPERV,Y AT $3F5
1300 DEY
1310 BPL .1
1320 RTS
1330 IMAGE JMP ENTRY      IMAGE OF & VECTOR
1340 *-----
1350 * & NOW JUMPS HERE
1360 *-----
1370 ENTRY CMP #$84        'INPUT' TOKEN?
1380 BEQ INPUT YES
1390 LDX #$10        ERROR CODE,
1400 JMP ERROR SYNTAX ERROR
1410 INPUT JSR CHRGET    GET CHAR AFTER 'INPUT'
1420 CMP #$22        ASCII QUOTE?
```


How It Works

Look at the machine language source listing (this is for reference purposes only; it's easier to enter the program from the hex dump). When Applesoft sees an ampersand, it JMPs to address \$3F5. This address may contain another JMP instruction to the actual machine language program. Lines 1270-1330 set up a JMP at \$3F5 to the start of the program, which is labeled ENTRY. These lines provide the code that is executed when AMPER-INPUT is initialized.

After the JMP to ENTRY, the Applesoft TTXPTR (at \$B8 and \$B9) points to the byte that follows the ampersand in memory, and the A register is loaded with the contents of that byte. Lines 1370-1400 check to make sure this byte contains the INPUT token.

Lines 1410-1490 print the string that follows &INPUT, or a question mark if there is no string. The STRTXT subroutine sets up the string so that STRPRT can print it; between the calls to these routines the program does a syntax check to make sure a semicolon follows the string.

Lines 1500-1540 look at the variable name in the &INPUT statement, find the variable's place in the BASIC program's variable table, and branch according to variable type. On exit from PTRGET the A and Y registers contain the address in the variable table, and VALTYP (\$11) contains \$FF to indicate a string variable, or \$00 to indicate a numeric variable. It is important to save the address in FORPNT, because the LET1 subroutine looks for it there.

Numeric Variables

Lines 1580-1850 get the user's numeric expression, evaluate it, and store the value in the BASIC program's variable table. First, TTXPTR must be saved (lines 1580-1610) because it

```

1430      BEQ .1          YES, PRINT PROMPT
1440      JSR OUTGST      USE ? FOR PROMPT
1450      JMP SEEVER      PREPARE STRING
1460 .1      JSR STRTXT    ASCII ':' ?
1470      LDA #$3B        ERROR IF NOT
1480      JSR SYNCHR      PRINT THE STRING
1490      JSR STRPRT      GET POINTER INTO VAR TABLE
1500 SEEVER JSR PTRGET    AND SAVE IT
1510      STA FORPNT
1520      STY FORPNT+1
1530      BIT VALTYP      STRING VARIABLE?
1540      BVS STRING      YES
1550 *-----
1560 * INPUT A NUMERIC EXPRESSION
1570 *-----
1580      LDA TTXPTR      SAVE TTXPTR
1590      LDY TTXPTR+1
1600      STA TMPPTR
1610      STY TMPPTR+1
1620      JSR INLIN       GET A LINE FROM KEYBOARD
1630      LDA BUF         NULL INPUT?
1640      BNE .1          NO
1650      LDA #$30        ASCII '0'
1660      STA BUF         (SIMULATE INPUT OF 0)
1670      LDA #$00        END OF LINE
1680      STA BUF+1
1690      BEQ .3          ALWAYS. NO NEED TO TOKENIZE
1700 .1      CMP #$03      CTRL-C?
1710      BNE .2          NO
1720      JMP BREAK
1730 .2      LDA #$00
1740      STA TTXPTR      TOKEN REQUIRES THIS
1750      JSR TOKEN        TOKENIZE INPUT LINE
1760 .3      LDA #BUF      POINT TTXPTR AT BUFFER
1770      STA TTXPTR      SO LET1 KNOWS WHERE
1780      LDA /BUF          THE EXPRESSION IS
1790      STA TTXPTR+1
1800      JSR LET1        EVALUATE THE EXPRESSION
1810      LDA TMPPTR      RESTORE TTXPTR
1820      LDY TMPPTR+1
1830      STA TTXPTR
1840      STY TTXPTR+1
1850      RTS
1860 *-----
1870 * INPUT A STRING FROM KEYBOARD
1880 *-----
1890 STRING JSR INLIN     GET A LINE FROM KEYBOARD
1900      LDA BUF         CHECK FOR CTRL-C
1910      CMP #$03
1920      BNE .1          NO
1930      JMP BREAK
1940 .1      INX           GET LENGTH OF STRING
1950      LDA BUF,X
1960      BNE .1
1970      STX LENGTH      AND SAVE IT
1980      TXA             TELL GETSPA THE LENGTH
1990      JSR GETSPA      GET SPACE FOR STRING
2000      LDY #$00        PUT DESCRIPTOR IN VAR TABLE
2010      STA (VARPNT),Y  LENGTH FIRST
2020      INY
2030      LDA FRESPEC     ADDR OF STRING, LO BYTE
2040      STA (VARPNT),Y
2050      INY
2060      LDA FRESPEC+1    ADDR OF STRING, HI BYTE
2070      STA (VARPNT),Y
2080      LDX #BUF         COPY STRING INTO ITS
2090      LDA LENGTH      SPACE IN HIGH MEMORY
2100      JMP MOVSTR      (Y-REG HAS /BUF)
2110 *-----
2120 * SAVE AREA
2130 *-----
2140 LENGTH .HS 00        LENGTH OF STRING
2150 TMPPTR .HS 0000      TTXPTR

```


will be modified. The Applesoft INLIN routine is used to get the user's expression as a string. This routine puts the input into the keyboard buffer, resets the high-order bit of each byte to zero, puts a zero at the end of the string, and loads the registers—A with \$00, Y with \$01, and X with \$FF.

Lines 1630–1690 check for null input. If null input, an ASCII zero is put into the buffer to simulate the input of a zero. Lines 1700–1720 check for CTRL-C, jumping to the BREAK routine if a CTRL-C was entered as the first character.

Lines 1730–1750 tokenize the contents of the buffer by replacing keywords with one-byte values. Lines 1760–1800 evaluate the expression. The evaluation is performed simply by pointing TXTPTR to the buffer and calling LET1. The LET1 routine not only evaluates expressions, but it stores the value in the BASIC program's variable table. It gets the address into the variable table from FORPNT (remember lines 1510–1520). LET1 can distinguish between floating point variables and integer variables because PTRGET puts \$80 in address \$12 to indicate an integer variable, and \$00 otherwise (remember, \$11 contains a \$00 to indicate a numeric variable). Lines 1810–1850 restore TXTPTR and return to the BASIC program.

String Variables

Lines 1890–2100 get the user's string into the keyboard buffer, store it and its descriptor, and return to the BASIC program. Again, INLIN is used to get the string into the buffer. The program checks for CTRL-C and jumps to the BREAK routine if CTRL-C was entered as the first character of the string (lines 1900–1930). The program then finds the length of the string and puts it in the A register. The length is also stored locally.

The program calls GETSPA to find an address in high memory where the string can be stored; on entry to GETSPA the A register must contain the length, and on exit the address is in FRESPEC. After the call to PTRGET (line 1500) the address of the string's descriptor (in the BASIC program's variable table) could be found in VARPNT. Lines 2000–2070 now use VARPNT to move the string descriptor into the variable table.

Finally, lines 2080–2100 call the MOVSTR routine to move the string itself into its spot in high memory. To call MOVSTR, the A register must contain the string's length, and the X and Y registers must contain its present address. The destination is the address in FRESPEC. Note that the Y register was not explicitly loaded because it incidentally contains the proper byte, which is the high-order byte of the address of the keyboard buffer (see lines 2000, 2020, and 2050). ©

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INSIGHT: Atari

Bill Wilkinson

I have almost worked my way through my backlog of letters, so I will once again appeal to all of you to keep those cards and letters coming. Since it can sometimes take quite a while for a letter sent to COMPUTE!'s editorial offices to wend its way to me, I have decided to give you an address where you can write me directly:

Bill Wilkinson
c/o OSS
P.O. Box 710352
San Jose, CA 95171-0352

Before I start answering questions this month, I would like to talk a little about the future of Atari.

Right From The Source

I had the rare privilege to attend the meeting of the San Leandro (California) Atari User Group on the evening that Leonard Tramiel agreed to come and answer questions.

I hope the name Tramiel is familiar to all Atari owners by now. Jack Tramiel, the founder and former leader of Commodore, bought Atari from Warner Communications in July. Leonard, Jack's son, is now head of software at Atari. And though I am sure some favoritism was involved in choosing him for the position, I think it was probably an excellent appointment.

Leonard Tramiel is an articulate, humorous, open, and opinionated person. He endeared himself to me when he espoused one of my favorite opinions: The IBM PC is an eight-bit machine, and the Apple Macintosh is a 16-bit machine, and no amount of marketing ballyhoo is going to change that. (We are referring to the fact that the width of the data path to the Central Processing Unit (CPU) controls processing speed as much as, if not more than, the speed of register operations. Whew! Got that? There will be a quiz on Monday.)

Anyway, while Leonard was extremely careful to avoid divulging any technical details about future Atari computers, he went a long way toward reassuring many listeners (for example, me)

that Atari in general (and Leonard Tramiel in particular) knows what it is doing and where it is going. By the time you read this, the Winter Consumer Electronics Show (CES) in Las Vegas will be underway. And we're expecting to see the introduction of 16-bit and 32-bit Atari computers.

However, I also came away with the feeling that Atari will not abandon the eight-bit, 6502-based market for some time to come. In particular, Leonard stated emphatically several times that the 800XL would undergo only those modifications which would make it "both less expensive and more reliable."

Preserving Atari Loyalty

Possibly Leonard missed his calling: As a public relations person he did an outstanding job. I didn't take a formal poll, but I believe the impression he left on the audience was in the range of 90 to 95 percent positive. If there were any real negatives, it was regarding his stand that he wouldn't guarantee that current Atari peripherals would work on the new machines.

The attitude of some in the audience was, "Well, if I can't use my peripherals on the new machines, I am going to look at all computers instead of just Atari's." That's a reasonable attitude, but the response was just as rational: "If Atari can't convince you to buy the new machines on their merits and prices alone, then we don't know what we are doing." And finally, my view is that—with the possible exception of printers—there are very, very few Atari peripherals that I would want on a new, super-duper computer. (Who wants to talk to a disk drive at 19200 baud? Who really likes the kludge that became the 850?)

In summary, then, I have a better feeling about the future of Atari than I have had in a year or more now: to the point that our company, OSS, is continuing with plans for more and new Atari-compatible products. I will withhold judgment of the new machines until I see their software (*Please* give us an operating system! Not CP/M, MS-DOS, or Apple or Commodore style!), but with Leonard Tramiel's

leadership I have some hopes in that direction, also.

Where It's At

I've received a few letters in recent weeks asking if there is a good list of important memory locations for Atari computers. Oh, come now, COMPUTE!. Can it be that you are not advertising your 1983 book *Mapping the Atari*? To my knowledge, this is the one and only complete memory map of Atari computers. Further, it is much more than a memory map. It gives example programs, discusses which system routines will use and/or change certain locations, and much, much more. And yet there are readers of this magazine who are not aware of this book! How can that be?

Well, to be fair, the cover of *Mapping the Atari* does state that it is intended for owners of Atari 400 and 800 models. However, the people who wrote me own either 1200XLs or 800XLs. Does that matter? Not really.

More than 99 percent of the significant memory locations are the same in *all* Atari computers: 400, 800, 1200XL, 600XL, 800XL. Notice that I did qualify that just a little. Just what is a *significant* memory location?

Sidetrack: If you have been reading this column for any time at all, you know that I feel that the compatibility problems which many software vendors suffered when the XL machines appeared are the *fault of the vendors*. Since the first documentation from Atari appeared in the marketplace, Atari made a point of specifying which memory locations would control what functions, which subroutine entry points (mainly vectors) would remain unchanged, and which parts of the operating system (OS) were subject to change. Surely, when Atari released its first revision of the OS in early 1982, you would think the vendors and authors would have been put on notice: "Hey, guys, things are subject to change, and this proves it." The reply: "Yeah, but if I know that this routine at \$D099 will save me two bytes of code, I'm gonna use it."

The only consolation I seem to get is that every other machine seems to have the same kind of problem: Apple programmers had to go back to the drawing board when the IIe and IIc arrived. Many major programs for the IBM PC simply do not run on the PC-AT. Nobody can write machine language software for Commodore computers and expect it to work on more than a single model. The list goes on.

Mapping XL Memory

Back to the memory map: Generally, if you use *Mapping the Atari* with an XL machine, you can trust most of the RAM locations that are listed. Atari did publish a set of locations that were

changed in the XL machines, but there were not many. Even the ones that did change were ones unlikely to be used: OLDROW and OLDCOL moved, but the only routines that use them are FILL and DRAWTO. And even if you were to call for a FILL, you probably would do so after a PLOT, which automatically sets up OLDROW and OLDROW for you.

The ROM locations listed in the book are a bit more subject to change. As a rule of thumb, I would trust only the information about the last few bytes of a cartridge, the floating point ROMs, and \$E400 through \$E462. Also, it's a pretty sure bet that if the book mentions a difference between OS revision A and revision B when discussing a location, there will be yet another difference in the XL machines. (Example: Anybody who thinks that EOUTCH—output a character to the screen—is at an immutable location should refrain from using a machine manufactured after 1916.)

So all you XL machine owners should rush out and buy a copy of *Mapping the Atari*. And then you should write to COMPUTE! and tell them (don't ask) to publish an update, either in the form of a revised book or a low-cost appendix, for XL computers.

More No-Nos

As long as we are on the subject of only using *legal* memory locations (see how I sneaked that in?), let me respond to a couple of people who have asked a relevant question: "I have an 800XL, and I can't get it to put characters to the screen if I follow the instructions in *Machine Language for Beginners*. How can I change the program so it will work?"

When Richard Mansfield wrote that book, he was writing for Commodore, Apple, and Atari owners. And all the machines he was writing for *except* Atari have a documented entry point for a routine which will put a single character on the screen. So, for uniformity, he used an undocumented subroutine call on the Atari computers which does much the same thing. At the time he did this, that particular location had been written up several times in both the professional and amateur press, so he felt fairly safe. Ah, well, Richard, even the best of us have to be bitten once in a while.

The proper way to do any input/output (I/O) on an Atari computer is via Central Input/Output (CIO) calls. In early 1982, I wrote a series of articles on CIO calls which appeared in this column. I am not going to repeat that series, but I will give you a few pointers to get you started with CIO.

There are two things you can do if you want more info on the subject: (1) Find a library (per-

haps a user group library) with back issues of COMPUTE! (don't write the magazine; they don't have any). (2) Get your hands on a copy of the *Atari Technical Reference Manual* (it used to be \$30 from Atari customer service, but I don't know where you can get it now). The manual includes a pretty fair description of CIO along with lots and lots of other very worthwhile goodies.

The Legal Solution

Without further ado, then, let's look at how to put a character on the screen.

```
0200 IOCB0 = $0340
0210 IOCB0CMD = $0342
0220 IOCBLEN = $0348
0230 CMDPUT = $0B
0240 CIO = $E456
0250 ;
0260 ;Enter with character in A
      register
0270 ;Routine will print it to screen
0280 ;
0290 PUTSCREEN
0295     LDX #CMDPUT
0300     STX IOCB0CMD ; request output
0310     LDX #0       ; multi-purpose.
      zero
0320     STX IOCBLEN ; first, zero
      length
0330     STX IOCBLEN+1 ; (both bytes)
0340     JMP CIO      ; and now X is
      channel for CIO
```

That's it. Simply put those six lines of code anywhere in your machine language program. Then, when you want to print a character on the screen, use JSR PUTSCREEN after placing the character in the A register.

In theory, you can get an error when you call CIO (a minus value in the Y register indicates this), but in practice I don't believe you will ever see one as a result of putting a character to the screen.

How, you may ask, is this any better than calling a point in the OS ROM which does the same thing? Answers: (1) This way works on all Atari computers (well . . . the 6502-based ones, at least). (2) This follows Atari's rules. If you do it this way, Atari could scramble the OS ROMs anyway they wanted, but your program would still run.

Of course, the equates at the beginning of the program fragment are the keys to the whole thing. IOCB stands for *Input/Output Control Block*. Technically, you are supposed to put the channel number times 16 in the X register and then access the appropriate IOCB via X (see below). Since the screen is always open on channel zero, I took a legitimate shortcut. Similarly, CIO is actually a vector in the OS ROMs which is guaranteed to stay in place. If you follow the rule about using the X register to access the IOCBs, you are already set up for CIO, which requires

the channel number times 16 in the X register.


Oh, yes. Normally, CIO expects to transfer an entire buffer (for example, a line of text), in which case you must give CIO the buffer address and its length. But CIO cleverly provides for situations in which you want to print only a single character: Tell CIO that the length of the buffer is zero, and it will output a single character (or input a character, but that's a topic for another time) via the A register.

And that's about it. Simple, really. Before we quit for this month, though, I would like to show you how simply that routine could be converted to output a character to *any* channel.

```
0200 IOCB0 = $0340
0210 IOCB0CMD = $0342
0220 IOCBLEN = $0348
0230 CMDPUT = $0B
0240 CIO = $E456
0250 ;
0260 ;Enter PUTC with the character
0270 ;   in the A register and the
0275 ;   channel number times 16 in
      the
0280 ;   X register.
0285 ;
0290 PUTC
0300     PHA                ; save character
      for a moment
0310     LDA #CMDPUT ; request output
      ...
0320     STA IOCB0CMD,X ; ... on this
      channel
0330     LDA #0
0340     STX IOCBLEN ; now, zero
      length
0350     STX IOCBLEN+1 ; (both bytes)
0360     PLA            ; recover the
      character
0370     JMP CIO        ; and now X is
      channel for CIO
```

Do you see the really minimal changes we made? This is one of the beauties of the Atari OS. It is so completely organized (*orthogonal* is a good computerese word for it) that it's actually easy to learn and use. Perhaps we'll do a little more of this if you would like. Write and tell me.

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IBM Personal Computing

Donald B. Trivette

Music For Amateurs

The theme of this month's *COMPUTE!* is music, so the editor suggested I write something about making music with the IBM PC and PCjr. Great idea, except I know less about music than Beethoven knew about BASIC. I did write a musical game called "Name These Notes." It's similar to the *Name That Tune* TV show. The first player who stops the music and identifies the correct tune gets the points. But before I could even test the program, I had to hire a music student to translate sheet music into computer music. Although the game is lots of fun, no software publisher will touch it—something about paying royalties on all those tunes, but that's another story. The point is that you don't have to know anything about scales or octaves or half notes to experiment with music on your IBM—or even to write a musical game.

Both the PC and the PCjr have the circuits necessary to generate tones, both have a tiny internal speaker for playing those tones, and both run a version of the BASIC programming language which includes a music-making command. Start up your PC or PCjr and try it.

The PLAY Statement

First you must get the proper version of BASIC running on your computer. Although the PC and PCjr have a built-in BASIC—a version of the language that is a permanent part of memory—that BASIC does not have the command that allows you to play music. Instead, you'll need the advanced disk version of BASIC on the PC (also known as BASICA), or Cartridge BASIC on the PCjr. BASICA for the PC is included on the DOS disk; Cartridge BASIC for Junior is an extra-cost option.

For the PC: First load DOS, then type BASICA at the A> prompt. For the Entry Model

PCjr: Insert Cartridge BASIC in either front slot and switch on the computer. For the Enhanced Model PCjr: Insert Cartridge BASIC, load DOS, and type BASIC at the A> prompt.

Once the BASIC prompt Ok is displayed on the screen, you are ready to compose. We'll start with something simple. The BASIC music statement is named PLAY. Type **PLAY "CDE"** and press the Enter key. You'll hear the musical notes C, D, and E played by your computer. (If you typed the statement correctly but got a Syntax Error anyway, then you're running the wrong version of BASIC.) When typing notes, upper- and lowercase characters and spaces are unimportant; "CDE" sounds just like "c d e". Should you be musically inclined, you'll recognize these notes as *do, re, mi*—the first three notes of the diatonic scale. Now type **PLAY "CDEFGAB"** and press the Enter key again. Those are the seven basic notes of the scale from which all music is composed on the computer (or any other musical instrument, for that matter).

There are lots of things that can be done with those seven notes. For example, if they are played in a low octave, they will sound, well, low; and if they're played in a high octave, they'll sound high. (That is the sum total of my knowledge regarding octaves.) The PC and PCjr can reproduce seven octaves. The PLAY statement defaults to octave 4, but gives you a way to change the octave. It's the O character (for Octave)—the fifteenth letter of the alphabet. The PCjr BASIC manual doesn't distinguish between the numeric 0 and the alphabetic O. This is sure to cause readers great frustration when they try running the examples in the book. The PC BASIC manual, on the other hand, is printed with slashed zeros to represent the numeric 0. To simplify, I'll use a lowercase o for the alphabetic character.

Changing Octaves Within Tunes

Now let's mix in a few octave changes to hear the effect. Try entering these lines:

```
PLAY "o0 CDEFGAB"  
PLAY "o6 CDEFGAB"  
PLAY "o2 CD o4 EF o6 AB"
```

Look up the PLAY statement in your BASIC manual to see all the things that can be done with the notes. They may be played sharp or flat (+ or -); for different lengths of time (Ln, where $n = 1$ for a whole note, 2 for a half note, 4 for a quarter note, etc.); in different tempos (Tn, where $n = 32$ to 255 quarter notes per minute); and in legato (ML), staccato (MS), or normal (MN). It's not necessary to know what these terms mean to have fun playing music. In fact, experimenting with these options is a good way to learn what they *do* mean. Try this:

```
PLAY "ms o3 CDEFGAB"  
PLAY "ml o3 CDEFGAB"  
PLAY "t50 ms o3 CDEFGAB"  
PLAY "t250 ml o3 CDEFGAB"
```

Even the tone deaf will notice that music from the PC doesn't sound quite right. It sounds tinny and mechanical. Part of the problem is the small internal speaker—IBM is a computer company, not a music company—and part of the problem is that the PC has only one *voice*, or sound channel. In other words, it's *monophonic*: It can play only one note at a time, so it can't make chords or blend notes together.

Junior's Improved Sound

The PCjr is more musically accomplished than its big brother. It has an external speaker jack (marked A for Audio on the rear panel) which can be connected directly to your stereo system. By running an inexpensive cable (available from any audio store) to your amplifier, Junior can make beautiful music through your high-fidelity speakers. (For a simple way to modify your PC to hook it up to a stereo system, see "The Amplified PC," COMPUTE!'s PC & PCjr magazine, September 1984.)

Plus, there's an even more important difference between the PC and PCjr's sound capabilities. The PCjr has an extra *polyphonic* sound chip that allows it to play up to three voices at once. In fact, it's the same sound chip found in the discontinued Texas Instruments TI-99/4A home computer. The other members of the PC family do not have this chip and are restricted to monophonic music.

Junior's extra voices only work when the computer is connected to an external speaker system, a TV set, or to IBM's RGBjr Display, which has a speaker of its own. Otherwise, Junior's internal speaker works just like the PC's internal

speaker—it supports but one voice.

If you have your PCjr connected to an external sound system, try this three-voice composition:

```
10 SOUND ON  
20 PLAY "mn CDEFGAB","ml CDEFGAB","ms  
CDEFGAB"
```

It's not music to my ears either, but it does demonstrate what three scales, played at the same time, sound like. For a more melodious example, run the multiple-voice program from the PCjr BASIC manual on page 4-272. (My manual has some typographical ambiguities: In line 50, the three O's should be the alphabetic characters; in line 150, "1=1;" really means "L=L;".) Notice that to turn on Junior's external speaker and use more than one voice, you must first include the SOUND ON statement. There is no equivalent for that on the PC.

A PC/PCjr Music Utility

Enough about multiple voices. You've got to know what you are doing, musically, to program them in a pleasant way. To satisfy both groups of readers, the tunes in this column are in one voice only; they play on either the PC or the PCjr.

When I was working on "Name These Notes," I needed a utility program to display the notes on the screen as they were played. This helped the musician, who was reading the chicken scratches on sheet music, to catch typographical errors on the screen. Things begin to get fuzzy when you've been staring at a screenful of "DDDP16DDG8A8B8DDDP" for an hour.

The program listing following this column is a modified version of that utility—a program that displays as it plays. It has two modes: a slow mode, in which the display may cause the music to be played more slowly (especially the "William Tell Overture"); and a fast mode that has no delay. I've put in a few tunes for which there are no royalty fees (I hope). If you can read sheet music, add a few tunes of your own. If you can't, try changing the tempo and octaves on these. The results can be fun. (If you have a PCjr, be sure DOS and Cartridge BASIC are running so you can save the program on disk.)

For the lazy but curious: If you just want to hear the tunes, you need only type the word PLAY and the character string of notes. For example, to hear "America," type PLAY "GGAF+4.G8ABBo4"

The first five lines, 10-50, are the character strings that make up the tunes; lines 60-80 are for your own compositions. For instance, to add the scales as tune number 6, type:

```
60 X$(6)="Scales=CDEFGAB"
```


Notice that the title is separated from the notes by an equal sign. While BASIC doesn't care whether you put blank spaces between the musical notes, this program does. Should you type the scale as "CDE FGAB", only the first three notes will be displayed and played. The musical notes (A-G) must be in uppercase; the other characters may be upper- or lowercase. I used lowercase, except for the L (length), which might be easily confused with a 1.

BASIC limits the length of a character string—the stuff between the quote marks—to 255 characters. There is a way to play longer pieces using what the BASIC manual describes as an "X variable."

PLAY "T120 L1202CFAL603CL1202AL403C"

New Software

Now for some personal notes on software. There are two new programs for the PCjr that deserve mention this month. *Managing Your Money* (written by MECA and distributed by IBM) is now available on cartridge for \$199. This is the same great program that runs on the PC; it will take care of all your home accounting, budgeting, investing, and tax problems. This may be the program that does for PCjr sales what *VisiCalc* did for the Apple.

IBM is also the distributor for *King's Quest* by Sierra, a new fantasy game (\$50). If you want to see how good graphics can be on the PCjr, try this one. The animated characters, lifelike images, challenging puzzles, and tricky strategy make *King's Quest* a winner. (The version sold under the IBM logo will only run on the PCjr. However, Sierra markets identical versions for the Apple, Tandy, and IBM PC computers.) Looking for a last-minute Christmas gift for a PCjr owner? This is it. (Should any of you figure out the gnome's name, please write me.)

PC/PCjr Music Display Utility

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```

HM 10 X$(1)="America=GGAF+4.G8ABBo4Co3
      B4.A8GAGF+G2.o4DDDD4.C8o3Bo4CCCC
      4.o3B8ABo4m1C8o3B8A8mnG8B4.o4C8D
      m1E8mnC8o3BAG2."
IF 20 X$(2)="America the Beautiful=GG4
      .E8EGG4.D8DEFGABG2.GG4.E8EGG4.D8
      Do4DC+DEo3Ao4D2.o3Go4E4.E8DCC4.o
      3B8Bo4CDo3BAGo4C2."
6F 30 X$(3)="Silent Night=T65m1F8.mnG1
      6F8D4.m1F8.mnG16F8D4.o4CC8o3A4.B
      -B-8F4.GG8m1B-8.mnA16G8m1F8.mnG1
      6F8D4."

```

```

6D 40 X$(4)="William Tell Overture=L16
      o3DDDDp16DDDDp16DDG8A8B8DDDDp16DDDDp
      16BBA8G-8D8DDp16DDDDp16DDG8A8B8p1
      6Go4D4p8o3G8B8G8"
IB 50 X$(5)="Mary Had a Little Lamb=t1
      00o3L8GFE-FGGGp8FFF4GB-B-4GFE-FG
      GGGFFGFE-0."
HM 60 X$(6)="="
HE 70 X$(7)="="
IM 80 X$(8)="="
PE 90 X$(9)="End Program="
LK 100 KEY OFF
KG 110 CLS:PRINT "Tunes"
LP 120 FOR I=1 TO 9
HP 130 PRINT I;MID$(X$(I),1,INSTR(X$(I)
      ),"=")-1)
NF 140 NEXT
PL 150 PRINT:PRINT "Enter tune number:
      ";
EA 160 A$=INKEY$:IF A$="" THEN 160
NI 170 I=VAL(A$)
LJ 180 IF I=0 THEN GOTO 110
NI 190 IF I=9 THEN END
BC 200 B$=X$(I)
ID 210 PRINT
QJ 220 REM
LE 230 PRINT "Enter: F for fast or S f
      or slow: ";
CO 240 A$=INKEY$:IF A$="" THEN 240
HL 250 IF A$="F" OR A$="f" THEN GOTO 4
      60
JN 260 PRINT
DK 270 '-- Begin Slow Mode --
GJ 280 TIT$=MID$(B$,1,INSTR(B$,"=")-1)
      :PRINT TIT$
JN 290 PLAY "T12003MFMNL4"
NC 300 C$=MID$(B$,INSTR(B$,"")+1)+" "
EB 310 C$=MID$(C$,1,INSTR(C$," ")-1)
IC 320 KK=LEN(C$):KIK=0:T$=""
KB 330 FOR KI=1 TO KK
OL 340 IF KI MOD 25 =0 THEN PRINT
GL 350 W$=MID$(C$,KI,1)
BH 360 IF W$<"A" OR W$>"G" THEN GOTO 3
      90
PD 370 COLOR 15:PRINT T$;" ";:PLAY T$:
      COLOR 7:LOCATE ,POS(0)-(LEN(T$)
      +1):PRINT T$;" ";
CM 380 T$=""
OL 390 T$=T$+W$
AB 400 NEXT KI
PI 410 COLOR 15:PRINT T$;" ";:PLAY T$:
      COLOR 7:LOCATE ,POS(0)-(LEN(T$)
      +1):PRINT T$;" ";
QI 420 PRINT:PRINT
OL 430 PRINT:PRINT "Press any key to c
      ontinue.";
GK 440 A$=INKEY$:IF A$="" THEN 440
BE 450 GOTO 110
DP 460 '-- End Slow Mode -- Begin Fast
      Mode --
CN 470 PRINT:PRINT:PRINT
GL 480 TIT$=MID$(B$,1,INSTR(B$,"=")-1)
      :PRINT TIT$
IM 490 PLAY "T12003MFMNL4"+MID$(B$,INS
      TR(B$,"")+1)
BL 500 GOTO 110

```


PROGRAMMING THE TI

C Regena

Mixing Graphics And Music

I've talked about combining graphics with music in a TI program before. This month I'll add a few more ideas and techniques to try to help you in your programming. Remember, there are many ways to do the same thing, and the important idea is to enjoy your computer!

Clear-Screen Effects

The command CALL CLEAR is the usual way to quickly clear the screen. For a different effect, try:

```
CALL HCHAR(1,1,32,768)
```

or

```
CALL VCHAR(1,1,32,768)
```

These statements tell the computer to start with the first row and first column and fill the screen with 768 spaces (ASCII character 32).

If you want to fill the screen with a color, try the following example. Set the variable C to the desired color number:

```
100 CALL CLEAR  
110 CALL SCREEN(C)
```

or

```
100 CALL COLOR(9,C,C)  
110 CALL HCHAR(1,1,96,768)
```

Following is a sample program segment that illustrates another way to clear the screen—by starting at the center and moving outward.

```
100 CALL CLEAR  
110 CALL COLOR(9,14,14)  
120 C=13  
130 T=8  
140 U=0  
150 FOR R=12 TO 1 STEP -1  
160 CALL HCHAR(R,C,96,T)  
170 CALL VCHAR(R+1,C,96,U)  
180 CALL VCHAR(R+1,C+T-1,96,U)  
190 CALL HCHAR(R+1+U,C,96,T)
```

```
200 C=C-1  
210 T=T+2  
220 U=U+2  
230 NEXT R  
240 GOTO 240
```

Another effect is to change all the spaces to a different color by redefining the color for color set 1:

```
CALL COLOR(1,2,7)
```

This definition will retain the default foreground color of black (color 2) for the symbols in set 1, but will change the background color to 7. Since the space character is blank, the background color shines through wherever there's a space.

Making The Invisible Visible

The CALL COLOR statement changes the color of any characters in the specified set on the screen. For example, try writing a program to print a message on the screen, then follow the message with this statement:

```
200 CALL COLOR(5,10,1)
```

All the characters in set 5 will change from black to red.

Remember that the number 1 in a color definition means transparency, or the current screen color. Try drawing something on the screen transparently, then use a different CALL COLOR statement to make the object appear all at once. For example:

```
100 CALL CLEAR  
110 CALL COLOR(6,1,1)  
120 PRINT "HI JIM":  
130 CALL COLOR(6,13,1)  
140 GOTO 140
```

Line 100 clears the screen, then line 110 defines the colors for set 6 to be transparent. Line

120 prints a message and scrolls it upward. Line 130 makes the printing visible by changing the color set to dark green. Line 140 keeps the color on the screen until you press CLEAR.

Changing Character Shapes

Another technique you may have fun with is to change a character definition while the character is on the screen. For example, suppose you have a lot of printing on the screen, then you use CALL CHAR to redefine the letter E as a straight line. Wherever there is an E on the screen, it will suddenly appear as a straight line. The following sample program illustrates what happens when you change the definition of the space character. The GOSUB statement is a simple delay loop to pause between definitions.

```
100 CALL CHAR(32,"FF")
110 GOSUB 190
120 CALL CHAR(32,"0102040810204
    08")
130 GOSUB 190
140 CALL CHAR(32,"1010101010101
    01")
150 GOSUB 190
160 CALL CHAR(32,"8040201008040
    201")
170 GOSUB 190
180 GOTO 100
190 FOR D=1 TO 200
200 NEXT D
210 RETURN
220 END
```

Graphics can be a lot of fun. If you like to use graphics, you really need to just sit at the computer and try different things. See what happens if you define the colors first, then display the characters, or if you change the colors after the graphics are on the screen. Try defining the characters before or after printing them on the screen. Look at the difference between using PRINT and CALL HCHAR or CALL VCHAR statements.

A Holiday Greeting

This month I've included a program which is my holiday greeting to you. This program combines sound and graphics using some of the techniques previously discussed. Here's a breakdown of the program.

Line 100 clears the screen, then line 110 changes the screen color to dark blue. The default values of a CALL COLOR statement are black printing on a transparent (screen color) background. Line 140 will change all the spaces to a blue background rather than screen color. The CALL COLOR statements in lines 150-190 change the color sets for graphics to be solid blue squares—the graphics will be drawn invisibly at first. The CALL COLOR statements in lines

200-240 change the printing to white letters on a blue background.

Lines 320-440 print the graphics on the screen. These lowercase letters and symbols need to be typed with the ALPHA LOCK key released. Turn the ALPHA LOCK key back on to type the rest of the program. Since the letters are blue with a blue background on a blue screen, you won't see anything yet.

Line 480 changes the screen color to black. In effect, this puts a black border around the screen (recall that all spaces and other characters are blue). The extra PRINT statements and colons format an attractive left and right margin.

Lines 490-860 define the graphics characters while music is set up and playing. Remember, the graphics are already on the screen, but are invisible because they are blue. Lines 870-890 change the colors of sets 10, 11, and 12 to red with a blue background, making the sleigh appear. Line 920 changes the colors of set 9 so all the reindeer appear instantly.

If you'd like the message to blink, you can add some CALL COLOR statements for sets 5 through 8 among the CALL SOUND statements in lines 930-1170.

Adding The Sound Track

After the graphics in this program were completed, I added the SOUND statements for the music. Line 120 sets a tempo or time of 440. By using the variable T at the beginning of the program and expressing all durations as a function of T, you can change the tempo of the whole song by simply adjusting the value of T in line 120.

When writing the program, I tried only the melody notes of the song first to make sure the graphics did not interfere with the tempo of the music. Later I added two accompaniment notes for each statement.

Sometimes when you have two CALL SOUND statements with the same note and volume, the resulting sound is one long note rather than two shorter notes. To make sure you get distinct notes, you can change the volume numbers slightly. If you want to make two different chords sound like they have a common tied note, keep the frequency and volume the same for that note.

To make the melody heard over the accompaniment, use a louder volume for the melody notes. For example, use a volume of 2 for the melody, 5 for the middle note, and 8 for the bottom note:

```
CALL SOUND(T,466,2,294,5,175,8)
```

If you don't want to type this program, you can get a copy by sending a blank cassette or disk, a stamped, self-addressed mailer, and \$3 to:

C. Regena
P.O. Box 1502
Cedar City, UT 84720

Please specify the title of the program ("Jolly Old St. Nick") and that you need the TI version. Hope you have fun making your own holiday greeting programs!

Jolly Old St. Nick

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```
100 CALL CLEAR
110 CALL SCREEN(5)
120 T=440
130 CALL SOUND(T,587,2,466,5,17
5,8)
140 CALL COLOR(1,16,5)
150 CALL COLOR(9,5,5)
160 CALL COLOR(10,5,5)
170 CALL SOUND(T,587,3,466,6,17
5,8)
180 CALL COLOR(11,5,5)
190 CALL COLOR(12,5,5)
200 CALL COLOR(5,16,5)
210 CALL SOUND(T,587,2,466,5,17
5,10)
220 CALL COLOR(6,16,5)
230 CALL COLOR(7,16,5)
240 CALL COLOR(8,16,5)
250 CALL SOUND(T,587,3,466,7,17
5,10)
260 PRINT
270 CALL SOUND(T,523,2,440,5,15
6,8)
280 PRINT
290 CALL SOUND(T,523,3,440,6,15
6,8)
300 PRINT
310 CALL SOUND(T*2,523,2,440,5,
156,8)
320 PRINT : " a"
330 PRINT " bcd{3 SPACES}a"
340 CALL SOUND(T,466,2,392,5,14
7,8)
350 PRINT "{3 SPACES}ef bcd
{3 SPACES}a"
360 CALL SOUND(T,466,3,392,7,14
7,8)
370 PRINT TAB(9);"ef bcd
{3 SPACES}a"
380 CALL SOUND(T,466,2,392,5,14
7,10)
390 PRINT TAB(14);"ef bcd
{3 SPACES}hijkl"
400 CALL SOUND(T,466,3,294,5,19
6,10)
410 PRINT TAB(19);"ef mnopq"
420 CALL SOUND(4*T,587,2,349,5,
147,8)
430 PRINT TAB(23);"rstuv"
440 PRINT TAB(23);"wxyz("
450 PRINT ::TAB(7);"MERRY CHRI
STMAS"
460 PRINT ::TAB(13);"FROM"
```

```
470 PRINT ::TAB(12);"REGENA":::
480 CALL SCREEN(2)
490 CALL CHAR(96,"061F1F071F3E7
CFC")
500 CALL CHAR(97,"30F6FF8FF8")
510 CALL CHAR(98,"0001070F3F303
81")
520 CALL CHAR(99,"FEFFFFFFF3F"
)
530 CALL SOUND(T,392,2,311,5,11
7,8)
540 CALL CHAR(100,"01FFFFFFEFEFE
7E3F")
550 CALL CHAR(101,"0F01")
560 CALL SOUND(T,392,3,311,7,11
7,10)
570 CALL CHAR(102,"C0C0E0701808
")
580 CALL CHAR(104,"000000000000
0003")
590 CALL SOUND(T,392,2,311,5,11
7,8)
600 CALL CHAR(105,"000000000000
00C")
610 CALL CHAR(106,"0000010086C1
E8CE")
620 CALL SOUND(T,392,3,311,7,11
7,10)
630 CALL CHAR(107,"000CCEE77737
909")
640 CALL CHAR(108,"00000008D8F0
003")
650 CALL SOUND(T,349,2,294,5,11
7,8)
660 CALL CHAR(109,"0F0F0F0F0600
001C")
670 CALL CHAR(110,"F0FC7D3D3C7C
FEFF")
680 CALL SOUND(T,349,3,294,7,11
7,10)
690 CALL CHAR(111,"6F67E3F0FF7F
1E")
700 CALL CHAR(112,"03C7870FECC0
030F")
710 CALL SOUND(2*T,466,2,294,5,
117,8)
720 CALL CHAR(113,"FCFEF0801F7F
FEE")
730 CALL CHAR(114,"70C0C0C0C060
781E")
740 CALL CHAR(115,"7F3F1F03703F
1C38")
750 CALL CHAR(116,"E0FFFFFF7F07
001E")
760 CALL CHAR(117,"FFFFFFFFFEFC
")
770 CALL SOUND(T,440,2,349,5,17
5,8)
780 CALL CHAR(118,"C0808")
790 CALL CHAR(119,"03")
800 CALL SOUND(T,466,2,349,6,17
5,10)
810 CALL CHAR(120,"F83E03")
820 CALL CHAR(121,"0707FF1F")
830 CALL SOUND(T,523,2,349,5,22
0,8)
```



```

840 CALL CHAR(122,"F08080C07F")
850 CALL CHAR(123,"00C06060C")
860 CALL SOUND(T,587,2,349,7,23
3,8)
870 CALL COLOR(10,10,5)
880 CALL COLOR(11,10,5)
890 CALL COLOR(12,10,5)
900 CALL SOUND(2*T,523,2,349,8,
220,10)
910 CALL SOUND(2*T,523,2,440,8,
175,10)
920 CALL COLOR(9,11,5)
930 CALL SOUND(T,587,2,466,5,17
5,8)
940 CALL SOUND(T,587,3,466,6,23
3,8)
950 CALL SOUND(T,587,2,466,5,17
5,8)
960 CALL SOUND(T,587,3,466,6,23
3,8)
970 CALL SOUND(T,523,2,440,5,17
5,8)
980 CALL SOUND(T,523,3,440,6,31
1,8)
990 CALL SOUND(T*2,523,2,440,5,
175,8)
1000 CALL SOUND(T,466,2,392,5,1
96,8)
1010 CALL SOUND(T,466,3,392,6,2
94,8)
1020 CALL SOUND(T,466,2,392,5,1
96,8)
1030 CALL SOUND(T,466,3,294,5,2
33,8)
1040 CALL SOUND(2*T,587,2,349,5
,220,8)
1050 CALL SOUND(2*T,587,2,349,5
,262,8)
1060 CALL SOUND(T,392,2,311,5,1
56,8)
1070 CALL SOUND(T,392,3,311,6,1
33,8)
1080 CALL SOUND(T,392,2,311,5,1
56,8)
1090 CALL SOUND(T,392,3,311,6,1
33,8)
1100 CALL SOUND(T,349,2,294,5,1
17,8)
1110 CALL SOUND(T,349,3,294,6,2
33,8)
1120 CALL SOUND(2*T,466,2,294,5
,117,8)
1130 CALL SOUND(T,523,2,311,5,2
20,8)
1140 CALL SOUND(T,466,2,294,5,1
75,8)
1150 CALL SOUND(T,523,2,311,5,2
20,8)
1160 CALL SOUND(T,587,2,349,5,1
75,8)
1170 CALL SOUND(4*T,466,2,294,5
,175,8)
1180 CALL KEY(0,K,S)
1190 IF S<1 THEN 1180
1200 CALL CLEAR
1210 END

```

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JTERM For Atari

Frank C. Jones

This versatile terminal program lets you communicate with electronic bulletin boards, access commercial information services, link up to mainframe computers at your school or business, and to upload and download files over the phone lines. Version 3.2 was first published in COMPUTE! in January 1983. The improved version 3.8 listed here adds support for 1200 bps modems and several other features. The program is written in BASIC and machine language, and requires at least 32K RAM plus a modem attached to an 850 Interface Module or its equivalent.

"JTERM" is a flexible and responsive terminal program developed over several months with feedback from many people. It was born primarily because I was too cheap to go out and buy a commercial product. I wanted to try out my new communications hardware and look into some of the electronic bulletin boards (BBSs) I had heard about. Furthermore, I used a mainframe computer at work and thought it would be convenient to access it from the privacy of my home.

My first attempt was to copy a short BASIC program by Henrique Veludo in COMPUTE! ("Atari As Terminal," February 1981). The program worked, but I started making enhancements here and there, including a machine language routine to speed things up a bit. Before long I added the upload/download capability so I could transfer programs and text files to friends who had computers and modems.

About this time I joined an Atari user group in Washington, D.C., and discovered its BBS, run by sysop (system operator) Frank Huband. Soon I learned that some members did not have terminal programs that would do some things that mine would. I offered to donate my program to the club and uploaded it to the BBS. That's when the fun started.

I got calls with problems. I got calls with complaints. I got calls with suggestions. Huband picked up a few suggestions and complaints too. We started working together to incorporate as many of the reasonable ideas as we could, and during the next few months the program grew. As a result, JTERM is a thoroughly tested and debugged terminal program. Over the past few years it's been used successfully for thousands of hours by thousands of people.

Starting Up JTERM

First—and this is important—*save the program on disk or tape before running it for the first time.* To conserve memory, JTERM erases part of itself after initializing. If you run it before saving a copy, most of your typing will go down the drain.

When you're ready to get started, insert the BASIC cartridge (of course, the Atari 600XL and 800XL have built-in BASIC instead of a cartridge). Plug the modem into RS-232 port 1 on the Atari 850 Interface Module. To work properly, the module must be switched on *before* you turn on the computer.

Next, if you're using a disk drive, before loading and running JTERM you must boot up with the RS-232 handler routine as an AUTORUN.SYS file on your DOS disk. The handler routine, included on your Atari DOS Master Diskette, allows the computer to address the RS-232 port on the interface module. Copy the handler routine from the DOS Master Diskette to your regular DOS system disk and give it the filename AUTORUN.SYS. This causes it to load and run automatically when you boot up.

Finally, load and run JTERM. It's normal for the screen to black out for a short period of time as the program initializes. When the first menu appears, JTERM is ready.

Note: For various reasons, Atari did not place the RS-232 handler routine in a very secure place in memory. If you exit BASIC to DOS after booting up, the handler will be overwritten. You must either have a MEM.SAV file on your disk or reboot the handler after making a DOS call. Furthermore, it appears that the NEW command damages or wipes out the handler as well. Therefore, you should always reboot the handler after using this command.

Selecting Menu Options

The first screen in JTERM tells you the size and location in RAM of the *text buffer*. The text buffer is an area of memory set aside so you can *upload* (transmit) and *download* (receive) files. The file, of course, can be text, a program, simple graphics, or merely a record of everything you send and receive when communicating with a remote computer. Naturally you can't upload or download a file larger than the buffer, unless you divide it into parts. The size and location of the buffer varies according to how much memory is installed.

This screen also presents the first menu choice, transmission speed. All menu choices in JTERM are made by simply typing the appropriate key highlighted in inverse video (type an ordinary character, not an inverse video one).

JTERM 3.8 now works with modems transmitting at either 300 or 1200 bits per second (bps), also referred to (less accurately) as 300 or 1200 baud. Remember that the modems at both ends of the phone connection must be transmitting and receiving at the same rate. If you aren't sure what the rate should be, the proper response is probably 300 bps.

Next, JTERM asks if you want to Download or Upload a file with the remote computer. If you want to communicate without transferring files, choose the Download mode.

Setting Translation And Parity

Now JTERM asks you to pick a translation set-

ting. You can choose between No Translation, Light Translation, and ATASCII (Atari ASCII). This can get rather technical, so if in doubt, consult the section below on "General JTERM Guidelines." Most often, you'll probably choose Light Translation.

In the No Translation and ATASCII modes, the 850 Interface Module does not tamper with the characters as they're sent and received. (However, JTERM does some translation itself; more about that later.) With Light Translation, the high-order bits are stripped from all outgoing and incoming characters and the ATASCII end-of-line (EOL) character, 155, is changed to the ASCII carriage-return character, 13, during output, and vice versa during input.

The next choice is between the various settings of outgoing parity (incoming parity is not checked or changed by this program). You should always choose None if you've already selected No Translation, because setting the parity on output will change the high-order bit that you presumably wanted to preserve. This option is also rather technical, so if in doubt, choose None. The other parity options are included for those who wish to access mainframe computers that require certain parity configurations.

At this point, if you chose the Upload option, you'll be asked for the filespec (device and filename) of the file to be uploaded. When you press RETURN, the file is loaded into the buffer and listed on the screen as a check. JTERM then enters the terminal mode, where all communications take place. If you chose the Download option, JTERM enters the terminal mode immediately after you select the parity.

Terminal Operations

Whenever you enter the terminal mode, the word TERMINAL appears in inverse video at the top of the screen. You're now in the machine language portion of JTERM. If you've made all the right connections, you can start talking with the remote computer.

If you selected the Download option, you can switch the memory save function on and off by pressing the SELECT button; the flags MEMSTORE ON and MEMSTORE OFF are printed on the screen as you toggle back and forth. With MEMSTORE ON, everything you send and receive is captured in the text buffer. With MEMSTORE OFF, everything is lost as it scrolls off the screen. If the buffer fills up, the flag MEMORY FULL appears.

If you selected the Upload option, JTERM prevents you from switching MEMSTORE ON until after you've uploaded the file. This is a new feature of version 3.8. It prevents incoming characters from overwriting the buffer.

The OPTION button toggles between *full duplex* and *half duplex*. JTERM defaults to full duplex when you enter the terminal mode for the first time. That is, only the characters received from the remote computer are printed on the screen or captured in the buffer. This assumes that the remote computer echoes all the characters it receives. If the remote computer is operating in half duplex, it cannot send and receive simultaneously and does not echo the characters. Therefore, you won't be able to see your own typing. The solution is to switch to half duplex mode yourself by pressing the OPTION button. The flags HALF DUPLEX and FULL DUPLEX appear on the screen each time you press OPTION.

Leaving Terminal Mode

When you're ready to exit terminal mode, press the START button. One of three things will happen:

1. If you chose the Upload option and have not yet sent the file, JTERM immediately begins uploading. The flag UPLOADING appears on the screen and the buffer is transmitted, 25 characters at a time, to the computer at the other end of the line. You'll still see all incoming characters displayed on the screen, so if the remote computer is echoing your transmission you can watch the uploading in progress. When the transfer is complete, JTERM returns to the terminal mode as if you had selected the Download option from the menu.

2. If you chose the Download option and did not capture anything in the buffer with MEMSTORE ON, you'll return to the first menu. You can start another session with different parameters if you wish.

3. If you chose the Download option and captured anything at all in the buffer with MEMSTORE ON, the program asks you to type a filespec for the file you wish to save. (You can also press RETURN for further options—more about this in a moment.) If you enter a filespec, you can send the file to the cassette recorder (C:), the printer (P:), the screen editor (E:), or the disk drive (D:FILENAME). After you press RETURN, the file is sent to the appropriate device and JTERM lets you go back to terminal mode by pressing START.

If, however, you wish to save the buffer again (perhaps to a different device) before returning to terminal mode, press START and *before releasing the START button*, press OPTION. You'll be prompted for a filespec again. You can repeat this process as often as you want.

Now for those other options we mentioned. If you simply press RETURN at the filespec prompt, you get three alternatives. Pressing

OPTION erases the buffer and returns you immediately to terminal mode without changing any parameters; pressing START erases the buffer and returns you to the menus, where you can change parameters; and finally, pressing SELECT returns you to the menus while *preserving* everything in the buffer.

Taking A Break

An additional feature of JTERM is its ability to send a break signal when you press the BREAK key. This flashes the screen, sounds a beep, prints the flag BREAK on the screen, and transmits a true break signal (approximately a half-second space tone).

The break signal is rarely needed when communicating with a BBS, since most of them don't recognize it anyway. But it can be essential when you're accessing a mainframe computer—there may be no other way to get its attention. Keep in mind, however, that the break routine passes briefly through BASIC. If you press BREAK a few times very quickly, you can trigger a standard program break and find yourself back in BASIC. If this happens, don't try to restart JTERM by typing RUN (it erased part of itself after initializing, remember). Instead, type GOTO 100.

A note to programmers about the BREAK key: If you've already studied the listing, you may have noticed the call in line 65 to the mysterious subroutine at line 2110. This subroutine was added when I discovered that the BREAK key doesn't perform the same way on different Atari computers. Actually, it's not the computer's fault—blame the 850 Interface Module. Whenever concurrent input/output is turned on, the RS-232 port handler substitutes its own interrupt handlers for the ones in the operating system ROM. This is necessary because concurrent input/output handles the serial bus interrupts differently than the operating system. Originally, the machine language portion of JTERM detected the BREAK key by sensing what the 850 interrupt handlers did with it. Of course, this was too good to last; later versions of the 850 handle the BREAK key by ignoring it.

So, the subroutine at line 2110 detects the presence of the newer interrupt handlers and installs a patch, if necessary, to make the BREAK key work as it should. This is a new feature of JTERM 3.8. Version 3.2 required users to remove a REM to activate the patch if needed. Now the program does this itself.

A warning: Do not renumber JTERM without modifying the subroutine in lines 2080–2100. This is the routine that erases all the DATA statements and initialization code after the program is run to conserve memory for the buffer. If

you renumber the program without changing this routine, it will perform fatal surgery and whatever is left won't be of much use. (To find out how this routine works, see my article in *COMPUTE!'s Second Book Of Atari*.)

General JTERM Guidelines

The JTERM menus were designed for maximum flexibility when communicating with many different types of computers, terminals, and bulletin boards. This may cause some confusion, so here are some general guidelines:

Most often you will select 300 bps, Download, Light Translation, No Parity, and Full Duplex. This should work fine when communicating with information utilities such as CompuServe and The Source, as well as with most BBSs. If your modem and the equipment on the other end both have 1200 bps capability, you can select the faster 1200 bps speed. However, remember that some utilities such as CompuServe charge more for 1200 bps access.

For communicating between Atari computers, choose the ATASCII mode instead of Light Translation. This allows full compatibility between characters sent and received. Also select Half Duplex instead of Full Duplex.

For downloading TRS-80 graphics from a TRS-80 BBS, choose No Translation.

Usually you'll select None for the parity option unless you are communicating with a mainframe computer.

The half/full duplex option accomplishes with software what the half/full duplex switch on some modems does with hardware. It is included for those whose modems lack the duplex switch.

Technical Notes: Translations

When you choose between Light Translation, No Translation, or ATASCII in the third menu, you're setting the configuration of your 850 Interface Module RS-232 ports. You should read your 850 instruction manual for information about these configurations.

Even in the No Translation mode, JTERM does some translating of its own. First, nothing received through the port is changed at all before it's stored in memory. Therefore, if you choose ATASCII or No Translation, JTERM saves everything *exactly* as it was sent. Except for the ATASCII mode, however, there *is* some translation before characters are displayed on the screen. JTERM won't display control characters (ASCII values less than 32). This means that you will not see linefeeds, for instance; they will, however, be stored and can mess up a program you are downloading. You should *not* ask for linefeeds from the other computer; you do not

need them even if the test messages are single-spaced.

The cursor-control keys will not work in these modes since they have ASCII values of 28, 29, 30, and 31. In addition, before displaying anything on the screen, JTERM translates the carriage-return character (ASCII 13) to the ATASCII EOL character, the printer bell character (ASCII 7) to the console bell (ATASCII 253), and the backspace character (ASCII 8) to the ATASCII DELETE/BACKSPACE (ATASCII 126). Again, none of this translation affects what is stored in memory; characters are stored exactly as they are received.

In ATASCII mode *everything* is sent to the screen as it is received, because JTERM assumes you are communicating with another Atari. JTERM won't translate any outgoing characters, either.

In the No Translation mode, two characters are changed. The DELETE/BACKSPACE character is changed to the ASCII backspace, so it does the same thing on most remote computers that it does on the Atari. And the RETURN key, or EOL, is changed to the ASCII carriage return before it is sent. In Light Translation the 850 module would do this automatically, but in No Translation it doesn't. I added this feature because I felt there were enough situations in which inverse video characters (ASCII values from 128 up) could be sent and received even though the host computer would still not recognize the EOL character.

In half duplex operation, outgoing characters sent to the port are returned to the input routine and handled just like any other incoming characters.

Additional Details

- When terminal mode is entered for the first time, the DTR line on RS-232 port 1 is set for modems that monitor this line.

- JTERM is designed to work with the Atari 850 module and the Atari RS-232 port handlers. It will also function with any equipment that properly emulates this system. JTERM works fine, for example, with the ATR8000 RS-232 port and the handlers included with MYDOS version 3.18.

- 1200 bps operation was added to JTERM 3.8 because these faster modems are becoming cheap enough for home computer users to afford. Even I bought one.

- Although it was not mentioned in the January 1983 article, JTERM 3.2 switched MEMSTORE OFF and changed to full duplex whenever the program cycled through BASIC. The same thing happened when you returned to the menus or even pressed the BREAK key. Now

these settings are preserved no matter what, even if the program is stopped and then restarted with GOTO 100.

• In ATASCII mode, JTERM 3.8 now lists *all* characters to the screen, including control characters. However, the screen editor does not respond to screen control characters (other than EOL) in three situations: (1) when a file to be uploaded is listed on the screen just after it has been loaded into the buffer; (2) during the upload process itself; (3) whenever you switch MEMSTORE ON in terminal mode. This feature was added by popular demand to make files being uploaded or downloaded easier to read on the screen. They now appear just as they do when you type LIST in BASIC.

JTERM For Atari

Refer to "COMPUTE!'s Guide To Typing In Programs" before entering this listing.

```

J0 15 DIM PROG$(383),PROG2$(7),SPO
    OL$(17),IN$(26),NORM$(4),ATA
    SCI$(4)
KG 20 CON=53279:POKE 559,0:POKE 20
    3,128:POKE 204,0:SVE=0
KO 25 FOR I=1 TO 4:READ A:NORM$(I,
    1)=CHR$(A):NEXT I
CO 30 FOR I=1 TO 4:READ A:ATASCI$(
    1,1)=CHR$(A):NEXT I
EA 35 DATA 201,13,208,4,162,0,240,
    24
BB 40 FOR I=1 TO 383:READ A:PROG$(
    1,1)=CHR$(A):NEXT I
IN 45 DIM MSG$(65):RESTORE 2000:FO
    R I=1 TO 65:READ A:MSG$(I,1)=
    CHR$(A):NEXT I
NO 50 DIM S$(5),T$(8),U$(9):FOR I=
    1 TO 5:READ A:S$(I,1)=CHR$(A
    ):NEXT I:FOR I=1 TO 8:READ A
    :T$(I,1)=CHR$(A):NEXT I
PP 55 FOR I=1 TO 9:READ A:U$(I,1)=
    CHR$(A):NEXT I:DIM BR$(7):FO
    R I=1 TO 7:READ A:BR$(I,1)=C
    HR$(A):NEXT I
JP 60 FOR I=1 TO 7:READ A:PROG2$(
    1,1)=CHR$(A):NEXT I:FLAG=0
KP 65 GOSUB 2110
HF 70 GOSUB 2080:N=FRE(0)-256:DIM
    TXT$(N)
DM 100 SETCOLOR 2,9,0:PROG$(197,19
    7)=CHR$(13):PROG$(189,189)=
    CHR$(8):PROG$(271,274)=NORM
    $
EK 110 POKE 82,0:PRINT "{CLEAR}";
GC 120 PRINT N-1;" BYTES OF MEMORY
    AVAILABLE":PRINT "FROM-";A
    DR(TXT$);" TO-";ADR(TXT$)+N
    -2
JF 130 CLOSE #1:OPEN #1,4,0,"K"
JO 140 POKE 752,1:PRINT "{2 DOWN}
    {TAB}BAUD:" :PRINT :PRINT "

```

```

{TAB}";CHR$(193);" = 300":P
RINT :PRINT "{TAB}";CHR$(19
4);" = 1200"
JH 150 POKE 559,34:GET #1,ANS:IF A
NS=ASC("A") THEN XIO 36,#4,
0,0,"R":GOTO 180
LF 160 IF ANS=ASC("B") THEN XIO 36
    ,#4,10,0,"R":GOTO 180
GH 170 GOTO 150
AE 180 PRINT "{CLEAR}{2 DOWN}{TAB}
    Operation Mode:" :PRINT :PRI
    NT "{TAB}";CHR$(196);"ownlo
    ad":PRINT :PRINT "{TAB}";CH
    R$(213);"pload"
EA 190 PRINT "{DOWN}{TAB}(or 1-4 f
    or disk file menu.)"
GH 200 POKE 752,0:GET #1,ANS:IF AN
S=68 THEN UPLD=0:GOTO 240
IJ 210 IF ANS=85 THEN UPLD=1:GOTO
    240
OO 220 IF ANS>48 AND ANS<53 THEN T
    RAP 110:QQ=ANS-48:GOSUB 880
GA 230 GOTO 110
CF 240 POKE 752,1:PRINT "{CLEAR}
    {2 DOWN}{TAB}Translation Mo
    de:" :PRINT :PRINT "{TAB}";C
    HR$(206);"one":PRINT :PRINT
    "{TAB}";CHR$(204);"ight"
BE 250 PRINT :PRINT "{TAB}";CHR$(1
    93);"TASCI"
FJ 260 POKE 752,0:GET #1,ANS:IF AN
S=76 THEN MODE=0:GOTO 300
LC 270 IF ANS=78 THEN MODE=32:GOTO
    300
AM 280 IF ANS=65 THEN MODE=32:PROG
    $(197,197)=CHR$(155):PROG$(
    189,189)=CHR$(126):PROG$(27
    1,274)=ATASCI$:GOTO 300
GK 290 GOTO 240
KG 300 POKE 752,1:PRINT "{CLEAR}
    {2 DOWN}{TAB}Parity:" :PRINT
    :PRINT "{TAB}";CHR$(206);"
    one":PRINT :PRINT "{TAB}";C
    HR$(207);"dd"
GL 310 PRINT :PRINT "{TAB}";CHR$(1
    97);"ven":PRINT :PRINT "
    {TAB}";CHR$(211);"et"
BD 320 POKE 752,0:GET #1,ANS:IF AN
S=78 THEN PARITY=0:GOTO 370
DH 330 IF ANS=79 THEN PARITY=1:GOT
    O 370
DI 340 IF ANS=69 THEN PARITY=2:GOT
    O 370
DG 350 IF ANS=83 THEN PARITY=3:GOT
    O 370
GF 360 GOTO 300
KL 370 IF UPLD THEN GOSUB 590
JH 380 PRINT "{CLEAR}{2 TAB}";T$:P
    OKE 65,0:IF NOT FLAG THEN
    A=ADR(TXT$)
OA 390 CLOSE #2:OPEN #2,13,0,"R":X
    IO 38,#2,MODE+PARITY,0,"R":
    XIO 34,#2,192,0,"R":XIO 40,
    #2,0,0,"R"
HO 400 POKE 766,SVE:A=USR(ADR(PROG

```



```

    ),A,ADR(TXT$)+N-1,ADR(MSG$
    )):SVE=PEEK(766):POKE 766,0
    :IF PEEK(207)=128 THEN 700
OF 410 IF A=ADR(TXT$) AND NOT UPL
    D THEN CLOSE #2:GOTO 100
KK 420 ON UPLD+1 GOSUB 490,760
BJ 430 IF UPLD THEN UPLD=0:TXT$=""
    :GOTO 380
IN 440 PRINT "PRESS ";S$;" TO RE-E
    NTER TERMINAL MODE"
PG 450 IF PEEK(CON)<>6 THEN 450
LL 460 IF PEEK(CON)=6 THEN 460
LE 470 IF PEEK(CON)=2 THEN 420
HA 480 GOTO 380
BK 490 CLOSE #2:?"{CLEAR}{4 DOWN}
    {TAB}ENTER OUTPUT FILENAME"
    :?"{TAB}1-4 FOR DISK FILE
    MENU":?"{4 SPACES}OR HIT <
    RETURN> FOR OPTIONS":? :?"
    {TAB}";
HC 500 POKE 702,64:POKE 65,3:TRAP
    670:INPUT SPOOL$:FLAG=0:IF
    SPOOL$<>"" THEN 560
EP 510 ? "{CLEAR}{2 DOWN}<START> e
    raises buffer; to menus":?"
    <SELECT> retains buffer; to
    menus":?" <OPTION> erases
    buffer; to terminal"
LC 520 I=PEEK(CON):IF I=5 THEN FLA
    G=1:GOTO 100
KD 530 IF I=6 THEN 100
KL 540 IF I=3 THEN 380
GK 550 GOTO 520
IK 560 TRAP 570:QQ=VAL(SPOOL$):IF
    QQ>0 AND QQ<5 THEN GOSUB 88
    0:GOTO 490
IB 570 TRAP 490:CLOSE #3:OPEN #3,8
    ,0,SPOOL$:IF SPOOL$(1,1)="E
    " THEN SETCOLOR 2,9,0
EF 580 TXT$(A-ADR(TXT$)+1)=" ":PRI
    NT #3:TXT$:CLOSE #3:RETURN
JK 590 PRINT "{CLEAR}{3 DOWN}{TAB}
    ENTER UPLOAD FILENAME":?"
    {TAB}OR 1-4 FOR DISK FILE M
    ENU":PRINT :PRINT "{TAB}";:
    POKE 702,64:INPUT SPOOL$:TX
    T$=""
JA 600 TRAP 610:QQ=VAL(SPOOL$):IF
    QQ>0 AND QQ<5 THEN TRAP 590
    :GOSUB 880:GOTO 590
KE 610 TRAP 670:CLOSE #3:OPEN #3,4
    ,0,SPOOL$:TRAP 4:POKE 65,3
KG 620 AD=ADR(TXT$):XX=INT(AD/256)
    :WW=AD-XX*256:ZZ=INT((N-1)/
    256):YY=(N-1)-ZZ*256
KI 630 IOCB=3:GOSUB 730:TXT$(QQ+1)
    =" "
OE 640 IF PEEK(883)=136 THEN 660
HH 650 PRINT "ERROR ";PEEK(883);"
    DURING TEXT LOAD":STOP
EA 660 CLOSE #3:POKE 766,128:PRINT
    TXT$:FOR I=1 TO 500:NEXT I
    :POKE 766,0:POKE 203,255:RE
    TURN
EF 670 PRINT "{CLEAR}{4 DOWN}{TAB}
    UNABLE TO OPEN ";SPOOL$:PRI
    NT "{TAB}PRESS ";S$;" WHEN
    READY"
AA 680 IF PEEK(CON)<>6 THEN 680
ID 690 GOTO PEEK(186)+256*PEEK(187
    )-10
OJ 700 CLOSE #2:SETCOLOR 2,13,10:S
    OUND 0,30,10,15:XIO 34,#2,2
    ,15,"R":FOR I=1 TO 20:NEXT
    I:XIO 34,#2,3,0,"R"
PN 710 SOUND 0,0,0,0:SETCOLOR 2,9,
    0
LO 720 POKE 766,1:PRINT BR$:POKE 7
    66,0:GOTO 390
JM 730 POKE 834+IOCB*16,7:POKE 836
    +IOCB*16,WW:POKE 837+IOCB*1
    6,XX:POKE 840+IOCB*16,YY:PO
    KE 841+IOCB*16,ZZ
PO 740 K=USR(ADR(PROG2$),IOCB*16)
FO 750 QQ=PEEK(840+IOCB*16)+256*PE
    EK(841+IOCB*16):RETURN
HK 760 PRINT "{CLEAR}{4 DOWN}
    {2 TAB}";U$:POKE 766,1
KG 770 LL=LEN(TXT$):LN=INT(LL/25):
    LN=LN+(LL<>LN*25)
HK 780 FOR I=1 TO LN
DM 790 IF I=LN THEN PRINT #2:TXT$(
    (I-1)*25+1);:GOTO 810
FA 800 PRINT #2:TXT$((I-1)*25+1,I*
    25);
EA 810 STATUS #2,B:BY=PEEK(747):IF
    BY THEN GET #2,A:PRINT CHR
    $(A);:GOTO 810
OM 820 IF PEEK(CON)=3 THEN POP :PO
    KE 203,128:RETURN
CD 830 NEXT I
DP 840 FOR I=1 TO 20
EI 850 STATUS #2,B:BY=PEEK(747):IF
    BY THEN GET #2,A:PRINT CHR
    $(A);:GOTO 850
CG 860 NEXT I
CG 870 PRINT "{TAB}UPLOAD COMPLETE
    ":FOR I=1 TO 500:NEXT I:POK
    E 203,128:POKE 766,0:RETURN
HP 880 SPOOL$="D?*:.*":SPOOL$(2,2)
    =STR$(QQ):POKE 65,3:PRINT C
    HR$(125):CLOSE #5:OPEN #5,6
    ,0,SPOOL$:TRAP 900
PC 890 INPUT #5,SPOOL$:PRINT SPOOL
    $:GOTO 890
DI 900 CLOSE #5:PRINT "PRESS ";S$;
    " TO CONTINUE"
AB 910 IF PEEK(CON)=6 THEN RETURN
GO 920 GOTO 910
CB 1000 DATA 104,104,133,213,104,1
    33,212,104,133,215,104,133
    ,214,104,133,225,104,133,2
    24,169,0,133,207,172,31
HL 1010 DATA 208,192,7,240,115,192
    ,6,208,1,96,192,5,208,35,1
    72,31,208,192,5,240,249,16
    4,203,192,255
AD 1020 DATA 240,93,152,141,254,2,
    73,128,133,203,208,6,169,1
    2,133,217,208,36,169,25,13
    3,217,208,30,192

```


KE 1030 DATA 3,208,67,172,31,208,1
92,3,240,249,164,204,152,7
3,128,133,204,208,6,169,51
133,217,208,4

EC 1040 DATA 169,38,133,217,24,165
224,101,217,141,68,3,165,
225,105,0,141,69,3,169,14,
141,72,3,169

CN 1050 DATA 0,141,73,3,169,11,141
66,3,162,0,32,86,228,169,
0,240,2,240,134,173,252,2,
201,255

PC 1060 DATA 240,54,162,32,169,11,
157,66,3,169,0,157,72,3,15
7,73,3,162,16,157,72,3,157
73,3

IH 1070 DATA 169,7,157,66,3,32,86,
228,201,126,208,4,169,8,20
8,6,201,155,208,2,169,13,1
62,32,32

CH 1080 DATA 86,228,164,204,208,50
165,17,208,9,169,128,133,
17,133,207,96,240,243,162,
32,169,13,157,66

LL 1090 DATA 3,32,86,228,173,235,2
201,0,240,163,169,7,157,6
6,3,169,0,157,72,3,157,73,
3,32

BA 1100 DATA 86,228,192,154,240,21
0,164,203,208,10,162,0,129
212,230,212,208,2,230,213
201,13,208,4,169

PB 1110 DATA 155,208,20,201,7,208,
4,169,253,208,12,201,8,208
4,169,126,208,4,201,32,14
4,22,160,11

PK 1120 DATA 140,66,3,160,0,140,72
3,140,73,3,162,0,32,86,22
8,165,203,208,142,165,215,
197,213,144

PL 1130 DATA 16,240,2,208,132,165,
214,197,212,144,6,240,4,16
9,0,240,131,169,255,133,20
3,165,224,141,68

KN 1140 DATA 3,165,225,141,69,3,16
9,13,141,72,3,169,0,141,73
3,169,11,141,66,3,162,0,3
2,86

BA 1150 DATA 228,169,0,141,254,2,2
40,213

AK 2000 DATA 155,205,197,205,207,2
10,217,160,198,213,204,204
155,205,197,205,211,212,2
07,210

GH 2010 DATA 197,160,207,206,160,1
55,205,197,205,211

LL 2020 DATA 212,207,210,197,160,2
07,198,198,155,200,193,204
198,160,196,213,208,204,1
97,216,160,155

LN 2030 DATA 198,213,204,204,160,1
96,213,208,204,197,216,160
155

HO 2040 DATA 211,212,193,210,212

ND 2050 DATA 212,197,210,205,201,2
06,193,204

BM 2060 DATA 213,208,204,207,193,1
96,201,206,199,155,194,210
197,193,203,155,104,104,1
04,170,76,86,228

JN 2070 DATA 32,128,6,141,14,210,1
69,0,133,17,96

AO 2080 POKE 842,13: ? "{CLEAR}":PO
SITION 2,6:FOR I=1000 TO 1
150 STEP 10: ? I:NEXT I: ? "
CONT":POSITION 0,0:STOP :L
IST 100,260

JA 2090 ? "{CLEAR}":POSITION 2,6:F
OR I=10 TO 65 STEP 5: ? I:N
EXT I: ? "CONT":POSITION 0,
0:STOP :LIST 100,260

LB 2100 ? "{CLEAR}":POSITION 2,6:F
OR I=2000 TO 2150 STEP 10:
 ? I:NEXT I: ? "G.2160":POS
ITION 0,0:STOP

IH 2110 CLOSE #2:OPEN #2,13,0,"R":
XIO 40,#2,0,0,"R"

AK 2120 IRQ=PEEK(534)+256*PEEK(535
):CLOSE #2

PA 2130 NWHAND=0:IF PEEK(IRQ+6)=18
2 AND PEEK(IRQ+7)=35 THEN
NWHAND=1

FK 2140 IF NWHAND THEN FOR I=1 TO
3:READ A:POKE 8457+I,A:NEX
T I:FOR I=1 TO 8:READ A:PO
KE 1663+I,A:NEXT I

KI 2150 RETURN

DP 2160 POKE 842,12:RETURN

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IBM Pie Chart Maker

Michael Posner

This useful program takes the raw figures you enter (up to nine items) and automatically translates them into percentages to create perfectly proportioned pie charts, in color. It requires an Enhanced Model PCjr with Cartridge BASIC or a PC with a disk drive, BASICA, and the color/graphics adapter.

"IBM Pie Chart Maker" uses the medium-resolution graphics screen (SCREEN 1) to create easily understood pie charts. You need no programming ability to use Pie Chart Maker, and a help screen is always available.

If you want to generate a hard copy printout of a chart, be sure to load the DOS screen-dump utility after booting your system disk (type GRAPHICS at the DOS prompt with the DOS disk in the drive, before loading BASIC). Then, to make a screen dump, switch on the graphics printer and press SHIFT-PrtSc (press Fn-P on the PCjr).

Menu Options

When you run Pie Chart Maker, an option menu appears on the screen:

- 1 Create a pie chart
- 2 Save current chart
- 3 Load chart
- 4 Alter current chart
- 5 Clear current data
- 6 Print chart on screen
- 7 Help
- 8 Exit Pie Chart Maker

To perform one of the functions, press the corresponding number key.

Option 1 is described in detail in the next section.

Option 2, "Save current chart," asks you to specify a filename for the chart. When the file is saved, control returns to the menu.

Option 3, "Load chart," prompts for the filename of the chart you wish to load. After it is loaded, the menu reappears. Please note that loading a chart erases any chart in memory.

Option 4, "Alter current chart," lets you change data in a chart. Pie Chart Maker lists the current values and asks for the number to be changed. Enter this number, then the new value(s). These are substituted, and again the program asks for the number to be changed. Entering a zero returns you to the menu.

Option 5, "Clear current chart," erases the chart in memory. As a precaution, the program asks for verification before executing this command.

Option 6 prints the chart on the screen. As mentioned above, use the PrtSc key to reproduce the chart on the printer.

Option 7 calls up the help and instructions screen. Press the space bar to return to the menu.

Option 8 exits Pie Chart Maker and returns to BASIC. Again, the program asks for verification.

Creating A Pie Chart

Creating a pie chart is easy. Let's say you wish to chart the annual budget of a small computer company with the money distributed as follows:

Purpose	Amount
1. Research and Development	\$20,000
2. Production	\$18,000
3. Employee wages	\$13,000
4. Advertising	\$11,000
5. Other expenses	\$10,000

The first prompt after selecting Option 1 on the menu is "Name of chart?" An appropriate entry would be "Annual Budget." For "Number of items?" you would enter the number 5. Pie Chart Maker accepts up to nine data items. For "Number 1?", enter 20,000, and for "Name 1?", enter R & D. Note that names longer than ten characters are shortened to ten in the print on screen mode. Enter the other four data items for the budget accordingly.

The next prompt asks, "Are you using a color monitor (0 = color, 1 = no color)?" Enter the appropriate answer. Then Pie Chart Maker exits to the menu.

Program breakdown:

20-90: Set variables and error trap, go to menu.
100-250: Create chart.
260-270: See if chart is defined.
280-300: Clear variables, draw main circle and initial ray.
310: Set up main loop, choose color.
320-350: Find point for line, draw line.
370-420: Fill with PAINT.
440-500: Fill with LINES from center.
510-570: Fill with arcs.
590-630: Draw circle portions for key.
640-880: Choose filler and fill circle portions.
890-950: Print percentages, name of chart, return to menu.
960-1100: Print options, go to selected option.
1110-1150: Error trapping.
1160-1260: Save chart.
1270-1340: Load chart.
1350-1430: Help and instructions screen.
1440-1580: Alter data.
1590-1620: Clear chart data.
1630-1660: Exit to BASIC.
1670-1810: Find percentages.

Variables:

XC x coordinate of main circle.
MR radius of main circle.
XK x coordinate of circle portions of key.
PX x coordinate for placing percentage.
XL x coordinate for placing data name.
CL,SL point on circle to which ray is drawn.
NG\$ name of graph.
CV color: 0=yes, 1=no.
N number of items.
XL(N) datum number n.
X(N) percentage for datum number n.
N\$(N) name for datum number n.
YP(N) coordinate for n\$(n) (percent printed at YP-1).

Programming Notes

Pie Chart Maker first computes the percentage of each figure you enter. Then it draws the main circle. It converts percentages to degrees, and then to radians. The BASIC trigonometry functions sine (sin) and cosine (cos) are used to segment the main circle according to the percentages computed for the various data items. As each portion is drawn, it is filled in one of three ways. The PAINT statement of BASIC is the first choice. A second choice is a series of rays from the center of the circle to the edge. Third is arcs of decreasing radii. All these may be done in three colors.

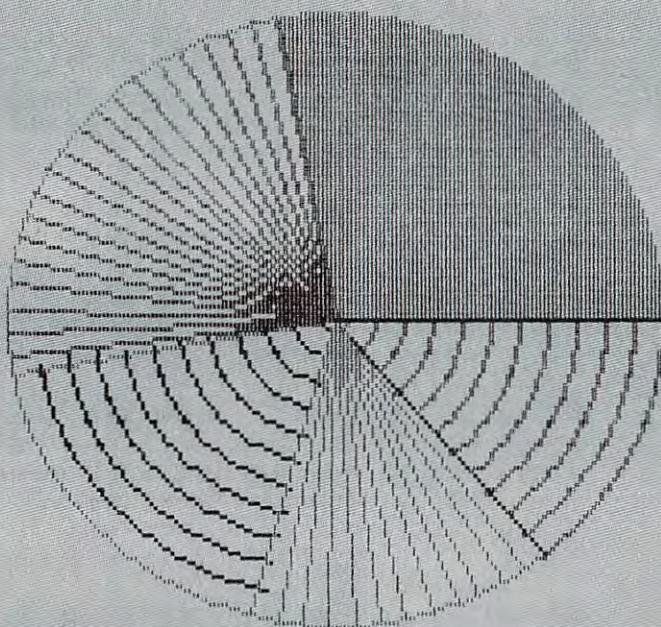
Next, the program prints the key at the right of the screen. The circle portions are plotted using a circle command within a FOR-NEXT loop, and then are filled in the same way as the portions of the main circle they represent. Finally, the program prints the percentages and labels.

IBM Pie Chart Maker

Refer to "COMPUTE!'s Guide For Typing In Programs" article before typing this program in.

```
GC 20 KEY OFF:ON ERROR GOTO 1110
PK 30 XC=99:MR=80:XK=205:PX=29:XL=30
EO 40 FOR X=1 TO 9:READ A:YP(X)=A:NEXT
```

Annual Budget



27.78%
R & D

25.01%
Product' n

18.06%
Wages

15.27%
Advert' ng

13.88%
Expenses


```

:REM y coordinate for chart I.D.
IA 50 DATA 3,6,8,11,13,16,18,21,23
CA 60 FOR X=1 TO 9:READ Y:C(X)=Y:NEXT:
    REM color and type of filler
CE 70 DATA 1,5,9,4,8,3,7,2,6
PP 80 PI=3.141593
PO 90 GOTO 960
FG 100 CLS:PRINT TAB(34)"Create chart"
PD 110 PRINT:PRINT
OJ 120 INPUT"Name of chart ";NG$
OI 130 NG$=LEFT$(NG$,26)
KK 140 INPUT"Number of entries (2-9)";
    N
IF 150 IF N>9 OR N=0 THEN 100
JO 160 FOR X=1 TO N
ND 170 PRINT"Number"X;:INPUT X1(X)
BI 190 PRINT"Name"X;:INPUT N$(X)
DB 200 IF N$(X)="" THEN N$(X)=N$(X-1)
GA 210 NEXT X
KJ 220 INPUT"Are you using a color mon
    itor (0=Y,1=N)";Y$
JN 230 CV=VAL(Y$)
HE 240 GOSUB 1670
NG 250 RETURN
NC 260 IF N<>0 THEN 280
NC 270 PRINT:PRINT"No chart defined":F
    OR Z=1 TO 2000:NEXT:RETURN
NA 280 S=0:CO=0:R=0:S1=0:C1=0:CO=0:S2=
    0:C2=0:CR=0:RO=0:SP=0:D=0
HE 290 SCREEN 1,0:IF CV=0 THEN SCREEN
    1,1
EL 300 LINE (XC,99)-(XC+MR,99),1
AF 310 CS=0:FOR X=1 TO N:CS=CS+1:CO=C(
    CS)
BA 320 D=3.6*X(X)+D:R=D*(PI/180):S=SIN
    (R):C=COS(R):REM find point on
    circle
IH 330 S1=-((5/6)*MR*S)+99:C1=(MR*C)+X
    C
NM 340 CIRCLE (XC,99),MR,CO
IJ 350 LINE (XC,99)-(C1,S1),CO:REM dra
    w line to point
BM 360 IF CO>3 THEN 430
GD 370 REM paint area
JG 380 R1=(R-RO)/2+RO:C2=COS(R1)*MR+XC
    :S2=-((SIN(R1)*MR*5/6)+99
JE 390 C2=C2-SGN(C2-XC):S2=S2-SGN(S2-9
    9)
GC 400 PAINT(C2,S2),CO,CO
KH 410 CN=C(CS+1):LINE (XC,99)-(C1,S1)
    ,CN
ID 420 GOTO 580
CH 430 IF CO>6 THEN 520
PE 440 REM lines from center
CK 450 CL=CO-3:FOR A=RO TO R STEP .08
GD 460 C3=(COS(A)*MR)+XC:S3=-((SIN(A)*M
    R*(5/6))+99
BG 470 LINE (XC,99)-(C3,S3),CL
JK 480 NEXT A
EB 490 IF CL<3 THEN LINE (XC,99)-(C3,S
    3),C(CS+1)
IA 500 GOTO 580
IN 510 REM arcs
MG 520 SP=CO-6
CM 530 FOR CR=MR TO 1 STEP -7
FM 540 IF R>2*PI THEN R=2*PI
KP 550 CIRCLE (XC,99),CR,SP,RO,R
CB 560 NEXT CR
GI 570 IF SP<3 THEN LINE (XC,99)-(C1,S
    1),C(CS+1)
HG 580 RO=R:NEXT X:CIRCLE (XC,99),MR,3
    :CIRCLE (XC,99),MR+1,3
DH 590 REM draw circle portions for ke
    y
CD 600 FOR C=20 TO (N-1)*20+20 STEP 20
CH 610 CK=C(C/20):CK=CK-(3*INT(CK/3)):
    IF CK=0 THEN CK=3
DM 620 CIRCLE (XK,C),15,CK,-PI/4,-3*PI
    /4
OI 630 NEXT
KB 640 FOR Z=1 TO N
HI 650 CM=C(Z):IF CM<4 THEN GN=1:GOTO
    680
OH 660 IF CM>6 THEN GN=3:GOTO 680
CG 670 GN=2
OP 680 CN GN GOSUB 720,760,840:REM CHO
    OSE FILLER FOR PORTION
OE 690 NEXT
FC 700 GOTO 900
NM 710 REM paint portion
LK 720 CC=CM-INT(CM/3)*3:IF CC=0 THEN
    CC=3
DM 730 YC=15+(20*(Z-1))
CE 740 PAINT (XK,YC),CC,CC:GOTO 880
OJ 750 REM lines from center
LC 760 CC=CM-INT(CM/3)*3:IF CC=0 THEN
    CC=3
BP 770 YC=20+(20*(Z-1))
NP 780 FOR RC=PI/4 TO 3*PI/4 STEP .3
HM 790 CS=COS(RC)*15+XK
EH 800 SC=YC-SIN(RC)*15*5/6
MB 810 LINE (XK,YC)-(CS,SC),CC
NI 820 NEXT:GOTO 880
ID 830 REM arcs
LP 840 CC=CM-INT(CM/3)*3:IF CC=0 THEN
    CC=3
BM 850 YC=20+(20*(Z-1))
OP 860 FOR CR=12 TO 2 STEP -3
DB 870 CIRCLE (XK,YC),CR,CC,PI/4,3*PI/
    4:NEXT
EO 880 YP=YP(Z):LOCATE YP,XL:PRINT LEF
    T$(N$(Z),10):RETURN
BN 890 REM print percentages
KM 900 FOR Z=1 TO N
DM 910 YP=YP(Z):LOCATE YP-1,PX
GA 920 PRINT USING"###.##";X(Z):LOCATE
    YP-1,PX+6:PRINT "%":NEXT
HB 930 GO=(27-LEN(NG$))/2:LOCATE 2,GO:
    PRINT NG$:REM print name of gra
    ph
NM 940 IF INKEY$(">") THEN 940
NM 950 RETURN
HF 960 SCREEN 0,0:WIDTH 80:CLS:PRINT T
    AB(29)"IBM Pie Chart Maker"
BJ 980 PRINT:PRINT
PP 990 PRINT TAB(29)"1-Create a pie ch
    art"
DG 1000 PRINT TAB(29)"2-Save current c
    hart"
JC 1010 PRINT TAB(29)"3-Load chart"

```



```

LA 1020 PRINT TAB(29)"4-Alter current
      chart"
EB 1030 PRINT TAB(29)"5-Clear current
      data"
LG 1040 PRINT TAB(29)"6-Print chart on
      screen"
KC 1050 PRINT TAB(29)"7-Help"
NB 1060 PRINT TAB(29)"8-Exit Pie Chart
      Maker"
ND 1070 PRINT:PRINT:PRINT"Enter functi
      on number:";
LN 1080 F=VAL(INKEY$):IF F<1 OR F>8 TH
      EN 1080
PO 1090 ON F GOSUB 100,1160,1270,1440,
      1590,260,1350,1630
HI 1100 GOTO 960
KC 1110 IF ERL=1300 THEN RESUME 1270
JM 1120 IF ERL=140 THEN PRINT CHR$(30)
      :RESUME 140
CA 1130 IF ERL=170 THEN PRINT CHR$(30)
      :RESUME 170
NF 1140 IF ERL=1470 THEN PRINT CHR$(30)
      :RESUME 1470
NA 1150 ON ERROR GOTO 0:END
FH 1160 SCREEN 0,0:CLS:PRINT TAB(35)"S
      ave chart"
AB 1170 IF N<>0 THEN 1200
KM 1180 PRINT"No chart currently defin
      ed"
PF 1190 FOR X=1 TO 1500:NEXT:RETURN
FC 1200 PRINT:INPUT"Filename to save c
      hart";NS$
GM 1210 FOR Z=1 TO LEN(NS$):IF MID$(NS
      $,Z,1)<>" " THEN NEXT:GOTO 123
      0
AH 1220 PRINT"Please put no spaces in
      filename.":GOTO 1200
NE 1230 OPEN NS$ FOR OUTPUT AS #1
BF 1240 PRINT #1,N:PRINT #1,NS$:PRINT #
      1,CV:PRINT #1,NG$
GL 1250 FOR S=1 TO N:PRINT #1,X1(S):PR
      INT #1,NS$(S):NEXT
OJ 1260 CLOSE #1:RETURN
DA 1270 SCREEN 0,0:CLS:PRINT TAB(35)"L
      oad chart"
DN 1280 PRINT:PRINT:FILES
LA 1290 PRINT:PRINT:INPUT"Filename of
      chart";NL$
GG 1300 OPEN NL$ FOR INPUT AS #1
KB 1310 INPUT #1,N:INPUT #1,NS$:INPUT #
      1,CV:INPUT #1,NG$
NA 1320 FOR L=1 TO N:INPUT #1,X1(L):IN
      PUT #1,NS$(L):NEXT
BO 1330 CLOSE #1:GOSUB 1670
JN 1340 RETURN
DP 1350 CLS:PRINT TAB(23);"IBM Pie Cha
      rt Maker Help & Instructions"
JP 1360 PRINT:PRINT"      This graph uti
      lity makes pie charts from dat
      a you provide. From the menu,
      press <1> to create a chart.
      Enter the name of chart, num
      ber of items, and then each dat
      a item, along with a name to i
      dentify it.
NO 1370 PRINT:PRINT"      Other function
      s include: saving or loading
      a chart, altering data, cleari
      ng data, printing to screen, o
      r exiting the program."
NK 1380 PRINT:PRINT"      To perform on
      e of the above functions, pres
      s the space bar while your cha
      rt is on the screen. This wil
      l take you to the menu. Then
      press the number of the func
      tion you wish to execute."
CM 1400 PRINT:PRINT"      While your cha
      rt is on the screen, hold down
      SHIFT and press PrtSc to send
      the chart to the printer (pr
      ess Fn-P on the PCjr).
GJ 1410 LOCATE 23,25:PRINT"(Press spac
      e bar to continue)"
NP 1420 IF INKEY$<>" " THEN 1420
JM 1430 RETURN
KK 1440 CLS:PRINT TAB(35)"Alter data"
NH 1450 PRINT:PRINT:PRINT"# 1 = "NG$
      (name of chart)":PRINT"# 2 = "C
      V;:PRINT"(0=color/1=no color)"
      :FOR AD=1 TO N
GB 1460 PRINT"#AD+2"="X1(AD)", "N$(AD
      ):NEXT
PO 1470 PRINT:INPUT"Input # to change
      (0 to exit)";NC
UP 1480 IF NC=0 THEN 1570:IF NC<1 OR N
      C>N+3 THEN 1470
OL 1490 IF NC>2 THEN 1540
OH 1500 INPUT"Enter new data";NN1$
PO 1510 IF NC=1 THEN NG$=NN1$
BL 1520 IF NC=2 THEN CV=VAL(NN1$)
OW 1530 GOTO 1440
NB 1540 INPUT"Enter new value (number,
      name)";NN1$,NN2$
BI 1550 NN=VAL(NN1$):X1(NC-2)=NN:N$(NC
      -2)=NN2$
UG 1560 GOTO 1440
OI 1570 GOSUB 1670
KN 1580 RETURN
DL 1590 SCREEN 0,0:CLS:PRINT TAB(35)"C
      lear data"
EM 1600 PRINT:PRINT:INPUT"Are you sure
      ";S$
OE 1610 IF S$<>"y" AND S$<>"Y" THEN RE
      TURN
GG 1620 RUN 20
BI 1630 CLS:PRINT TAB(35)"Exit to BASI
      C"
FI 1640 PRINT:PRINT:INPUT"Are you sure
      ";S$
PA 1650 IF S$<>"y" AND S$<>"Y" THEN RE
      TURN
BG 1660 SCREEN 0,0:WIDTH 80:CLS:END
BK 1670 REM compute percentages
ML 1690 SU=0:FOR M=1 TO N:SU=SU+X1(M):
      NEXT
MF 1700 X1(Z)=0:FOR Z=1 TO N:X(Z)=X1(Z
      )/SU*100:NEXT
JC 1730 RETURN

```


Random Access DATA Statements For Apple

Robert Jacques Beck

By adding this short routine to your programs, you can gain random access to any piece of information stored in DATA statements—a powerful and useful technique. It works on all Apple II-series computers with either DOS 3.3 or ProDOS.

Any byte in Random Access Memory (RAM) can be immediately accessed during a read or write by specifying its address. *Random access* data files offer the same type of quick access: You locate records by specifying record numbers. Records may be retrieved in any order.

Serial, or *sequential*, access is based on the principle of starting with the first record and counting up to the one you want. Sequential access is usually slower than random access. While it takes approximately the same amount of time to read any record in an Applesoft random access file, the time required to read an identical record in a sequential file increases as the record is placed towards the file's end. This is because DOS must traverse each record in the file to count end-of-record marks until it locates the record it is searching for.

DATA statements in BASIC provide an in-memory sequential access file. You begin by reading the first DATA statement, and you move sequentially through the data list with each successive READ.

Until I figured out the technique described in this article, I'd always been annoyed at the rigidity of DATA statements. They're fine if you want to access your data the same way your DATA statements are organized, but they are difficult to use any other way within the confines of BASIC. Some BASICs use the RESTORE command to reset a pointer to the beginning of the data, but that's not where you always want to go. A few BASICs, such as Atari BASIC, let you RESTORE to a specific line number or even a variable, providing much more flexibility. But many BASICs (including Applesoft) lack this feature.

You can get flexibility by reading all your DATA statements into arrays and using an index

to grab array elements. But storing variables as data and as arrays can be costly in terms of memory. Another approach is to read through the data each time until you get to the element you want, using code such as this:

```
10 RESTORE
20 FOR I = 1 TO N
30 READ INFO
40 NEXT I
```

After these lines have been executed, the variable INFO is equal to the Nth data element. The major disadvantage of this method is its slowness.

Flexible Data

Fortunately, there are a couple of zero-page pointers that let us manipulate the READ operation. The two short programs included here illustrate how to pull variables directly out of DATA statements as if they were in random access files.

In the Apple, decimal locations 123 and 124 (hexadecimal \$7B and \$7C) store the line number of the last DATA statement read. Locations 125 and 126 point to the data's absolute memory location. The pointers are stored in the usual Apple fashion; that is, the first memory location is the low byte (lower two hexadecimal digits) and the second memory location is the high byte (upper two hexadecimal digits). To translate the information in the pointers into a line number that makes some sense, use this formula:

```
LN = PEEK(123) + PEEK(124)*256
```

It may seem strange that the upper two digits are both multiplied by 256 when you convert to decimal. After all, while one of the digits is the 256 digit, the other is the 4096 digit (just as the third and fourth digits in a decimal number represent hundreds and thousands). But since Applesoft multiplies a byte's upper digit by 16 when you PEEK, and since $4096 = 16 \times 256$, you don't have to convert each digit separately.

Back to the pointers. Unfortunately, you can't use the line number pointer to do anything. It's just a tag-along to the memory pointer: To move from one data location to another, that's the pointer you'll need to adjust. There are a couple of ways to go about it.

Random Languages

Program 1 prints a memory location table of all the stuff in your DATA statements. Lines 60000 and 60010 print the table's heading. Line 60015 stops the program after the last of the DATA statements are read; line 60020 reads the DATA one variable at a time. Line 60030 calculates the pointer location just after a READ and line 60040 calculates the current line number. Line 60050 checks to see if the current line number is the same one which was just read—if it isn't, the position index (I = a variable's position within a DATA statement) is initialized. Line 60060 prints the table, one row at a time. Just tack these lines onto your program, anywhere after the last DATA statement. If you use the line numbers from Program 1 (60000–60090), then RUN 60000 to get your table.

Program 2 is a whimsical little program that shows one way to use the information from Program 1. Lines 70 to 100 read and print a list of three languages in English. Line 50 reads some memory locations into the array ML. These memory locations were obtained from Table 1. Pick which language you want the list printed in next. Line 115 sets the variable LOC to the memory location of the appropriate DATA statement. Lines 120 and 130 break the memory location into high and low bytes, then lines 140 and 150 reset the pointer so the list will be read from the correct DATA statement.

No matter how many times you cycle through the program, you'll always get the list printed in the language you want, and you'll never get an END OF DATA message.

The table is what Program 1 does when attached to Program 2. Since the locations are calculated *after* a READ, to locate a variable use the value from the immediately preceding variable.

An alternate method is to add or subtract the difference between the pointer's current value and new value it must have in order to point to a variable. Try these changes in Program 2:

```
10 DATA ENGLISH,-32,SPANISH,0,FRENCH,38
20 DATA INGLES,-75,ESPAÑOL,-38,FRANCES,0
30 DATA ANGLAIS,-114,ESPAÑOL,-82,FRANCAIS,-39
40 REM
50 REM
80 READ A$(I),ML(I)
115 LOC = ML(W) + PEEK (125) + PEEK (126)*256
```

Line 80 now reads not only the variable, but also a number that is added to the pointer in line 115. The advantage here is that we're relying on the separation between variables, rather than their actual memory locations.

Insert the three DATA statements into the program anywhere you wish. As long as you don't change the relative position of any data, you can edit the program without affecting how the data is handled.

Line No.	Position	Location	Variable
10	1	2058	2068
10	2	2063	2096
10	3	2068	2124
20	1	2081	ENGLISH
20	2	2089	SPANISH
20	3	2096	FRENCH
30	1	2108	INGLES
30	2	2116	ESPAÑOL
30	3	2124	FRANCES
40	1	2137	ANGLAIS
40	2	2146	ESPAÑOL
40	3	2155	FRANCAIS

Generated By Combining Program 1 and Program 2

Program 1: Random Access DATA—Table Generator

```
60000 PRINT "LINE #" SPC( 3)"POSITION"
      SPC( 3)"LOCATION" SPC( 3)"VARIABLE"
60010 FOR I = 1 TO 40: PRINT "-": NEXT I
60015 ONERR GOTO 60090
60020 READ A$
60030 LOC = PEEK (125) + PEEK (126) *
      256
60040 NL = PEEK (123) + PEEK (124) *
      256
60050 IF NL < > LN THEN I = 1:LN = NL
60060 PRINT NL SPC( 10 - LEN ( STR$ (
      LN))) SPC( 10 - LEN ( STR$ (I)))
      LOC SPC( 11 - LEN ( STR$ (LOC)))A$
60070 I = I + 1
60080 GOTO 60020
60090 END
```

Program 2: Random Access DATA—Demonstration

```
10 DATA 2068,2096,2124
20 DATA ENGLISH,SPANISH,FRENCH
30 DATA INGLES,ESPAÑOL,FRANCES
40 DATA ANGLAIS,ESPAÑOL,FRANCAIS
50 READ ML(1),ML(2),ML(3)
60 HOME
70 FOR I = 1 TO 3
80 READ A$(I)
90 PRINT I SPC( 3)A$(I): PRINT
100 NEXT I
110 INPUT "WHICH ONE?":W
115 LOC = ML(W)
120 HB = INT (LOC / 256)
130 LB = LOC - HB * 256
140 POKE 125,HB
150 POKE 126,HB
160 GOTO 60
```


Multiplication Part 1

Many microprocessors don't have a multiplication instruction, including the 6502. But to do math, to efficiently handle tables, or even to input a multidigit number, a program must be fruitful, and multiply.

Classic Simplicity

The easiest way to perform multiplication is repeated addition. This is much too simple, and we tend to avoid it. Yet for very small numbers it can be reasonably efficient. If you have a small number in X and wish to multiply the contents of address \$0390 by X, placing the results into addresses \$0391 (high) and \$0392 (low), you might code:

```
LDA    #$00
STA    $0391
LOOP   CPX    #$00
      BEQ    EXIT
      DEX
      CLC
      ADC    $0390
      BCC    LOOP
      INC    $0391
      BCS    LOOP
      ; complete the job here
EXIT   STA    $0392
```

It's very simple. If the result is known to fit into a single byte, the coding can be shortened even more. If X contains a high value, however, this kind of program becomes time-consuming.

To examine the classic method of multiplication, we should try an example in decimal notation to see how it works:

$$\begin{array}{r} 246 \\ \times 123 \\ \hline 738 \\ 492 \\ 246 \\ \hline 30258 \end{array}$$

The steps are: multiplying (by each digit), shifting over to a new column, and addition. Ex-

actly the same steps will be used in binary, but they become simpler. Multiplication will be either times 0 or times 1 (giving zero or the original multiplicand). Shifting a column changes to shifting a bit; this could be a left or right rotation depending on which way we're going. And addition can be performed by the ADC command as we generate the various intermediate products. Let's look at some simple binary multiplication.

Multiplying Bits

$$\begin{array}{r} 11010 \\ 101 \\ \hline (a) 11010 \\ (b) 00000 \\ (c) 11010 \\ \hline 10000010 \end{array}$$

The decimal equivalent of this multiplication is 26×5 equals 130; but it's more interesting to see the binary workings. The intermediate values that we add (lines a and c) correspond to the original multiplicand, appropriately shifted. There's a zero in there too (line b), but a multiplication program wouldn't go to the trouble of adding zero. Instead, it would skip the addition.

It doesn't matter in principle if we shift the multiplicand left or right; we'll end up with the same result. In practice, we usually employ a trick. We don't shift the multiplicand at all; instead, we shift the *product* as it is generated. Thus, we would work the above example backwards: We would start with line (c) and put the value 11010 into the product area. Backing up to line (b), we'd shift the product left (giving 110100). The appropriate multiplier bit would be zero, so we'd skip the addition. Back up to line (a), shifting the product again (and getting 1101000). Now we spot a 1 bit at the right of the multiplier, so we add the multiplicand once again; 1101000 plus 11010 gives 1000010, our answer.

We'll talk more about the general multiplication procedure next time. By extracting the same logic for specific numbers, we can generate very fast multiplication algorithms.

For example, often you'll need to multiply a number by ten decimal. If a program receives decimal values typed in by the user, each digit will be added to the previous value times ten. Example: If the user has typed in 23 and now types 4, the 23 must be multiplied by ten to give 230; then we add the 4 to get 234.

A Shifty Solution

Let's examine the binary representation for ten decimal: 1010. If we keep in mind the procedure described above, we can do the job easily. Start with the high bit (1, of course). Starting with a product of zero, add in the value to be multiplied by ten. (For the sake of example, let's say that it is 23.) Shift it left; since the next bit is a zero, we won't add. Shift it left again (by this time the 23 has achieved a value of 92); the next bit of the multiplier is a 1, so we add the original value of 23 (giving 115). Shift left again; the final bit is zero, so no addition. Result: 230.

You might like to try your hand at working through the logic of multiplying by 60—binary 111100. It ends up as add (or load); shift-add; shift-add; shift-add; shift; shift.

Shifts become "long shifts" when applied to numbers over one byte long. ASL becomes ASL-ROL for two bytes, or ASL-ROL-ROL for three bytes. Depending on the programmer's knowledge of the values, it may be necessary to check for overflow—the result may be too big to fit the space provided.

Let's write a simple routine for a Commodore machine to input a two-digit decimal number. We'll need to multiply the first digit by ten.

```
; print question mark
LDA    #$3F
JSR    $FFD2
; get first digit
DIG1   JSR    $FFE4
; reject illegal keys
CMP    #$30
BCC    DIG1
CMP    #$3A
BCS    DIG1
; echo and convert to binary
JSR    $FFD2
AND    #$0F
; store in work area; multiply by ten
STA    $0380
ASL    A
ASL    A
ADC    $0380
ASL    A
```

Note that we don't need to check for overflow or clear the carry flag before addition. We

know the digit is less than ten; we know that the shifts will produce values well within one byte's range, and that the carry will be cleared by the shifts.

```
; store results; get next digit
STA    $0380
DIG2   JSR    $FFE4
; reject illegal keys
CMP    #$30
BCC    DIG2
CMP    #$3A
BCS    DIG2
; echo and convert to binary
JSR    $FFD2
AND    #$0F
; add previous digit
CLC
ADC    $0380
```

The two-digit number is now a binary value in the A register. The program will probably continue by storing it somewhere. There's no ambiguity on size: The result fits within one byte, since it can't be over 99.

Next month we'll talk about general multiplication: any number by any other number. ©

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TELECOMPUTING TODAY

Arlan R. Levitan

Smokey & The Modem—Part 8086

I live in the greater Detroit area, a hotbed of muscle cars and micros. In this town it's hard to miss the fact that America's involvement with microcomputers shares a lot of overtones with its longstanding love affair with the automobile.

The image of T-shirted car enthusiasts discussing the displacement and horsepower of their chariot engines while Bruce Springsteen tunes play in the background comes readily to mind when you hear the name *Motown*. But in this and other towns, you're just as likely to find corporate and casual computer users congregating and speaking in reverent tones about the capacity of their hard disks and the cycle times of their central processing units.

Motor cars and micros. Both encourage a fascination with speed and power. And while General Motors, Ford, Chrysler, and American Motors are still fighting a pitched battle against foreign manufacturers for the hearts and minds of the car-buying public, IBM, Apple, Commodore, Tandy, and Atari are girding themselves for an expected onslaught of Japanese MSX-standard computers.

The marketing type who coined the term "power user" to describe personal computer owners who can't get enough memory or a fast enough CPU had a firm grip on the ego-related realities of the micro market. Reminding an avid power user that faster processors, massive mass storage, and megabyte memories don't necessarily let you write text or enter spreadsheet data twice as fast is about as fruitful as discussing the 55 mph speed limit with the owner of a 1967 Plymouth Road Runner running a Hemi-Head engine.

Souped-Up Modems

All this discussion of speed has a point. I've received a number of inquiries from readers about what kind of modem they should purchase. In particular, there seems to be a lot of interest in the new high-speed 2400 bits per second (bps) modems appearing on the scene.

The major factor which determines the price of a modem is the maximum speed at which it can send and receive data over the phone lines. A low-speed modem's top rate is 300 bps, equivalent to about 30 characters per second. These modems range in price from \$50 to \$280, depending on what other features are included. They're often referred to as *Bell 103-compatible* (Bell 103 is a phone company standard).

Bell 212-compatible modems can handle data transmissions at both 300 and 1200 bps. They used to cost \$500 to \$700, but recent developments in chip technology have allowed several manufacturers—notably Anchor Automation and Qubie Corporation—to break the \$300 price barrier with full-featured 300/1200 bps modems. Industry projections indicate that by 1986, these medium-speed modems will dominate the consumer market and typically list for under \$200.

The new kids on the block are the 2400 bps modems. Although they are twice as fast as 1200 bps units and operate on standard voice-grade phone lines, they also command a premium price (\$800 to \$1,500). Sometimes these 2400 bps modems are referred to as CCITT (*Consultative Committee on International Telephony and Telegraphy*) V.22 units—by those who own the Telecommunications Edition of *Trivial Pursuit*. Some 2400 bps units are also capable of 1200 and 300 bps transmission.

The terms *high*, *medium*, and *low* speed refer to transmissions over regular (voice-grade) telephone lines, the kind you have in your home. True high-speed transmissions aren't practical on these lines. Instead, specially prepared *conditioned* lines are required by businesses which transmit data at rates from 9600 to 57,600 bps. Both the conditioned lines and the high-speed modems are expensive and are limited to point-to-point transmissions. The line is permanently installed between two locations and cannot be used to access the regular telephone network. Of course, conditioned lines are out of the question for most of us.

Judging A Modem By Its Baud

You'll often see the term *baud* when reading about transmission speeds. Modems will be advertised as "1200 baud" or "2400 baud." But strictly speaking, this is an improper use of terminology. Baud (named after Georges Baudot, a telecommunications pioneer) is used to describe the division of each second into tiny, discrete pieces (also called *signal modulation*) by a modem's electronic circuitry.

A 300 bps modem's signal is indeed modulated at 300 baud. Since each tiny division holds one bit of data, the effective transmission rate is calculated as 300 baud per second times one bit per baud, or 300 bits per second (bps).

Things take a different turn with 1200 bps modems. You might expect each second to be divided into 1200 pieces. This is not the case. A 1200 bps modem actually divides each second into 600 pieces. Using a technique called four-level phase shift keying (psk for short), each piece can represent a string of two bits.

This isn't as complicated as it may seem. All it means is that by using a method that plays with the phase characteristics of the modem's signal, each baud can be in one of four binary phases, namely:

00 or 01 or 10 or 11

There you have it. Each baud can be in one of four phases, with each representing exactly two bits. Multiply 600 baud per second times two bits per baud and *voilà!* You get 1200 bits of information per second (1200 bps).

Even More Bits Per Baud

Knowing this, it may come as no surprise to learn that 2400 bps modems also use a modulation rate of 600 baud. What is different is the method of phase shift keying. A 2400 bps modem uses a method that yields 16-level phase shift keying, so each piece or baud can represent a string of four bits:

0000 0001 0010 0011
0100 0101 0110 0111
1000 1001 1010 1011
1100 1101 1110 1111

So with a 2400 bps modem, each baud can be in one of 16 phases, with each representing exactly four bits. Multiply 600 baud per second times four bits per baud and we get (drumroll, please . . .) 2400 bits of information per second.

That's why you should avoid terms like *1200 baud* and *2400 baud* when describing modems. Both are actually 600 baud units which use clever schemes to pack more than one bit per baud. Use *bits per second* (bps) instead.

This information can really come in handy for small talk at user group parties; it's a lot more

impressive to computer hobbyists than crushing a dozen aluminum beverage cans into your forehead.

Do You Need The Speed?

Under most transmission schemes in use today, it actually takes ten bits to send one character of data. Therefore, the approximate character transmission speeds of 300, 1200, and 2400 bps modems under optimal conditions are 30, 120, and 240 characters per second, respectively.

Is the extra cost of a medium- or high-speed modem a worthwhile investment for you? That depends on your telecomputing style.

Do you plan to make heavy use of commercial information services such as CompuServe, The Source, Delphi, or Dow Jones News/Retrieval? Since none of the commercial services offers 2400 bps service yet, spending big bucks on a 2400 bps modem is not a good bet. Why don't they offer 2400 bps service? Because there has to be a 2400 bps modem on both ends of the connection—yours and theirs. Since very few people own 2400 bps modems right now, information services wouldn't get much return on their investment in 2400 bps equipment while the price of the new technology is relatively high.

Besides, medium-speed 1200 bps units offer a very good price/performance value. However, you must balance the shorter connect times made possible by faster modems against any surcharges imposed on the higher transmission rates.

Here's a quick example. Suppose Steven J. is a frequent user of the Just Folks Information Service. Steve calls only during the evening (referred to as non-prime time by the commercial information services) and spends about five hours a month on Just Folks with his 300 bps modem. Assume that Just Folks' hourly charges are \$7.75/hour for 300 bps, non-prime time access; plus a \$3/hour surcharge for 1200 bps, non-prime time access. Steve's yearly cost for accessing Just Folks at 300 bps is:

$$\$7.75/\text{hour} * 5 \text{ hours/month} * 12 \text{ months/year} = \$465$$

If Steve upgraded to a 1200 bps modem, he'd reduce his yearly cost to:

$$\$10.75/\text{hour} * 1.25 \text{ hours/month} * 12 \text{ months/year} = \$161.25$$

The money Steve saves in a year would pay for a brand-new 1200 bps modem!

The Point Of Diminishing Returns

Admittedly, this is an ideal case. It assumes that armed with a 1200 bps modem, Steve will stay on-line only one quarter of the time that he

would with his 300 bps unit. Depending on exactly what he's doing, the reduction may not be so dramatic, but under this rate structure a 1200 bps modem looks extremely attractive.

Now let's suppose that Just Folks decides to bite the bullet and support 2400 bps. Assume that to recoup its investment in the new equipment, the service tacks on an \$8/hour surcharge for non-prime time 2400 bps access. Steven J.'s yearly bill would be:

$\$15.75/\text{hour} * .625 \text{ hours/month} * 12 \text{ months} =$
 $\$118.13$

Although upgrading from 300 to 1200 bps saved Steven about \$300, the difference between 1200 and 2400 bps is only a little over \$40 for the year! The key in this example is the additional surcharge for 2400 bps.

You can use this method to estimate your operating costs for accessing information services, computer-based bulletin board systems, or school computers. Just plug in the appropriate numbers for your intended use.

Hurry Up And Wait

The cost effectiveness of a medium- or high-speed modem also depends on how quickly the remote system responds to commands typed in from your computer. When the remote system is heavily loaded with users, slow response times are very common. In fact, if the system is very busy, a 1200 bps user can wait just as long as a 300 bps user for requests to be processed, and data may be transmitted to you in spurts rather than a continuous stream, lowering the effective transmission rate.

I've been logged onto some information services during the evening (8:00 p.m. to midnight Eastern Standard Time) at 1200 bps and have clocked effective transfer rates below 300 bps. In these cases, there's no advantage to 1200 bps—it actually costs more than using a low-speed unit for the same amount of data. A 2400 bps modem would be even more expensive overkill.

If you're a night owl, you'll find the best effective transmission speeds on the commercial services between 1:00 a.m. and 7:00 a.m. EST.

Response time is usually no problem on Bulletin Board Systems (BBSs). Since you are typically the only person using a BBS at any one time, the remote system can devote its full attention to you alone, so your transmission rate is preserved.

The Future Of 2400 Bps

Does the lack of support for 2400 bps bode ill for the acceptance of the new high-speed modems? While it certainly doesn't help matters, there is some hope for life in the fast lane.

Many 2400 bps modem manufacturers see the thousands of popular BBS systems run by hobbyists as the key. Since a BBS needs only one modem, the investment is more manageable by the individual or club operating the system.

Several of these manufacturers are reported to be working with the system operators of a number of popular bulletin boards to start a seed program for 2400 bps modems. By special arrangement, 2400 bps modems will be made available to selected system operators at prices very close to that of 1200 bps modems.

Industry-wide support of such a project would be welcome indeed. If significant numbers of bulletin boards support 2400 bps, it will provide a real incentive for everyone else to acquire high-speed modems. Since BBSs typically do not charge for connect time, it would cost users nothing extra to access them at 2400 bps. The only charges are for long-distance phone calls, and those charges are based only on the duration of the call. The additional cost of a 2400 bps modem can be recovered fairly quickly.

As the numbers of 2400 bps users grow, one of the major commercial information services will move to offer 2400 bps service and its competitors will quickly follow. The greater the perceived size of the 2400 bps market, the lower the extra 2400 bps surcharges will be.

Taking The Plunge

So we come to where the rubber meets the road. Should you spend the extra dollars today on a 2400 bps modem?

The economic case is weak at best. The short-term potential savings are low, considering the limited support of 2400 bps at this time.

On the other hand, computing, like cars, is a personal experience for many people. Critics can drone on and on for years about why it's inappropriate for humans to relate to machines. But it doesn't change the fact that driving down the road in a convertible with the wind in your hair and finding the last bug in a program are both kicks. Using a 2400 bps modem on good old regular phone lines is a lot like driving a Shelby AC Cobra with a 289 cubic-inch V-8. There may not be many places you can run flat out, but it can be a heck of a lot of fun when you do.

Two advantages of a 2400 bps modem over a Shelby Cobra: It costs about \$60,000 less and you'll never get a speeding ticket.

BCNU.

Arlan R. Levitan
The Source: TCT987
CompuServe: 70675,463
Delphi: ARLANL

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COMPUTE!'s Guide To Typing In Programs

Before typing in any program, you should familiarize yourself with your computer. Learn how to use the keyboard to type in and correct BASIC programs. Read your manuals to understand how to save and load BASIC programs to and from your disk drive or cassette unit. Computers are precise—take special care to type the program *exactly* as listed, including any necessary punctuation and symbols. To help you with this task, we have implemented a special listing convention as well as a program to help check your typing—the “Automatic Proofreader.” Please read the following notes before typing in any programs from COMPUTE!. They can save you a lot of time and trouble.

Since programs can contain some hard-to-read (and hard-to-type) special characters, we have developed a listing system that spells out in abbreviated form the function of these control characters. You will find these special characters within curly braces. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. Commodore machines have a special control key labeled with the Commodore logo. Graphics characters entered with the Commodore logo key are enclosed in a new kind of special bracket. A graphics character can be listed as [A]. In this case, hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S.

If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (printed in white on black) should be entered with the Atari logo key. Since spacing is sometimes important, any more than two spaces will be listed, for example, as: {6 SPACES}. A space is never left at the end of a line, but will be moved to the next printed line as {SPACE}. There are no special control characters found in our IBM PC/PCjr, TI-99/4A, and Apple program listings. For your convenience, we have prepared this quick-reference key for the Commodore and Atari special characters:

Atari 400/800/XL

When you see	Type	See
{CLEAR}	ESC SHIFT <	⌘ Clear Screen
{UP}	ESC CTRL -	↑ Cursor Up
{DOWN}	ESC CTRL =	↓ Cursor Down
{LEFT}	ESC CTRL +	← Cursor Left
{RIGHT}	ESC CTRL *	→ Cursor Right
{BACK S}	ESC DELETE	⌫ Backspace
{DELETE}	ESC CTRL DELETE	⌫ Delete character
{INSERT}	ESC CTRL INSERT	⌫ Insert character
{DEL LINE}	ESC SHIFT DELETE	⌫ Delete line
{INS LINE}	ESC SHIFT INSERT	⌫ Insert line
{TAB}	ESC TAB	⌫ TAB key
{CLR TAB}	ESC CTRL TAB	⌫ Clear tab
{SET TAB}	ESC SHIFT TAB	⌫ Set tab stop
{BELL}	ESC CTRL 2	⌫ Ring buzzer
{ESC}	ESC ESC	⌫ ESCape key

Commodore PET/CBM/VIC/64

When You Read:	Press:	See:	When You Read:	Press:	See:
{CLR}	SHIFT CLR/HOME	⌘	{GRN}	CTRL 6	⌘
{HOME}	CLR/HOME	⌘	{BLU}	CTRL 7	⌘
{UP}	SHIFT ↑ CRSR	⌘	{YEL}	CTRL 8	⌘
{DOWN}	↓ CRSR	⌘	{F1}	f1	⌘
{LEFT}	SHIFT ← CRSR	⌘	{F2}	f2	⌘
{RIGHT}	→ CRSR	⌘	{F3}	f3	⌘
{RVS}	CTRL 9	⌘	{F4}	f4	⌘
{OFF}	CTRL 0	⌘	{F5}	f5	⌘
{BLK}	CTRL 1	⌘	{F6}	f6	⌘
{WHT}	CTRL 2	⌘	{F7}	f7	⌘
{RED}	CTRL 3	⌘	{F8}	f8	⌘
{CYN}	CTRL 4	⌘			
{PUR}	CTRL 5	⌘			

The Automatic Proofreader

Also, we have developed a simple, yet effective program that can help check your typing. Type in the appropriate Proofreader program for your machine, then save it for future use. On the VIC, 64, or Atari, run the Proofreader to activate it, then enter NEW to erase the BASIC loader (the Proofreader will still be active, hidden in memory, as a machine language program). Pressing RUN/STOP-RESTORE or SYSTEM RESET deactivates the Proofreader. You can use SYS 886 to reactivate the VIC/64 Proofreader, or PRINT USR(1536) to reenable the Atari Proofreader. The IBM Proofreader is a BASIC program that lets you enter, edit, list, save, and load programs that you type. It simulates the IBM's BASIC line editor.

Using The Automatic Proofreader

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a number (on the Commodore) or a pair of letters

(Atari or IBM) appears. The number or pair of letters is called a *checksum*. Try making a change in the line, and notice how the checksum changes.

All you need to do is compare the value provided by the Proofreader with the checksum printed in the program listing in the magazine. In Commodore listings, the checksum is a number from 0 to 255. It is set off from the rest of the line with *rem*. This prevents a syntax error if the checksum is typed in, but the REM statements and checksums need *not* be typed in. It is just there for your information.

In Atari and IBM listings, the checksum is given to the left of each line number. Just type in the program, a line at a time (without the printed checksum) and compare the checksum generated by the Proofreader to the checksum in the listing. If they match, go on to the next line. If not, check your typing: You've made a mistake. On the Commodore and Atari Proofreader, spaces are not counted as part of the checksum, and no check is made to see that you've typed in the characters in the right order. If characters are transposed, the checksum will still match the listing. Because of the checksum method used, do not use abbreviations, such as ? for PRINT. However, the Proofreader does catch the majority of typing errors most people make. The IBM Proofreader is even pickier; it *will* detect errors in spacing and transposition. Also, be sure you leave Caps Lock on, except when you need to enter lowercase characters.

Special Proofreader Notes For Commodore Cassette Users

The Proofreader resides in the cassette buffer, which is used during tape LOADs and SAVEs. Be sure to press RUN/STOP-RESTORE before you save or load a program, to get the Proofreader out of the way. If you want to use the Proofreader with tape, run the Proofreader, then enter these two lines *exactly* as shown, pressing RETURN after each one:

```

A$="PROOFREADER.T":B$="{10 SPACES}"
:FORX=1TO4:A$=A$+B$:NEXT
FORX=886TO1018:A$=A$+CHR$(PEEK(X))
:NEXT:OPEN 1,1,A$:CLOSE1

```

Then press RECORD and PLAY on a blank tape, and a special version of the Proofreader will be saved to tape. Anytime you need to reload the Proofreader after it has been erased, just rewind the tape, type OPEN1:CLOSE1, then press PLAY. When READY comes back, enter SYS 886.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include

many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader will prompt you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program into the normal BASIC environment (this will replace the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert a program to Proofreader format, save it to disk with SAVE "filename",A.

VIC/64 Proofreader

```

100 PRINT "{CLR}PLEASE WAIT...":FORI=886TO1018:READA:CK=CK+A:POKEI,A:NEXT
110 IF CK<>17539 THEN PRINT "{DOWN}YOU MADE {SPACE}AN ERROR":PRINT "IN DATA STATEMENTS.":END
120 SYS886:PRINT "{CLR}{2 DOWN}PROOFREADER ACTIVATED.":NEW
886 DATA 173,036,003,201,150,208
892 DATA 001,096,141,151,003,173
898 DATA 037,003,141,152,003,169
904 DATA 150,141,036,003,169,003
910 DATA 141,037,003,169,000,133
916 DATA 254,096,032,087,241,133
922 DATA 251,134,252,132,253,008
928 DATA 201,013,240,017,201,032
934 DATA 240,005,024,101,254,133
940 DATA 254,165,251,166,252,164
946 DATA 253,040,096,169,013,032
952 DATA 210,255,165,214,141,251
958 DATA 003,206,251,003,169,000
964 DATA 133,216,169,019,032,210
970 DATA 255,169,018,032,210,255
976 DATA 169,058,032,210,255,166
982 DATA 254,169,000,133,254,172
988 DATA 151,003,192,087,208,006
994 DATA 032,205,189,076,235,003
1000 DATA 032,205,221,169,032,032
1006 DATA 210,255,032,210,255,173
1012 DATA 251,003,133,214,076,173
1018 DATA 003

```

Atari Proofreader

```

100 GRAPHICS 0
110 FOR I=1536 TO 1700:READ A:POKE I,A:CK=CK+A:NEXT I
120 IF CK<>19072 THEN ? "ERROR IN DATA STATEMENTS. CHECK TYPING.":END
130 A=USR(1536)
140 ? :? "AUTOMATIC PROOFREADER NOW ACTIVATED."

```



```

150 END
1536 DATA 104,160,0,185,26,3
1542 DATA 201,69,240,7,200,200
1548 DATA 192,34,208,243,96,200
1554 DATA 169,74,153,26,3,200
1560 DATA 169,6,153,26,3,162
1566 DATA 0,189,0,228,157,74
1572 DATA 6,232,224,16,208,245
1578 DATA 169,93,141,78,6,169
1584 DATA 6,141,79,6,24,173
1590 DATA 4,228,105,1,141,95
1596 DATA 6,173,5,228,105,0
1602 DATA 141,96,6,169,0,133
1608 DATA 203,96,247,238,125,241
1614 DATA 93,6,244,241,115,241
1620 DATA 124,241,76,205,238,0
1626 DATA 0,0,0,0,32,62
1632 DATA 246,8,201,155,240,13
1638 DATA 201,32,240,7,72,24
1644 DATA 101,203,133,203,104,40
1650 DATA 96,72,152,72,138,72
1656 DATA 160,0,169,128,145,88
1662 DATA 200,192,40,208,249,165
1668 DATA 203,74,74,74,74,24
1674 DATA 105,161,160,3,145,88
1680 DATA 165,203,41,15,24,105
1686 DATA 161,200,145,88,169,0
1692 DATA 133,203,104,170,104,168
1698 DATA 104,40,96

```

IBM Proofreader

```

10 'Automatic Proofreader Version 2.00 (
   Lines 270,510,515,517,620,630 changed
   from V1.0)
100 DIM L$(500),LNUM(500):COLOR 0,7,7:KE
   Y OFF:CLS:MAX=0:LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,CHR$(4)+CHR
   $(70):ON KEY(15) GOSUB 640:KEY (15)
   ON:GOTO 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PRINT"Proofr
   eader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT(LEN(L$)/W
   )-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POKE 1052,34:
   POKE 1054,0:POKE 1055,79:POKE 1056,1
   3:POKE 1057,28:LINE INPUT L$:DEF SEG
   :IF L$="" THEN 150
170 IF LEFT$(L$,1)="" THEN L$=MID$(L$,2
   ):GOTO 170
180 IF VAL(LEFT$(L$,2))=0 AND MID$(L$,3,
   1)="" THEN L$=MID$(L$,4)
190 LNUM=VAL(L$):TEXT$=MID$(L$,LEN(STR$(
   LNUM))+1)
200 IF ASC(L$)>57 THEN 260 'no line numb
   er, therefore command
210 IF TEXT$="" THEN GOSUB 540:IF LNUM=L
   NUM(P) THEN GOSUB 560:GOTO 150 ELSE
   150
220 CKSUM=0:FOR I=1 TO LEN(L$):CKSUM=(CK
   SUM+ASC(MID$(L$,I))*I) AND 255:NEXT:
   LOCATE Y,1:PRINT CHR$(65+CKSUM/16)+C
   HR$(65+(CKSUM AND 15))+""+L$
230 GOSUB 540:IF LNUM(P)=LNUM THEN L$(P)
   =TEXT$:GOTO 150 'replace line
240 GOSUB 580:GOTO 150 'insert the line
260 TEXT$="":FOR I=1 TO LEN(L$):A=ASC(MI
   D$(L$,I)):TEXT$=TEXT$+CHR$(A+32*(A>9
   6 AND A<123)):NEXT

```

```

270 DELIMITER=INSTR(TEXT$," "):COMMAND$=
   TEXT$:ARG$="":IF DELIMITER THEN COMM
   AND$=LEFT$(TEXT$,DELIMITER-1):ARG$=M
   ID$(TEXT$,DELIMITER+1) ELSE DELIMITE
   R=INSTR(TEXT$,CHR$(34)):IF DELIMITER
   THEN COMMAND$=LEFT$(TEXT$,DELIMITER
   -1):ARG$=MID$(TEXT$,DELIMITER)
280 IF COMMAND$<>"LIST" THEN 410
290 OPEN "scrn:" FOR OUTPUT AS #1
300 IF ARG$="" THEN FIRST=0:P=MAX-1:GOTO
   340
310 DELIMITER=INSTR(ARG$,"-"):IF DELIMIT
   ER=0 THEN LNUM=VAL(ARG$):GOSUB 540:F
  IRST=P:GOTO 340
320 FIRST=VAL(LEFT$(ARG$,DELIMITER)):LAS
   T=VAL(MID$(ARG$,DELIMITER+1))
330 LNUM=FIRST:GOSUB 540:FIRST=P:LNUM=LA
   ST:GOSUB 540:IF P=0 THEN P=MAX-1
340 FOR X=FIRST TO P:N$=MID$(STR$(LNUM(X
   )),2)+""
350 IF CKFLAG=0 THEN A$="":GOTO 370
360 CKSUM=0:A$=N$+L$(X):FOR I=1 TO LEN(A
   $):CKSUM=(CKSUM+ASC(MID$(A$,I))*I) A
   ND 255:NEXT:A$=CHR$(65+CKSUM/16)+CHR
   $(65+(CKSUM AND 15))+""
370 PRINT #1,A$+N$+L$(X)
380 IF INKEY$<>" " THEN X=P
390 NEXT :CLOSE #1:CKFLAG=0
400 GOTO 130
410 IF COMMAND$="LLIST" THEN OPEN "lpt1:
   " FOR OUTPUT AS #1:GOTO 300
420 IF COMMAND$="CHECK" THEN CKFLAG=1:GO
   TO 290
430 IF COMMAND$<>"SAVE" THEN 450
440 GOSUB 600:OPEN ARG$ FOR OUTPUT AS #1
   :ARG$="":GOTO 300
450 IF COMMAND$<>"LOAD" THEN 490
460 GOSUB 600:OPEN ARG$ FOR INPUT AS #1:
   MAX=0:P=0
470 WHILE NOT EOF(1):LINE INPUT #1,L$:LN
   UM(P)=VAL(L$):L$(P)=MID$(L$,LEN(STR$(
   VAL(L$)))+1):P=P+1:WEND
480 MAX=P:CLOSE #1:GOTO 130
490 IF COMMAND$="NEW" THEN INPUT "Erase
   program - Are you sure";L$:IF LEFT$(
   L$,1)="" OR LEFT$(L$,1)="" THEN MA
   X=0:GOTO 130:ELSE 130
500 IF COMMAND$="BASIC" THEN COLOR 7,0,0
   :ON ERROR GOTO 0:CLS:END
510 IF COMMAND$<>"FILES" THEN 520
515 IF ARG$="" THEN ARG$="A:" ELSE SEL=1
   :GOSUB 600
517 FILES ARG$:GOTO 130
520 PRINT"Syntax error":GOTO 130
540 P=0:WHILE LNUM>LNUM(P) AND P<MAX:P=P
   +1:WEND:RETURN
560 MAX=MAX-1:FOR X=P TO MAX:LNUM(X)=LNU
   M(X+1):L$(X)=L$(X+1):NEXT:RETURN
580 MAX=MAX+1:FOR X=MAX TO P+1 STEP -1:L
   NUM(X)=LNUM(X-1):L$(X)=L$(X-1):NEXT:
   L$(P)=TEXT$:LNUM(P)=LNUM:RETURN
600 IF LEFT$(ARG$,1)<>CHR$(34) THEN 520
   ELSE ARG$=MID$(ARG$,2)
610 IF RIGHT$(ARG$,1)=CHR$(34) THEN ARG$
   =LEFT$(ARG$,LEN(ARG$)-1)
620 IF SEL=0 AND INSTR(ARG$,".")=0 THEN
   ARG$=ARG$+".BAS"
630 SEL=0:RETURN
640 CLOSE #1:CKFLAG=0:PRINT"Stopped.":RE
   TURN 150
650 PRINT "Error #";ERR:RESUME 150

```


NEWS & PRODUCTS

Atari Printer Interface

Microbits Peripheral Products has announced MicroPrint and MPP-1150, printer interfaces that work on all Atari computers.

The MicroPrint is compatible with all software and connects to the computer's serial bus. A four-foot cable with Centronics plug is included.

Suggested retail price is \$79.95.

Microbits Peripheral Products
225 Third Avenue SW
Albany, OR 97321

Commodore 64 Speech Synthesizer

Currah Technology has announced the *Voice Messenger-Speech 64*, a \$49.95 speech synthesizer for the Commodore 64.

The unit plugs into the cartridge port of the 64, does not take any RAM from BASIC work space, and allows computing while talking. With built-in software, the *Voice Messenger* lets the computer talk immediately when powered up.

The system uses an allophone-based synthesizer chip which allows individual speech sounds to be strung together to make intelligible speech. The *Voice Messenger* is two and a half inches square and three-quarters of an inch deep. Its output is carried to the auxiliary 64 sound input and reproduced through the television

or monitor speaker. Any word, sentence, or paragraph in English can be spoken. BASIC commands such as SAY and KOFF facilitate use. The *Voice Messenger* also allows the keys to talk individually as they are pressed.

Currah Technology
50 Milk Street
15th Floor
Boston, MA 02109

Apple, Atari, Commodore Strategy/Adventure Games

Rails West!, a strategy game which simulates the development of the railway system in the United States, and *Questron*, a role-playing fantasy, are two new releases from Strategic Simulations, Inc.

Up to eight players can take part in the action of *Rails West!*, which might include starting a corporation; taking over existing companies; buying and selling stocks and bonds; applying for a loan; or floating securities.

The country's economic situation in the late 1800s, from boom times to panics, also is a factor in the game.

In *Questron*, the mission is to seek out the diabolical Wizard Mantor and take the Book of Evil Magic, thereby saving the Questron empire. Hordes of creatures and monsters unleashed by Mantor are waiting to defeat you as you wander through the land building character traits.

Questron, available on disk,

retails for \$39.95 for the Commodore 64 version. The Apple and Atari disk versions retail for \$49.95. *Rails West!* retails for \$39.95 on disk for Commodore 64, Apple, and Atari computers.

Strategic Simulations, Inc.
883 Stierlin Road, Building A-200
Mountain View, CA 94043-1983

Fantasy Game, Graphics Utility For Apple

Xyphus, a fantasy role-playing game, and *Cat Graphics*, a utility program, have been released for Apple computers by Penguin Software.

Xyphus is a series of scenarios with continuing characters, featuring four-player independent movement and a variety of spells. Each scenario takes several hours to play, and all are linked together in a larger game.

Play occurs in the world of Arroya. Goblins and forces of demonic magic are in control of Arroya, but anyone who can slay Xyphus will gain a kingdom within the continent.

Xyphus retails for \$34.95 on disk.

Cat Graphics adds 55 new commands to Applesoft BASIC and is designed to make creating and using graphics on the Apple much easier. The same commands can be used for both standard (Apple II and II+) and double high-resolution graphics (Apple IIc and extended IIs).

There are 108 colors available in standard high resolution, and 256 in the double high-resolution mode. Using the

graphics commands eliminates the need to do PEEKs, POKEs, and CALLs. Sound and other commands are also included.

New drawing commands include Curve, Fill, Magnify, Line, Flip, and Reflect, and other commands allow text display on the graphics screen.

In addition, the electronic kaleidoscope program *Electric Fire* is also included in the \$34.95 retail price.

Penguin Software
830 4th Avenue
P.O. Box 311
Geneva, IL 60134

Atari Programming Aid

As an accompaniment to its ACTION! cartridge, Optimized Systems Software, Inc., has announced *The ACTION! ToolKit*, a programming enhancement for Atari computers.

Included are utilities which allow player/missile graphics, the use of floating point numbers in ACTION!, turtle graphics, dynamic runtime memory allocation, and advanced I/O operations. Demonstration programs also are included.

The ACTION! ToolKit is available on disk for \$39.95.

Optimized Systems Software, Inc.
1221B Kentwood Avenue
San Jose, CA 95129

Apple II Graphics Printing Program

A graphics printing program, *Printographer*, by Roger Wagner Publishing, Inc., has been introduced for the Apple II line, including the Apple IIc.

The software is designed to print any low-resolution or high-resolution graphics pictures directly to the printer or to disk. It works with any of more than 50 printers, including the Apple Imagewriter and the Apple

Scribe.

The *Printographer* also allows the addition of any of eight different type styles for labeling pictures, and allows magnification of pictures up to 99 times.

Printographer has a suggested retail price of \$39.95 for all versions.

Roger Wagner Publishing, Inc.
10761 Woodside Avenue, Suite E
P.O. Box 582
Santee, CA 92071

Atari, Commodore Light Pen Graphics And Art Program

Futurehouse has announced *Peripheral Vision*, a graphics and art program for use with the Edumate Light Pen.

Features include 15 different colors and six brush stroke widths; printing capabilities; 35 different textures; fill mode; mirror mode for kaleidoscopic effects; and zooming for detailed work.

The program also will draw circles, squares, and triangles automatically; copy and move shapes around the screen; adjust the speed and accuracy of the light pen; and place keyboard characters on the screen.

Peripheral Vision is available on disk or cassette for the Commodore 64 and Atari 400/800 and XL series of computers. Suggested retail price is \$39.95. A combination package which includes the Edumate Light Pen is available for \$59.95.

Futurehouse
P.O. Box 3470
Chapel Hill, NC 27514

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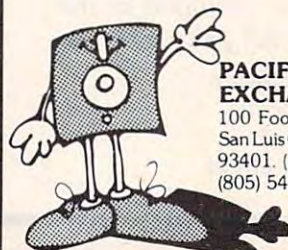
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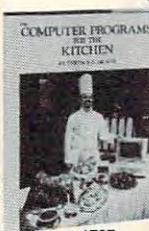
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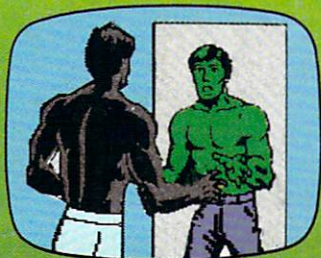
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