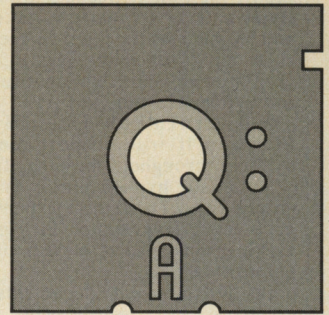


■ EDITED BY CHARLES PETZOLD

# PC TUTOR



*PC Tutor answers your questions on everything from programming and operating systems to hardware and applications software.*

## BASIC GRAPHICS ON THE MOVE

I would like to program games that I could play on the IBM PC, but I can't find out how to make graphics other than the LINE command and the CIRCLE command. Is there another way I can generate graphics in BASIC?

An 11 year old in need of help,

Kevin Carr  
Dallas, Texas

*Graphics have become an increasingly important part of software packages. If you master games at 11, you'll be doing dynamite business applications at age 22.*

*The usual procedure in BASIC is to draw an object using a combination of LINE, CIRCLE, PSET (for individual dots), and DRAW (for complex figures). Next, read the object drawn on the screen into an array, using the GET statement.*

*Once you have an object stored in an array, you can move it around the screen with the PUT statement. Figure 1 shows a small BASIC program that draws a rather crude Mercedes Roadster with me behind the wheel (I wish), so I can drive it across the screen.*

*A good way to learn programming is to study other people's programs. You might want to dig down into the BASIC programs included with PC-DOS for some graphics techniques. In particular, the DONKEY .BAS game—dumb as it may be—contains most of the principles of programming moving graphics in BASIC.*

## SUPERCHARGING JUNIOR

I use a PCjr and have a question that may be of interest to many PCjr owners. In a recent article ("Striving for Practical Perfection," PC Magazine, Volume 4 Number

16), Peter Norton mentioned that if he could have things his way, he would increase the clock speed on the PC AT. I'd like to know if it is possible to increase the clock speed on the PCjr and, if so, how you go about it? I'm hoping a little kick in the pants might improve the PCjr's performance.

Mark W. Hall  
West Bloomfield, Michigan

*In short, no it isn't. But you can learn a few things from "no" answers, so I won't stop at a simple denial.*

*In PC News ("AT Speed Thrills on Cheap Crystal," PC Magazine, Volume 4 Number 4, page 35), Bill Harts showed how PC AT owners can replace the 12-MHz crystal in the AT with a 16-MHz crystal and thereby increase processor speed by a third (along with voiding your warranty, possibly damaging your machine, and forever wondering if the strange things that your brand-new expansion card does are because of your speed greed). [We have not yet heard of anyone's actually harming his AT by using the faster crystal.—Ed.]*

*This little trick cannot be pulled on a regular PC, PC-XT, or PCjr, however. These machines use a 14.31818-MHz crystal. That frequency is divided by 3 to get the 4.77-MHz clock signal used for the 8088 microprocessor. The first reason for not using a higher-frequency crystal is that the normal 8088 is rated for only 5 MHz; 4.77 MHz is nearly at that maximum already. If you get too far above it, the microprocessor may not work at all.*

```

100 SCREEN 1 : COLOR 17,0 : CLS
110 DIM CAR%(122) : KEY OFF
120 LINE (0,100)-(25,106),3,BF 'car body
130 CIRCLE (3,108),3,1 'rear tire
140 CIRCLE (22,108),3,1 'front tire
150 LINE (20,100)-(18,94),1 'windshield
160 CIRCLE (13,97),2,2 'driver
170 GET (0,94)-(25,111),CAR% 'read car
180 FOR X% = 0 TO 285 STEP 5
190 PUT (X%,94),CAR% 'erase car
200 PUT (X% + 5,94),CAR% 'draw car
210 SOUND 37+X%/10,3-X%/100 'engine noise
220 NEXT X%
```

**Figure 1:** A BASIC program to demonstrate moving graphics. The program draws a car, reads it into an array, and then drives it across the screen.

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## ■ PC TUTOR

*On the PCjr system board, the 14.31818-MHz frequency is divided by 4 to get the 3.58-MHz color-burst signal required for your display. (On the PC and XT, the 3.58-MHz signal is available on the bus, but the color/graphics adapter derives its own 3.58-MHz clock from the 14-MHz clock also on the bus.)*

*And if it's not enough that you won't be able to use your display, the basic 14-MHz clock is divided by 6 to get 2.38 MHz and then by 2 to get 1.19 MHz, which drives the 8253 timer chip. Thus, with a faster crystal you won't be able to tell what time it is, either. Nor should you forget about the PCjr's serial printer port and the internal modem, because the 14 MHz is divided by 8 to get the 1.7895 MHz used for the baud clock.*

*So how do PC AT owners get away with supercharging their machines with such relative impunity? Simple: The AT system board has a separate 14.31818-MHz crystal used to generate the normal clock rates that PC peripherals have come to know and rely on.*

*Although the processor speed of the PCjr is the same as the PC and PC-XT, disk access is slower because of the lack of direct memory access (see the answer to "A DEBUG Oddity," in PC Tutor, PC Magazine, Volume 4 Number 24). To satisfy your original desire to give a little kick to the junior, however, you might try using a RAMdisk for heavy compilations, database management, and word processing. You mentioned in your original letter that your PCjr has 512K bytes, so you can probably fit a 160K RAMdisk in with no problem. While the DOS 2.1 Technical Reference manual lists a VDISK program, you'll do better upgrading to DOS 3.1, which has a VDISK.SYS program all ready to use.*

### A 370 IN A PC

I have a question about IBM's 370 option kit for the AT or XT. What exactly does the 370 processor do, and why does the option cost about \$3,800?

Johann Weber  
New York, New York

*The XT/370 was introduced over 2 years ago, about the same time as the PCjr and the 3270-PC. All three machines were dis-*

*cussed in PC Magazine, Volume 3 Number 1, which is interesting to reread in retrospect. At the time, various industry experts predicted that the arrival of the XT/370 signaled the end of open architecture for the PC, indicated a strong trend toward UNIX, and spelled death for the IBM-compatible market. Said one IBM watcher: "We don't know how bad it's going to be until we see the bodies start floating to the*

■ AT owners can speed up their machines because the AT system board has a separate 14.31818-MHz crystal to generate the normal clock rates that PC peripherals rely on.

*surface." Fortunately, of course, it hasn't been all that bad.*

*In the same issue, a PC Magazine contributing editor predicted that the PCjr would have a bigger and more profound impact than the original PC. This is a tough industry in which to make accurate predictions, however, and since people who attended the XT/370 press conference still speak of the machine in awed tones, the fervor at the time is not surprising.*

*The XT/370 and AT/370 get their names from IBM's System/370. Introduced by IBM in 1970, the System/370 still dominates the mainframe world. Its primary advantage over the previous System/360 (introduced in 1964) is the support of virtual memory. Virtual memory involves swapping chunks of memory to and from disk storage. This makes it appear as if the machine's usable memory capacity is much larger than it actually is.*

*Rudimentary forms of virtual memory have been used in a number of PC programs. For example, "overlay" (.OVL) files are sometimes used to hold parts of a program on disk until they are actually needed. When they are loaded, they tem-*