READ ALL ABOUT IT

When Sinclair Research designed Spectrum BASIC, the company took care to allow more experienced programmers to bypass some of its limitations. Here we present an explanation of how to read directly from the Spectrum's keyboard, and give a simple program to move a 'graphics pen' under keyboard control.

BASIC allows you to enter information from the keyboard using INPUT and INKEY$. The INPUT statement reads a number or string of characters, terminated by ENTER, to a numeric or string variable. The INKEY$ function scans the keyboard and returns either a string containing the character of the key pressed or, if no key is pressed, an empty string. These are both useful commands, but for some applications — for example, when combinations of keys must be read simultaneously — the IN function can be used to read the keyboard directly.

The keys on the Spectrum are connected to the Z80 microprocessor through input/output ports. There are 65536 input/output ports, and each one can be addressed individually. In the same way that PEEK and POKE are used to read or write to memory, IN and OUT are used to read and write to input/output ports. The function IN(m) will return the value of the port m, while the statement OUT(m,n) will write the value n to port m.

The keyboard consists of four rows of 10 keys, each row being divided into two half-rows of five keys. Each half-row maps onto a port as shown. Notice that the keys in the left-hand half-rows map to their ports from right to left, but that the right-hand half-rows map left to right.

The rightmost five bits of a port each map onto a key, and will take the value 0 if the corresponding key is pressed, or 1 if it is not. The bits marked X are unspecified — they can hold either a one or a zero. This means that the value of IN(m) will be undefined. This problem can be overcome by setting the value of the top three bits to zero in software by using the following instruction:

$$\text{DEF FN } a(p) = p - \text{INT}(p/32) * 32$$

where p is the value in the port — the undefined byte returned by IN(m). The division p/32 will give a number from 0 to just under 8. Taking INT(p/32) will discard the fractional part of this number, leaving an integer value from 0 to 7. Multiplying this by 32 then gives a value representing the top (leftmost) three bits of p.

In Touch

The Spectrum keyboard comprises eight blocks of five keys, each block being constantly monitored by a dedicated byte, or 'port'. Each key maps onto one bit of its port; while a key is held down, its 'signal' bit switches from one (its normal state) to zero. Here, keys Y, I and O are being pressed so the binary value of their port, byte 57342, is XXX01001 — bits 5 to 7 are undefined. Similarly, A and S are being pressed, so the value of byte 65022 is XXX11100

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