Map Reading

High-level languages like Basic manage memory automatically; otherwise we need a detailed layout of the memory in order to find our way around the computer

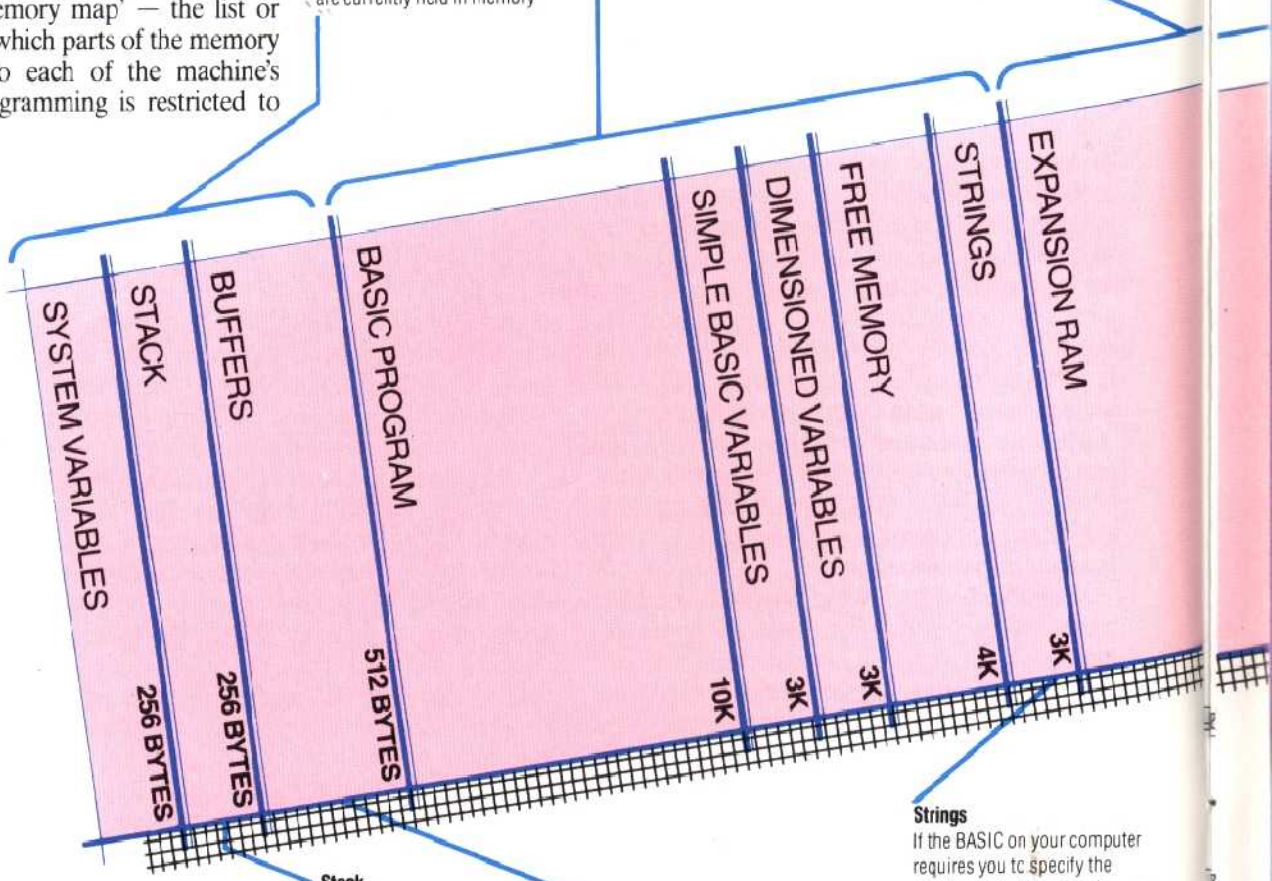
The CPU at the heart of a computer has an addressing range that determines the maximum number of memory locations it can access, and for most home computers this is 64 Kbytes. That memory space must contain all the RAM and ROM that comes with the machine, any expansion RAM or ROM that can be added on, and all the special interfacing chips and ports, which are regarded by the CPU as memory locations as well. One of the most important aspects of the design of a computer is the 'memory map' — the list or diagram that specifies which parts of the memory space are allocated to each of the machine's functions. If your programming is restricted to BASIC then you don't need to know about the memory map in any detail. But if you venture into machine code, or have ideas about building your own hardware add-ons, then it becomes of vital importance.

On these pages we show what a typical memory map contains. Our example is closer to a 6502-based system than one based on a Z80, but most features are common to both. Some manufacturers print a complete map in the user's handbook, while others remain very tight-lipped about the design. However, you will usually find that some user group has managed to work it all out by experimentation.

System Overhead
A computer with 4 Kbytes of RAM may in fact have only 3 Kbytes available to the user for programs. The difference is the system overhead, a section of the RAM that is reserved by the operating system whenever the machine is switched on. Part of this is used for system variables, such as temporary values when computing complex expressions, and pointers to where various things are currently held in memory

User RAM
The size of this determines the sophistication of the programs that you can run, and is perhaps one of the most important considerations when buying a home computer

Empty
Space for expansion RAM must be reserved in the memory map. Some systems permit more than 64 Kbytes to be added on, but this is generally 'bank switched' — a special circuit switches the relevant section of RAM into, and out of, the memory map as needed



Stack
This reserved section of memory is for the exclusive use of the CPU and is organised as a LIFO (Last In/First Out) data structure. A byte can be either 'pushed' onto the top of the stack or 'popped' from the top back into the CPU. When a GOSUB routine is performed in BASIC, for example, the CPU will push onto the top of the stack the location in memory to which it eventually has to RETURN. The stack is extensively used when evaluating arithmetic expressions, and in FOR . . . NEXT loops

Buffers
A keyboard buffer must be reserved in memory so that characters aren't lost if they are entered faster than the program can process them. A cassette buffer is also required, because most operating systems write data to cassette in blocks

Strings
If the BASIC on your computer requires you to specify the length of all strings in advance, then they will be stored in a table in the same way as dimensioned variables. If, however, it has 'dynamic strings' that can change in length, then the actual data will be stored separately in an area of memory that is constantly changing in size. At intervals, the operating system will instigate a 'garbage collection' that simply cleans up the string area and removes data that is obsolete