7 Levels of Computer Language

You will remember that we said that the computer can understand only the language of binary numbers: these numbers are coded to represent symbols or operations that must be carried out in the computer. Sometimes the binary numbers are called binary codes or machine codes or, simply, machine language.

Writing programs that consist only of binary numbers is possible, and this was done in the early days of programming, but the work is extremely tedious. Also, it requires either a superb memory or constant reference to 'look-up' tables to remind us of what it is that the binary number represents (as when we look up the meaning of a word in a dictionary). In most cases, for the convenience of the programmer, the programs are written in languages that lie above the machine language base.

Languages above the machine language base are described as either low level languages or high level languages. Low level languages use various combinations of

A microchip integrated circuit: the language that is used at this hardware level is machine language (binary codes) (courtesy of Ferranti)
abbreviations to make it easier for the programmer to remember the various operations: these abbreviations are memory aids or mnemonics, LD meaning LOAD, for example. In addition, denary numbers are expressed as hexadecimal numbers (which use a base of sixteen instead of a base ten).

Assembly language programs are divided into fields: a label field, instruction field, operand field and comments field. The processor works only on the first three fields, the comments field is to make programs more understandable to readers.

<table>
<thead>
<tr>
<th>Label</th>
<th>Instruction</th>
<th>Operand</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>P7</td>
<td>LDX</td>
<td>START + 15_16</td>
<td>Get address number</td>
</tr>
</tbody>
</table>

This tells the computer an address number which contains an instruction.

This instructs the computer to load whatever is in the operand into a register named X.

This is an address number. It will be loaded into register X.

High level languages, such as BASIC or COBOL, use the denary number system for data values or line numbers along with command or function words from general English (PRINT, LET, GOTO, ELSE, and so on). As a rough rule, the easier it is for a newcomer to computing to read a computer program, then the higher is the language level.

All languages above the machine language base produce a so-called source code. At the machine language base we have the object code which the computer responds to, works with and understands. The following diagram shows the relationship between source code, object code and language levels.

The problem with all these different language levels is that we have to connect them together so that they can communicate: they must be allowed to speak to each