
GCSE
OCR
Computer Science
J277
4
Translators and facilities of languages
Unit 8
Logic and languages
PG ONLINE

Objectives

- Describe the characteristics and purpose of different levels of programming language, including:
  - Low-level languages
  - High-level languages
- Understand the purpose of translators
- Describe the characteristics of a compiler and interpreter

Starter

- Name **five** programming languages
  - Are there any major differences between each of them?

```
if ( typeof types === "object" ) {

     // ( types-Object, selector, data )
     if ( typeof selector !== "string" ) {

          // ( types-Object, data )
          data = data || selector;
          selector = undefined;
     }
     for ( type in types ) {
          on( elem, type, selector, data, types[ type ], one );
     }
     return elem;
}
```

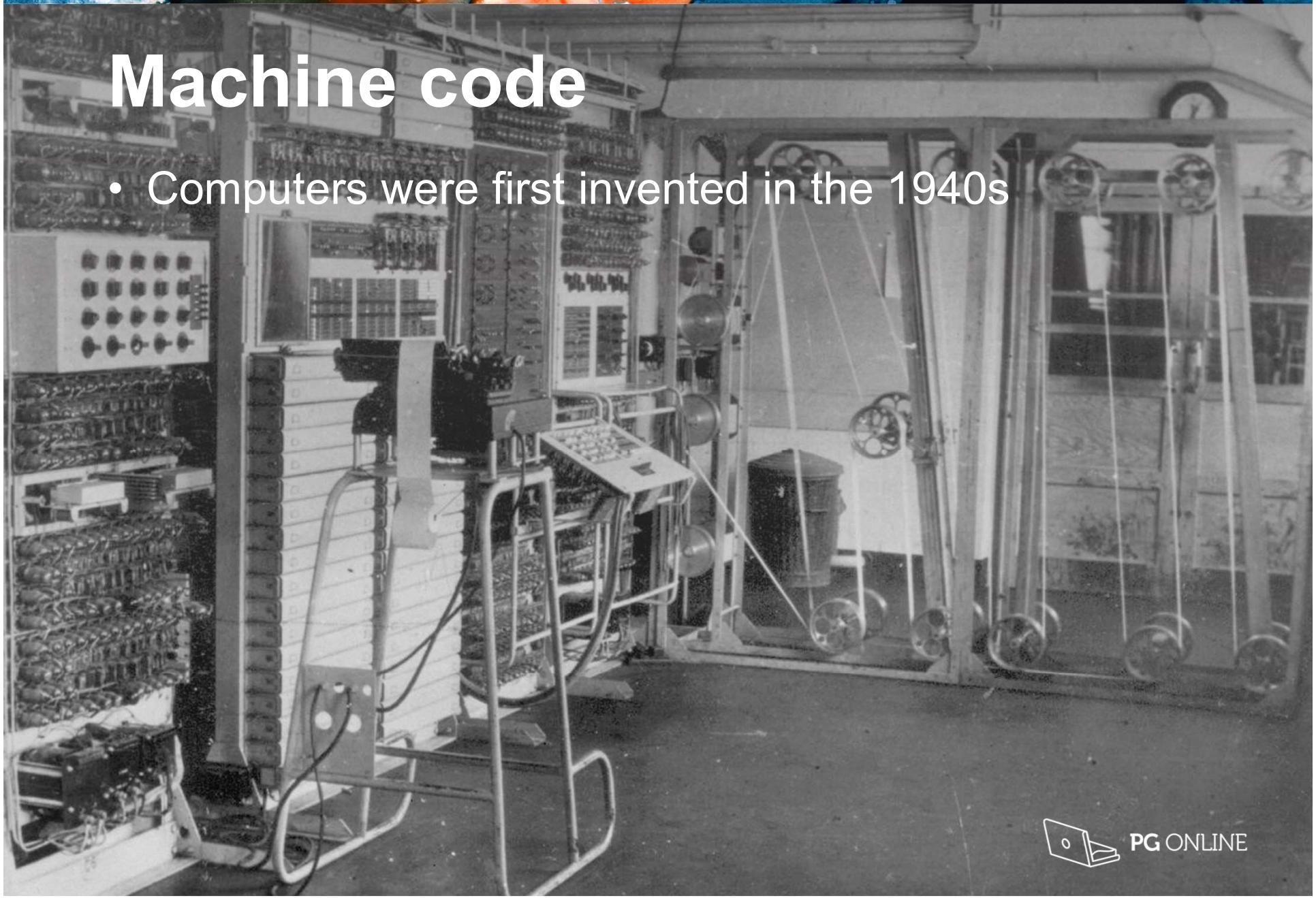
Starter

Answers

- High-level Programming languages
  - Python, Visual Basic, C#, Java, C++, PHP, Delphi, Logo
- Query languages
  - SQL
- Markup languages
  - HTML, XML
- Low-level Programming languages
  - Assembly language

Machine code

- Computers were first invented in the 1940s



Machine code

- In the first computers, all programs were written in machine code
- Instructions were written in binary, so a typical instruction looked like this:

101011001001

- Each instruction did one very small task like

LOAD the value 1 into the accumulator

- Writing programs was difficult and time-consuming

Assembly language

- Assembly language allows a programmer to create programs more easily that writing in machine code
  - Each assembly language instruction maps directly to machine code
- For example:

```
LDA     51
ADD     #FF
STO     52
```

Assembly language


```
10001011000001000010010100110011
10000000000000000000000000000001
01111111110000000000000000000000
00100010010000010000100101001100
10000000000
```

Machine code

means “Load the contents of memory location 51 into the accumulator, add hexadecimal value FF and store the result in location 52”

Assembly language

- Assembly language is processor-specific
- It has to be translated into machine code before it can be executed
- As each instruction corresponds directly to a machine code instruction, it is known as a low-level language

High-level languages

- High-level languages generally have statements that look a bit like English or Maths

```
area = (base * height) / 2 print(area)
```

- This makes these languages easier to learn and understand easy to learn and understand

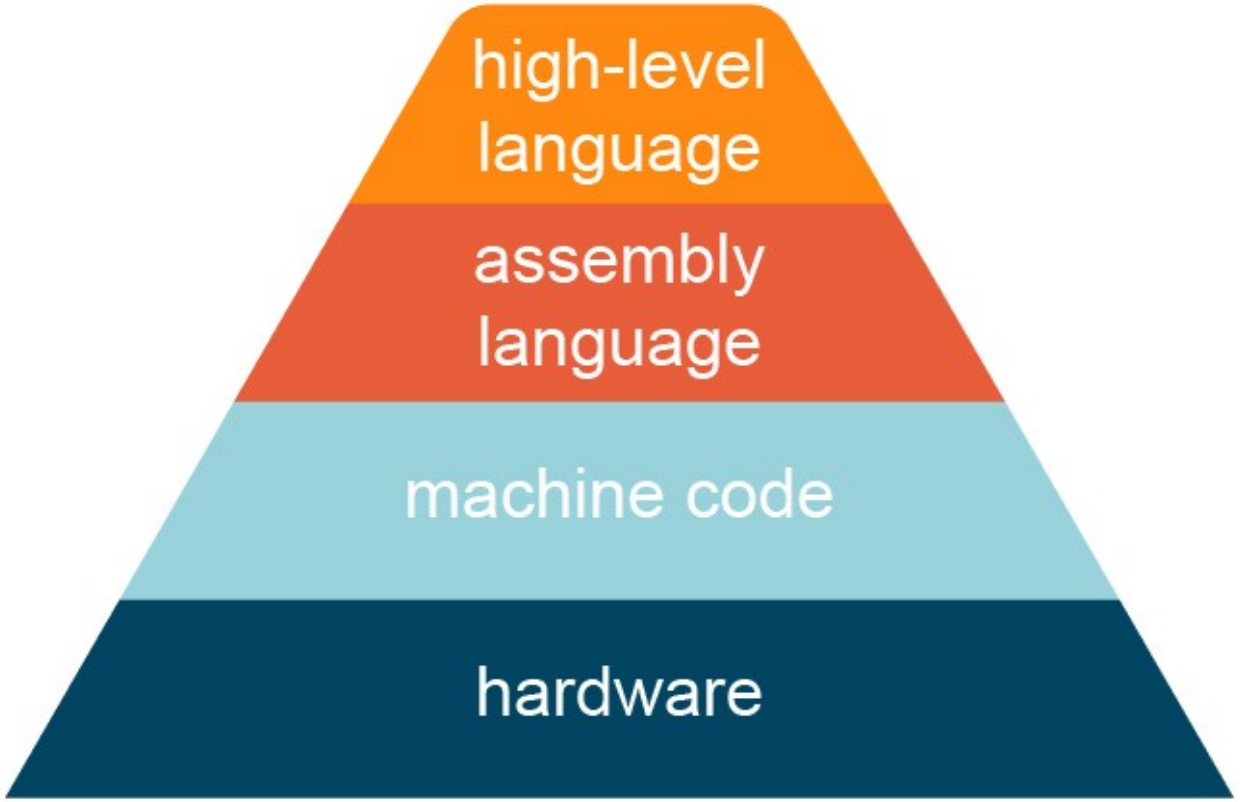
High-level languages

- High-level languages also have data structures such as arrays and records
- Many high-level languages have been especially designed to make it as easy as possible to write programs to solve certain types of problem
  - A single statement usually translates into several machine code instructions
- The translation is done by a program which may be either a compiler or an interpreter

Machine independence

- A program written in a high-level language such as Python or VB, for example, can be run on different types of processor with very few changes, if any, to the program statements
  - A different compiler or interpreter is used for each type of processor to translate the source code (written by the programmer) into machine code for that processor

High- and low-level languages



High-level Advantages

- There are a number of advantages of high-level languages, including:
  - A high-level language is easier to learn
  - Programs can be written faster in a high-level language
  - It is easier to understand and debug a high-level language
- Given all these advantages, why do you think that low-level languages are still used by some programmers?

Low-level advantages

Answers

- As a programmer has direct control over how a low-level program works they have a number of advantages, including:
  - A program written in a low-level language can run very quickly
  - The code will usually require less RAM
  - Statements in a low-level language can be used to control and manipulate specific hardware components
- As such, programs such as device drivers are often written in assembly code

Worksheet 4

- Now complete **Task 1** on **Worksheet 4**

Compiler

- A compiler translates a high-level language into machine code
  - The code written by the programmer is called the source code
  - The code produced by the compiler is called the object code

- The object code can be saved a storage drive and run whenever required

Interpreter

- An interpreter is another type of program that translates a high-level language into machine code
  - Unlike a compiler, no object code is produced
  - It translates each line of code and executes it immediately
  - If it reaches a line with a syntax error, it stops and displays an error message

Compiler vs interpreter

Compiler	Interpreter
Translates the whole program to produce object code	Translates and executes one line at a time
A compiled program executes faster as it is already in machine code	Takes more time to execute as each instruction is translated before it is executed
No need for the compiler to be present when the object code is run	The interpreter must be installed to run the program
Customers who have bought commercial software cannot see the code when they buy it so cannot adapt it	Customers can see the source code so could adapt it or see how it works

Compiler or interpreter?

- Some languages, such as Java, are compiled into an intermediate stage called bytecode
  - The bytecode can be interpreted on many different types of processor using an interpreter
- Javascript, used in creating web pages, is interpreted; the source code is included in the web page and then interpreted in the browser (e.g. Firefox, Chrome, Internet Explorer)

Worksheet 4

- Now complete **Task 2** on **Worksheet 4**

Plenary

- Complete the following by filling in the blanks

_____ languages include _____, VB and Java. They need to be _____ or interpreted before they can be run. _____ is a low-level language. It is _____ into _____ before it is run.

Compiled **Assembly language** **Machine code**
Python **High-level** **assembled**

Plenary

Answers

- Complete the following by filling in the blanks

High-level languages include Python, VB and Java. They need to be compiled or interpreted before they can be run. Assembly language is a low-level language. It is assembled into machine code before it is run.

Compiled **Assembly language** **Machine code**
Python **High-level** **assembled**

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