

**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 than writing in machine code
 - Each assembly language instruction maps directly to machine code
- For example:

LDA	51	→	1000101100000100001001010011001
			10000000000000000000000000000001
ADD	#FF		01111111110000000000000000000000
			0010001001000001000010010100110
STO	52		1000000000
Assembly language			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



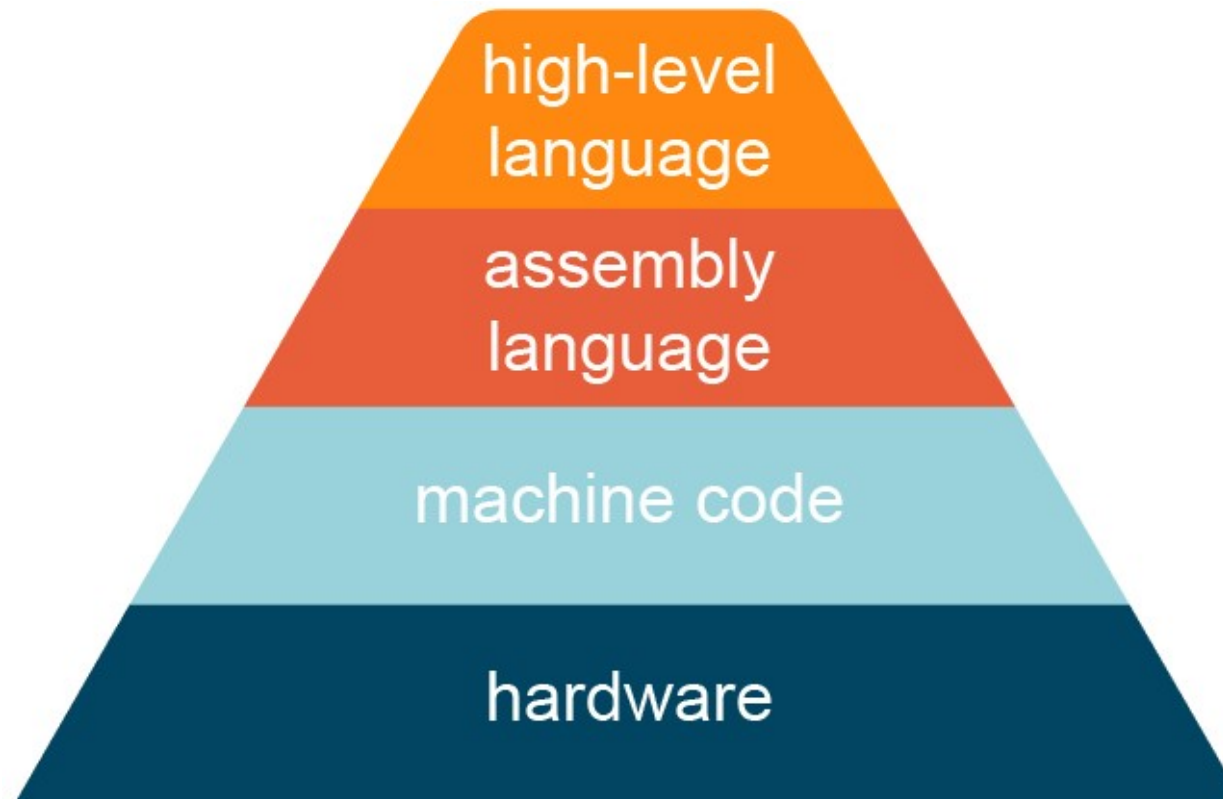
High-level languages

- 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

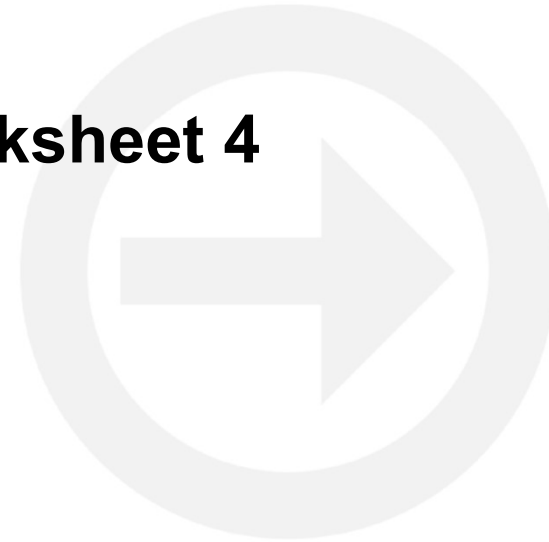
Answers

- 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

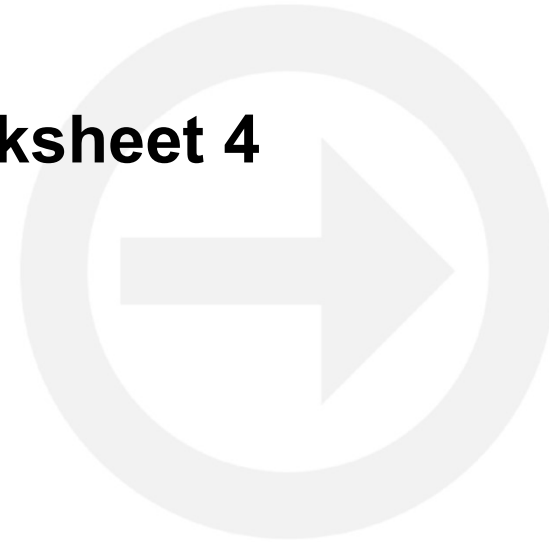
Compiler	Interpreter
Translates the whole program to produce object code	Translates and executes one line at a time
A compiled program executes faster as it is already in machine code	Takes more time to execute as each instruction is translated before it is executed
No need for the compiler to be present 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
Python

Assembly language
High-level

Machine code
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
Python

Assembly language
High-level

Machine code
assembled



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