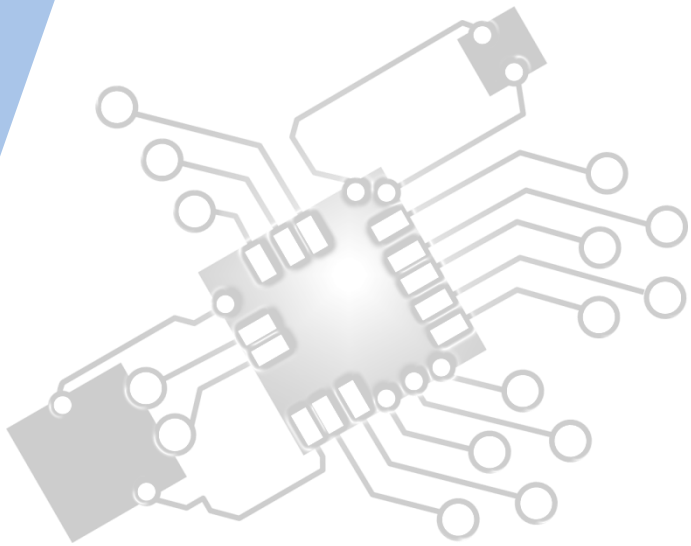
Computational thinking, problem-solving and programming: Introduction to programming

IB Computer Science



Content developed by
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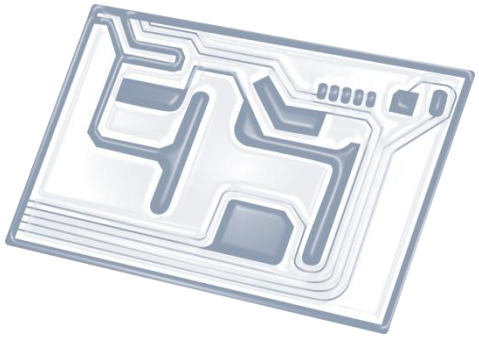
HL Topics 1-7, D1-4



1: System design

2: Computer Organisation

3: Networks

4: Computational thinking

5: Abstract data structures

6: Resource management

7: Control

D: OOP

HL & SL 4.3 Overview

Nature of programming languages

4.3.1 State the fundamental operations of a computer

4.3.2 Distinguish between fundamental and compound operations of a computer

4.3.3 Explain the essential features of a computer language

4.3.4 Explain the need for higher level languages

4.3.5 Outline the need for a translation process from a higher level language to machine executable code

Use of programming languages

4.3.6 Define the terms: variable, constant, operator, object

4.3.7 Define the operators =, ., <, <=, >, >=, mod, div

4.3.8 Analyse the use of variables, constants and operators in algorithms

4.3.9 Construct algorithms using loops, branching

4.3.10 Describe the characteristics and applications of a collection

4.3.11 Construct algorithms using the access methods of a collection

4.3.12 Discuss the need for sub-programmes and collections within programmed solutions

4.3.13 Construct algorithms using predefined sub-programmes, one-dimensional arrays and/or collections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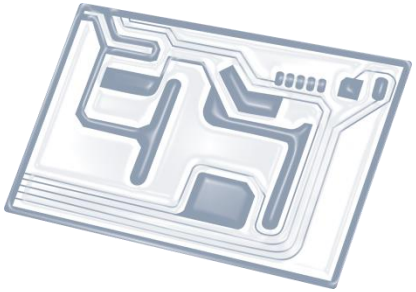


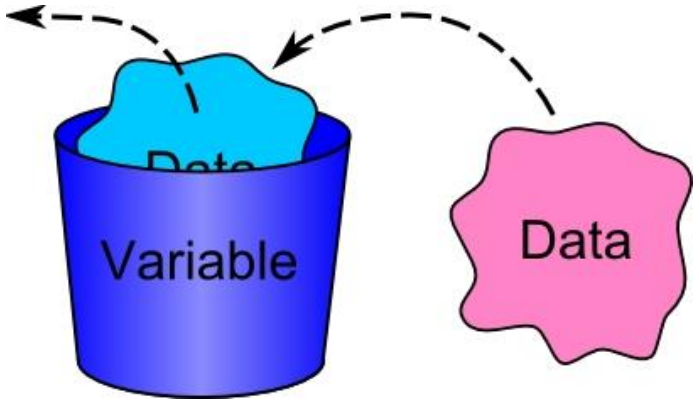
Topic 4.3.6

Define the terms: **variable**, **constant**, **operator**, **object**

Remember
D.3.1
(Paper 2)

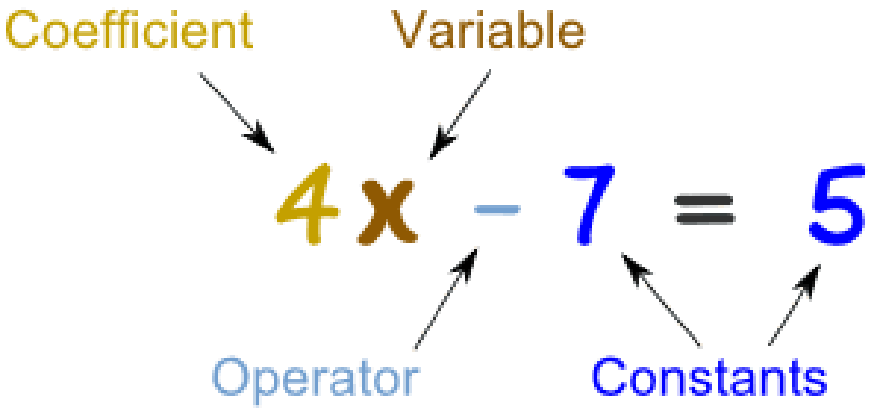
Definition: Variable

- Variables are **storage location** for data in a program.
- They are a way of **naming a memory location** for later usage (to put a value into/retrieve a value).
- Each variable has a **name** and a **data type** that is determined at its creation (and cannot be changed).



Definition: Constant

- A constant is an **identifier** with an **associated value** which cannot be altered by the program during normal execute -the value is constant.
- This is contrasted with a variable, which is an identifier with a value that can be changed during normal execution – the value is variable.

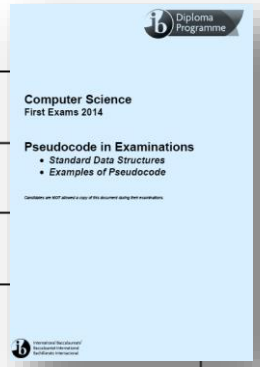


Definition: Operator

- A character/set of characters that represents an action
- Types:
  - **Boolean operators** (AND, OR, &&, ||) for working out true/false situations
  - **Arithmetic operators** (+, -, ++, --, /, %, div, mod) for doing simple mathematical calculations
  - **Assignment operators** , which assign a specified value to another value and (=)
  - **Relational operators** , which compare two values (<, >, >=, <=, ==, !=, .equals())

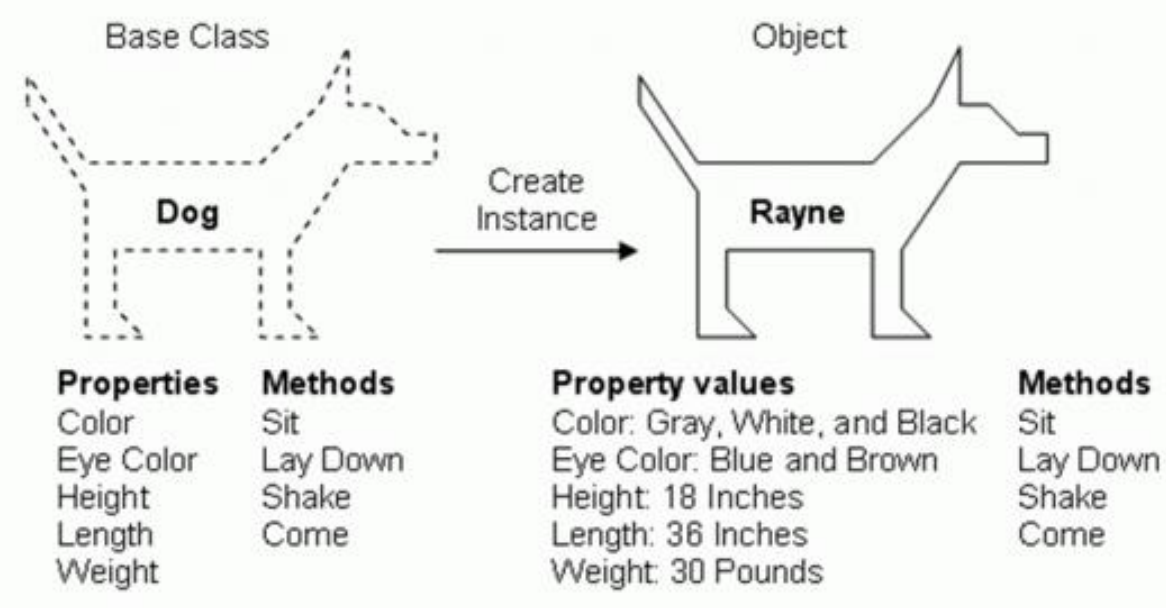
Definition: Operator (continued)

Symbol	Definition	Examples	
=	is equal to	X = 4, X = K	If X = 4
>	is greater than	X > 4	if X > 4 then
>=	is greater than or equal to	X >= 6	loop while X >= 6
<	is less than	VALUE[Y] < 7	loop until VALUE[Y] < 7
<=	is less than or equal to	VALUE[] <=12	if VALUE[Y] <= 12 then
≠	not equal to	X ≠ 4, X ≠ K	
AND	logical AND	A AND B	if X < 7 AND Y > 2 then
OR	logical OR	A OR B	if X < 7 OR Y > 2 then
NOT	logical NOT	NOT A	if NOT X = 7 then
mod	modulo	15 mod 7 = 1	if VALUE[Y] mod 7 = 0 then
div	integer part of quotient	15 div 7 = 2	if VALUE[Y] div 7 = 2 then



Definition: Object

- In Object-oriented programming (OOP), an object is **an instance of a class**.
- Objects are an **abstraction**: they hold both **data** (*states*), and **ways** to manipulate the data (*behaviours*).



Another set of definitions:

- **Variable**: a name that represents a value
- **Constant**: a value that cannot change during run-time
- **Operator**: numerical operations, String operations, logical (boolean) operations, e.g. operations on primitive data types
- **Object**: a collection of data and methods, created from a design (class), allowing multiple INSTANCES. An object has a REFERENCE VARIABLE that "points to" the contents of the object