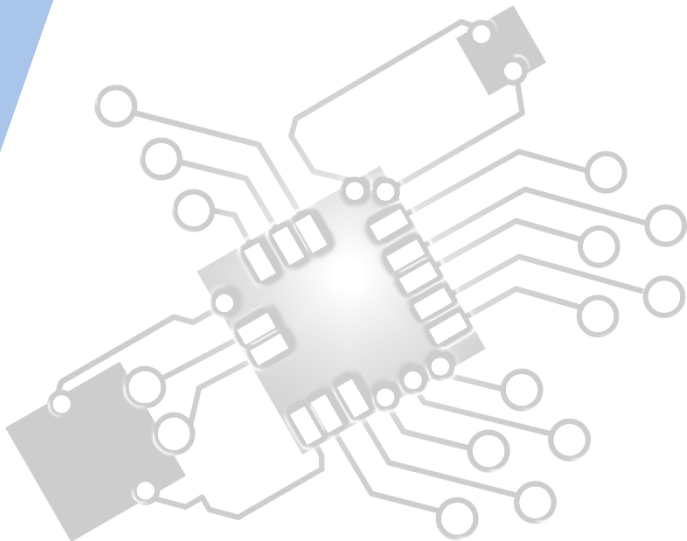




Computer Organisation

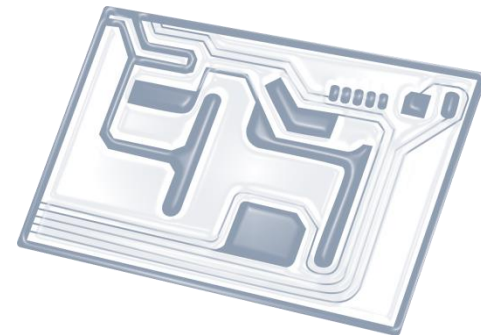
IB Computer Science



Content developed by
Dartford Grammar School
Computer Science Department



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 2 Overview

Computer architecture

2.1.1 Outline the architecture of the central processing unit (CPU) and the functions of the arithmetic logic unit (ALU) and the control unit (CU) and the registers within the CPU

2.1.2 Describe primary memory. 2 Distinguish between random access memory (RAM) and read-only memory (ROM), and their use in primary memory

2.1.3 Explain the use of cache memory

2.1.4 Explain the machine instruction cycle

Secondary memory

2.1.5 Identify the need for persistent storage

Operating systems and application systems

2.1.6 Describe the main functions of an operating system

2.1.7 Outline the use of a range of application software

2.1.8 Identify common features of applications

Binary representation

2.1.9 Define the terms: bit, byte, binary, denary/decimal, hexadecimal

2.1.10 Outline the way in which data is represented in the computer

Simple logic gates

2.1.11 Define the Boolean operators: AND, OR, NOT, NAND, NOR and XOR

2.1.12 Construct truth tables using the above operators

2.1.13 Construct a logic diagram using AND, OR, NOT, NAND, NOR and XOR gates



1: System design

2: Computer Organisation



3: Networks

4: Computational thinking



5: Abstract data structures

6: Resource management

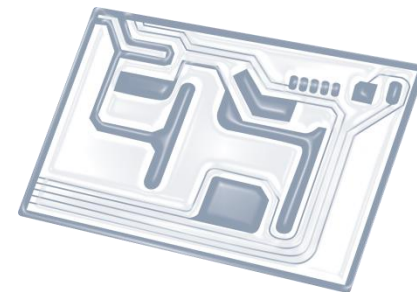


7: Control

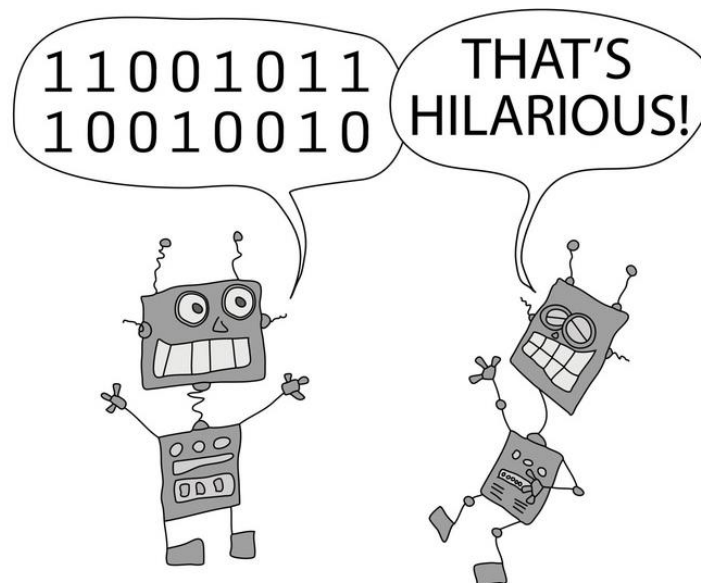
D: OOP



Topic 2.1.9

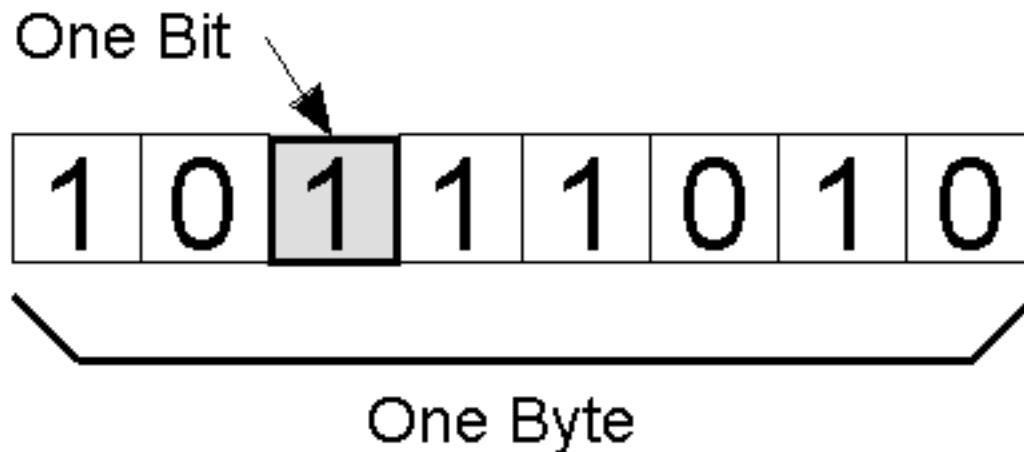


Define the terms: **bit**, **byte**, **binary**, **denary/decimal** and **hexadecimal**



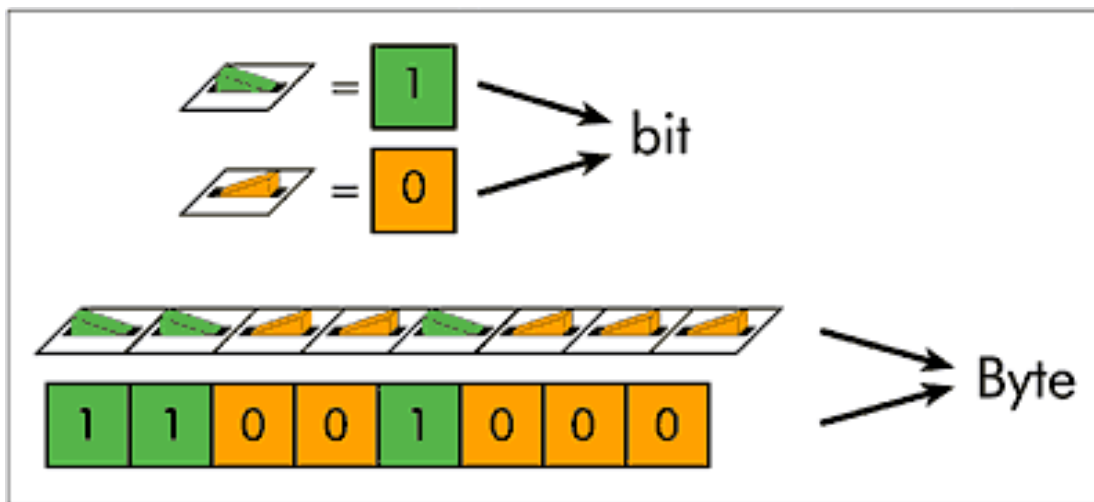
Definition: **bit**

Computers use binary - the digits 0 and 1 - to store data. A **binary digit**, or **bit**, is the **smallest unit of data** in computing. It is represented by a 0 or a 1.



Definition: **byte**

Bits can be grouped together to make them easier to work with. A **group of 8 bits** is called a **byte**.



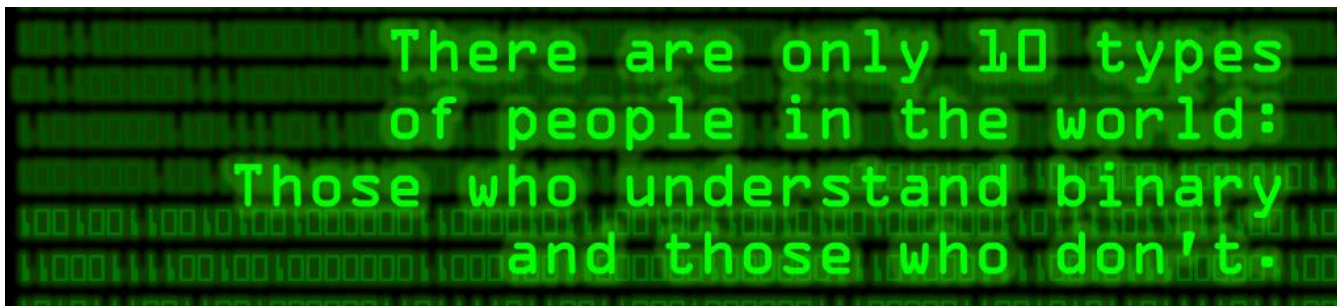
Multiples of byte		
SI decimal prefixes	Binary usage	
Name (Symbol)	Value	
kilobyte (kB)	10^3	2^{10}
megabyte (MB)	10^6	2^{20}
gigabyte (GB)	10^9	2^{30}
terabyte (TB)	10^{12}	2^{40}
petabyte (PB)	10^{15}	2^{50}
exabyte (EB)	10^{18}	2^{60}
zettabyte (ZB)	10^{21}	2^{70}
yottabyte (YB)	10^{24}	2^{80}

Common byte storage capacities

Data	Storage
One extended-ASCII character in a text file (eg 'A')	1 byte
The word 'Monday' in a document	6 bytes
A plain-text email	2 KB
64 pixel x 64 pixel GIF	12 KB
Hi-res 2000 x 2000 pixel RAW photo	11.4 MB
Three minute MP3 audio file	3 MB
One minute uncompressed WAV audio file	15 MB
One hour film compressed as MPEG4	4 GB

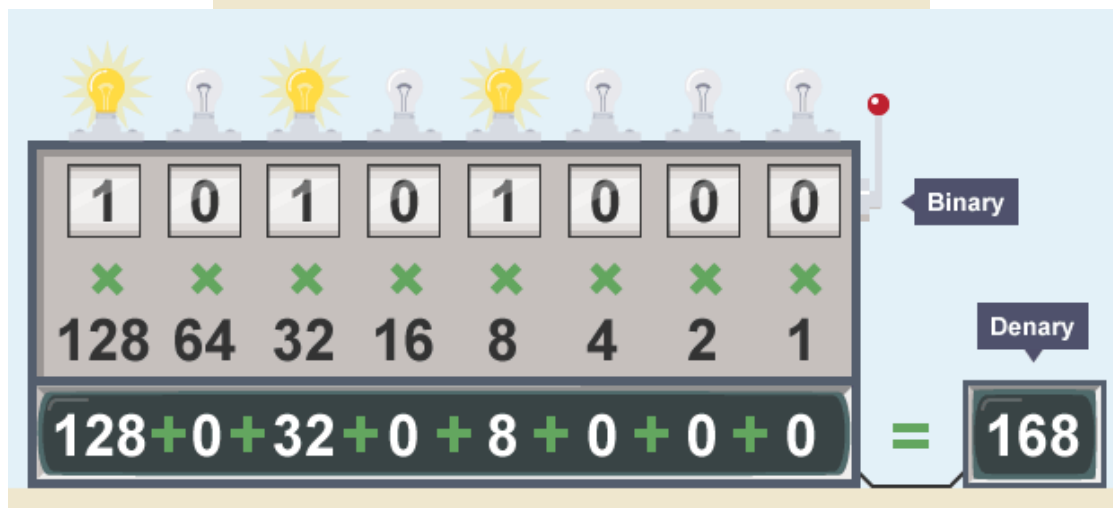
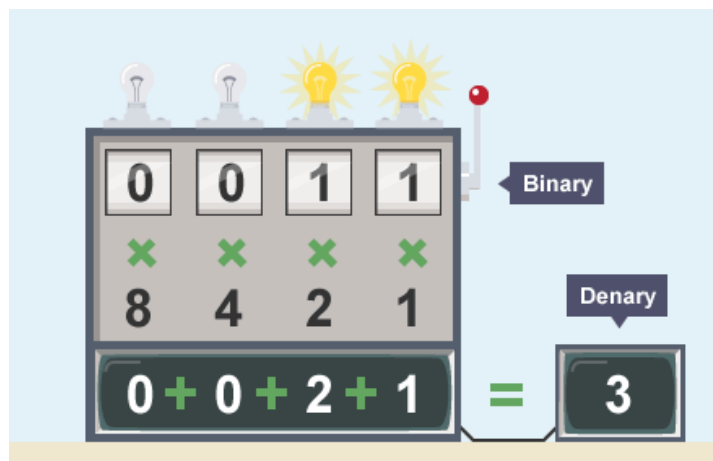
Definition: **binary**

- Computers use binary - the **digits 0 and 1** - to store data.
- Because it only has 2 symbols (0 & 1) it is also called **BASE-2** numbering
- Binary also refers to the format in which numbers are transmitted and calculated in a computer system.

A rectangular image with a black background and green binary code (0s and 1s) as a background pattern. The text is written in a green, monospace font.

There are only 10 types
of people in the world:
Those who understand binary
and those who don't.

Relationship between 'normal' numbers (denary) and binary



How to convert from **binary** to **denary**:

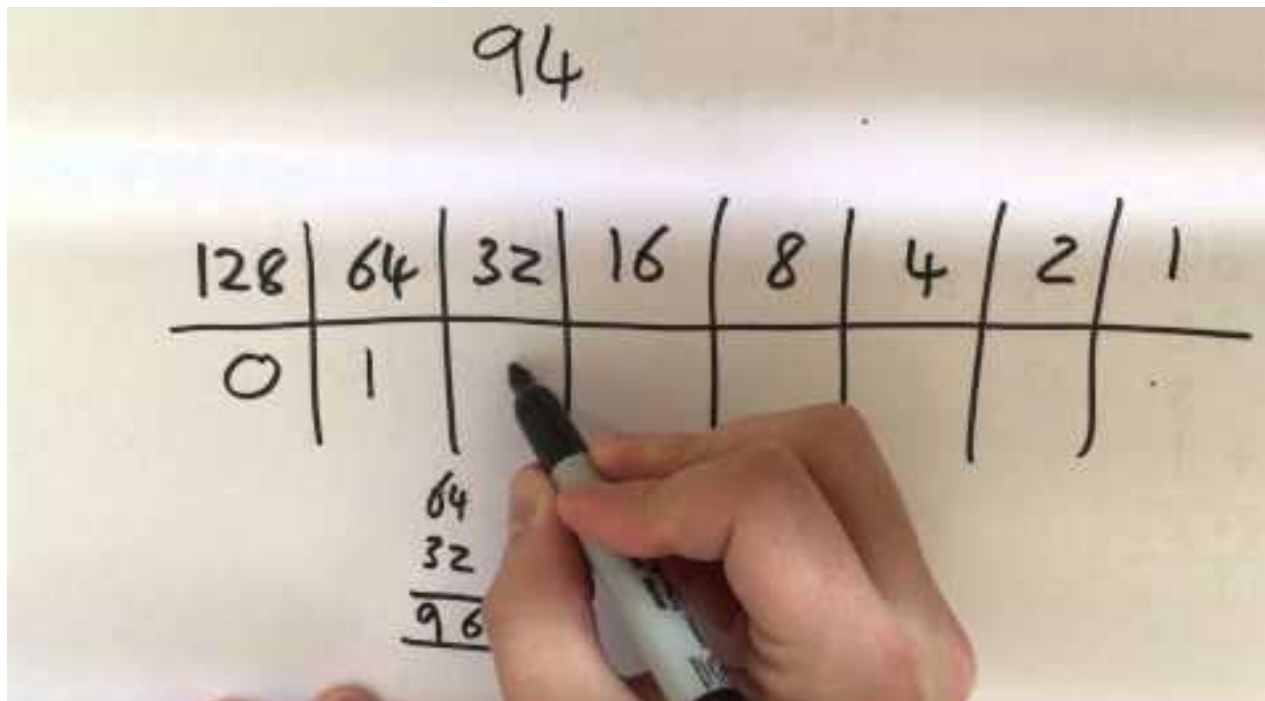
Binary:	0	1	1	0	0	1	0	1
Decimal:	128	64	32	16	8	4	2	1
	No	Yes	Yes	No	No	Yes	No	Yes
		64 + 32			+	4	+	1

↓

Decimal Equivalent: 101

Definition: **denary** / decimal

Denary is a **numbering system** with **10 symbols**: 0123456789
 It is, therefore, often referred to as **BASE-10** numbering.



Definition: hexadecimal

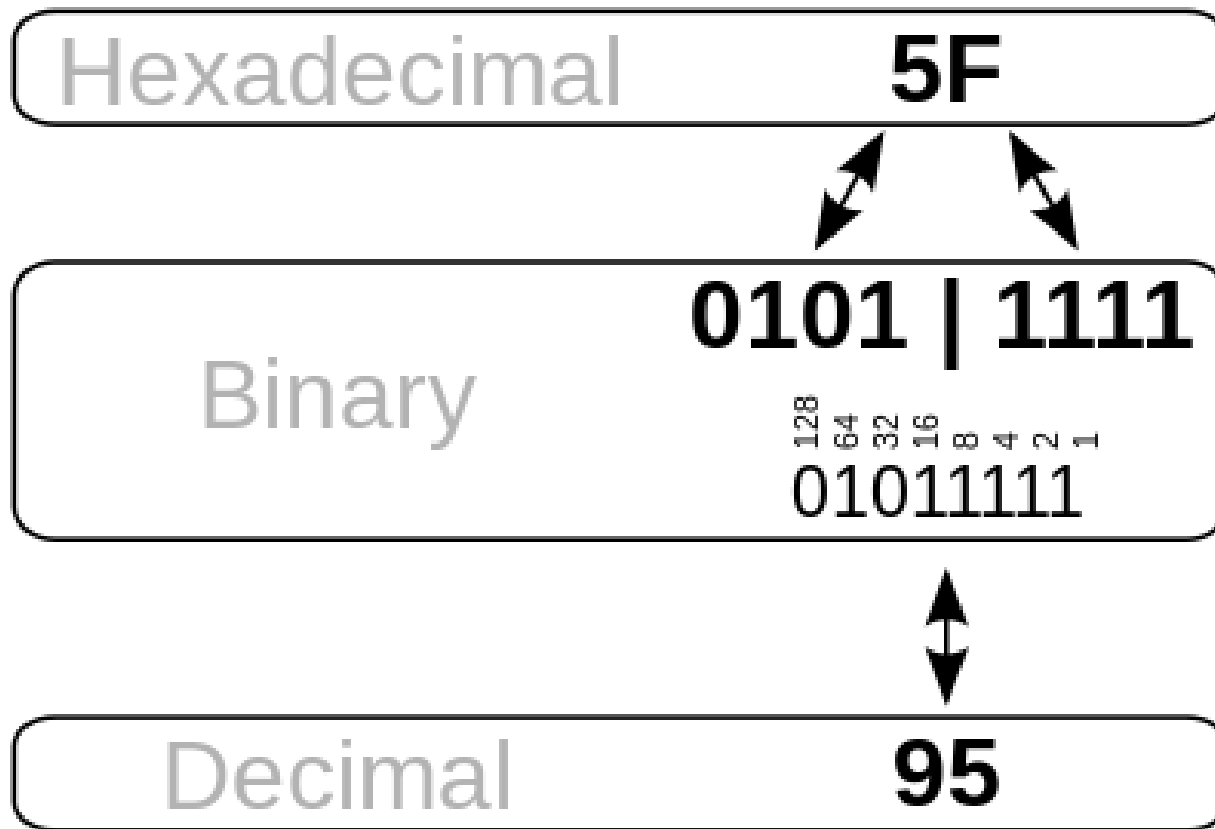
- Hexadecimal is a **numbering system** with **16 symbols**:

0123456789ABCDEF

- It is, therefore, often referred to as **BASE-16** numbering.
- Hex, as it is often called, is used to represent very large numbers quickly, such as those used in **colour representation**.

FFFFFF	000000	333333	666666	999999	CCCCCC	CCCC99	9999CC	666699
660000	663300	996633	003300	003333	003399	000066	330066	660066
990000	993300	CC9900	006600	336666	0033FF	000099	660099	990066
CC0000	CC3300	FFCC00	009900	006666	0066FF	0000CC	663399	CC0099
FF0000	FF3300	FFFF00	00CC00	009999	0099FF	0000FF	9900CC	FF0099
CC3333	FF6600	FFFF33	00FF00	00CCCC	00CCFF	3366FF	9933FF	FF00FF
FF6666	FF6633	FFFF66	66FF66	66CCCC	00FFFF	3399FF	9966FF	FF66FF
FF9999	FF9966	FFFF99	99FF99	66FFCC	99FFFF	66CCFF	9999FF	FF99FF
FFCCCC	FFCC99	FFFFCC	CCFFCC	99FFCC	CCFFFF	99CCFF	CCCCFF	FFCCFF

Hexadecimal to Denary



Binary to Hexadecimal

0 1 0 0 | 1 0 1 1

This is 4 in denary.

This is 11 in denary.

This is 4 in Hex.

This is B in Hex.