Hardware & Binary

Knowledge Organiser

Topic Summary: Understanding how a computer works and 'thinks' by understanding binary and logical binary operations.

Fancy reading more?
Try this great web-sites that explore this topic more widely!
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Want to know more?

Scan the QR code to visit the curriculum overview for Year 8 Computing, including topic summaries, key words, and other ways to learn more about this particular topic.

SCAN ME

Number bases

Denary (or decimal) is base-10 and is the number system we are most familiar with. We have the columns of units, tens, hundreds, thousands and so on. Base-10 means that we have 10 possible values (0, 1, 2, 3, 4, 5, 6, 7, 8, 9) in each column.

Binary is base-2 and has 2 values, 0 and 1. It requires a greater number of digits in binary to represent a number than denary. This is how data and instructions are stored in a computer.

Bits	Max value binary	Max value denary
1	1_2	1_{10}
2	11_2	3_{10}
3	111_2	7_{10}
4	1111_2	15_{10}
5	11111_2	31_{10}
6	111111_2	63_{10}
7	1111111_2	127_{10}
8	11111111_2	255_{10}

Elements of a computer

A computer is a machine that can handle inputs, processes these and outputs information. It can also handle arithmetic and logical operations.

Hardware

Physical components/objects that you can touch, like a Keyboard or Mouse. For example:
USB Sticks, display screens, Keyboard

Software

You cannot 'touch' software. Software refers to the programs that run on a computer, rather like the music playing on a CD.
Examples of software:
MS Word, MS PowerPoint

Converting between number bases

Denary to binary conversion
Create a grid:

128	64	32	16	8	4	2	1

Add a 1 to the corresponding cell if number contributes to target number and 0 to all the other cells

Worked example: convert 24_{10} to binary.

128	64	32	16	8	4	2	1
0	0	0	1	1	0	0	0

$16_{10} + 8_{10} = 24_{10}$
The binary value is $\underline{11000}_2$ (we can ignore the preceding zeros)

Binary to denary conversion

Worked example: Convert 01011001_2 to denary
Create the grid:

128	64	32	16	8	4	2	1
0	1	0	1	1	0	0	1

Add up the cells that have a corresponding value of 1:
$64 + 16_{10} + 8_{10} + 1 = \underline{89}_{10}$

Binary addition

Binary addition rules

$0_2 + 0_2 = 0_2$
$0_2 + 1_2 = 1_2$
$1_2 + 0_2 = 1_2$
$1_2 + 1_2 = 10_2$ (carry 1)
$1_2 + 1_2 + 1_2 = 11_2$ (carry 1)

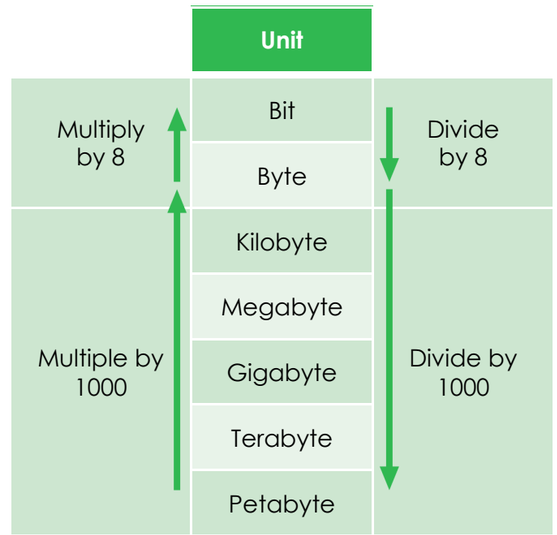
Example

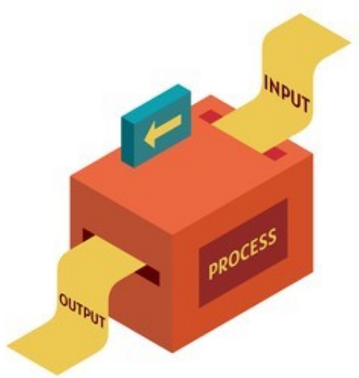
$$\begin{array}{rl} & 1\,0\,1\,0\,1\,0\,0\,1_2 \\ & 0\,0\,0\,0\,1\,0\,0\,1_2 \\ + & \underline{0\,0\,0\,1\,0\,1\,0\,1_2} \\ & \underline{1\,1\,0\,0\,0\,1\,1\,1_2} \end{array}$$

carry 1 1 1 1

Topic Links:

This knowledge will be used throughout the GCSE at year 9 and above





Key Words:

Hardware
Software
Binary
Base 2
Base 10
Decimal
Denary
Logic gate
AND/ OR/ NOT
Boolean
Bit
Nibble
Byte
Kilobyte
Megabyte
Gigabyte
Binary addition