

Today we are
going to...



To understand how and why computer systems use binary

Keywords

Nibble
Register Denary
Binary
Megabyte
Kilobyte
Conversion Gigabyte Bit
Byte

Success Criteria

Must

Recognise the use of binary in computer systems

SILVER

Should

Define the terms bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte

GOLD

Could

Convert positive denary whole numbers (0-255) into 16-bit binary numbers and vice versa

PLATINUM



Understanding binary

- Computers understand only two things: power on, or power off
- This is represented by switches, and computers are essentially calculators made up of billions of switches
- Power on = 1
- Power off = 0



Literacy Focus

- ☐ Binary
- ☐ Denary
- ☐ Conversion
- ☐ Register
- ☐ Bit
- ☐ Byte
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- ☐ Kilobyte
- ☐ Megabyte
- ☐ Gigabyte
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Binary number system

- Computers use a binary number system consisting of only 0s and 1s
- Everything that a computer needs to process must be converted into a binary format
- This format is used for storing numbers, text, images, sound and program instructions

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My Success Criteria

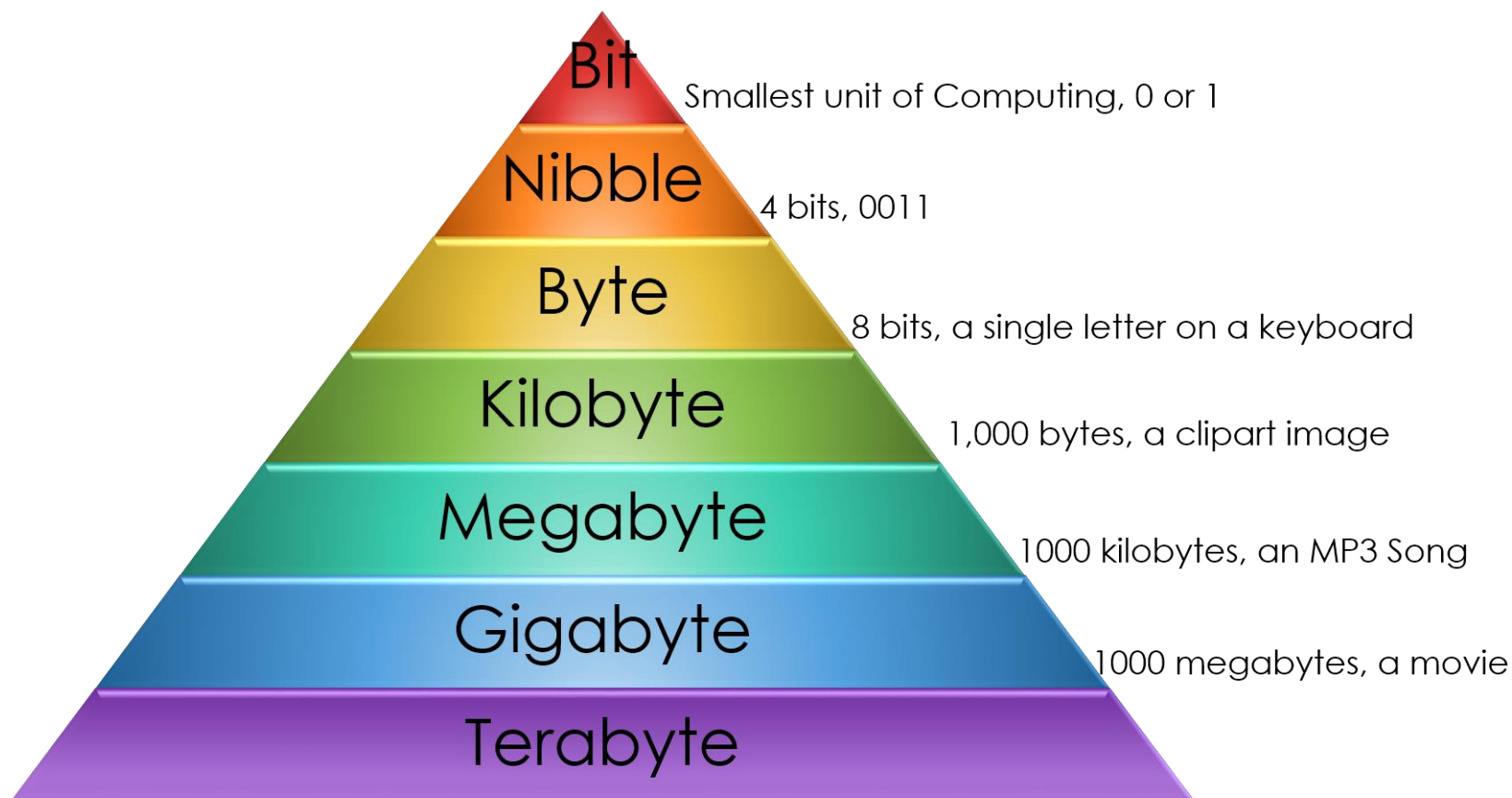
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Bits and bytes



Literacy Focus

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A sense of scale

File	Size
One character of text	1 byte
A full page of text	30 KB
One small digital colour photograph	3 MB
Music CD	600 MB
A DVD	4.5 GB
Hard disk	1 TB

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Binary representation

Number of Switches (Bits)	Possible combinations or states
1	2
2	4
3	
4	
5	
6	
7	
8	

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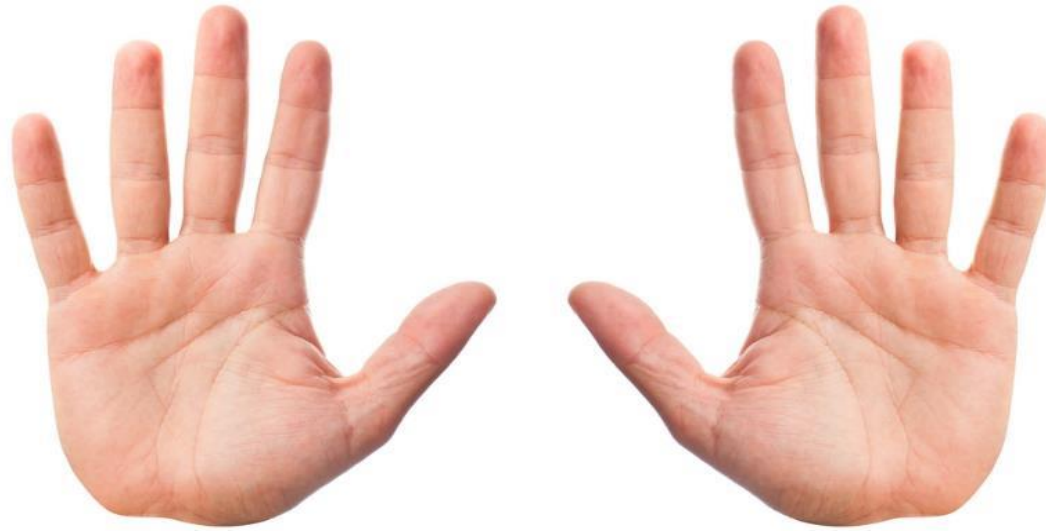
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Binary and denary number systems

- Denary is a base 10 number system with 10 digits 0-9
- Why 10 digits?



- Binary is a Base-2 system with 2 digits, 0 and 1

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Numbers with the denary system

Thousands, Hundreds, Tens and Units

1000

100

10

0

2

7

0

3

$$2 \times 1000 + 7 \times 100 + 0 \times 10 + 3 \times 1 = 2703$$

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Binary works in the same way...



Base 2

nibble

	x2		x2		x2		x2		x2		x2			
128		64		32		16		8		4		2		1

We start at 1 and double each number...

Byte

bit

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Worked example..

128	64	32	16	8	4	2	1
1	0	0	1	0	1	1	0
1x128			1x16		1x4	1x2	= ?

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One more...

•What is:

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

$32 + 16 + 8$

$+ 1$ **57**

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Worksheet 1

•Complete Task 1a



Literacy Focus

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Denary to binary

- Convert 28 to binary:

- Method

- Working right to left, write out the numbers 1, 2, 4, 8 and so on doubling each time to 128

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

- 28 has a 16 in it, leaving 12. 12 is 8 + 4

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Countdown

How would we convert...

96

11000000



Literacy Focus

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Countdown

How would we convert...

112
1110000



Literacy Focus

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Countdown

How would we convert...

127

11111111



Literacy Focus

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Worksheet 1

• Now complete Task 1b and Task 2



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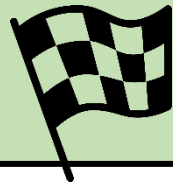
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Checkpoint 1



Recognise the use of binary in computer systems

Must

Should

Could

✓ How confident are you with this?

Term	Definition
Binary	
Bit	
Byte	
Denary	



Representing large integers

- You have seen how to represent the numbers 0-255 in binary, in a single byte (8 bits)
- What is the largest number that can be held in 16 bits?
- What's the largest denary number that can be held in
 - 2 denary digits? 4 digits?



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Representing large integers

- Computers used to use 2 bytes to represent an integer
- Nowadays, they mostly use 4 bytes
- What is the largest integer that can be represented
 - in 2 bytes?
 - in 4 bytes?
- (Answers in the format $2^n - 1$ please!)

1:00

Literacy Focus

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Using 16 bits

- The eight most significant bit place values:

32,768 16,384 8,192 4,096 2,048 1,024 512 256 128

0 1 0 1 1 0 0 1 0

- The technique for conversion is identical to that used with only eight bits

Literacy Focus

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Checkpoint



✓ How confident are you?



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Storage Sizes

- Create this in your notebooks.
How many **bytes** are in:



Kilo Byte	
Mega Byte	
Giga Byte	
Tera Byte	
Peta Byte	
Exa Byte	
Zetta Byte	
Yotta Byte	

Literacy Focus

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Task! Worksheet 1

•Now complete Task 3



Literacy Focus

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Computer registers

- A computer register is a small, but very fast piece of memory
- It can have 8, 16 or 32 bits
- All calculations done by the computer are carried out in registers

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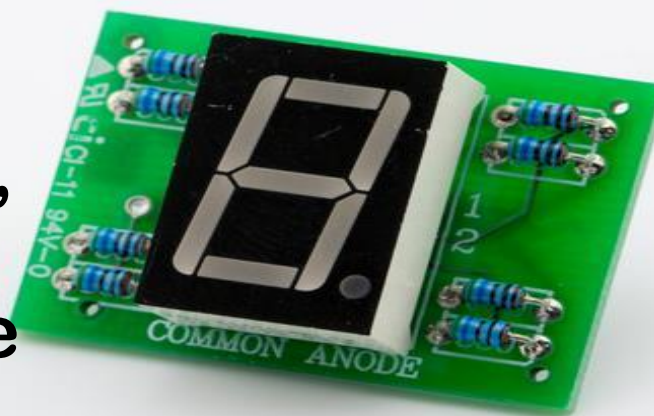
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Digital displays

- A standard numeric display uses 7 (or 8) segments
- Each segment is given a binary value
- Based on the binary values, lights are switched on or off to create a recognisable number



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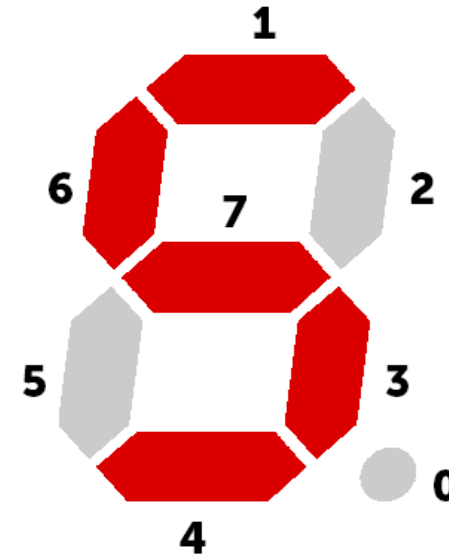


Binary in digital displays

- A register of 8 bits is used to store and determine the state of each segment (including the decimal point - 0)

Display Register

7	6	5	4	3	2	1	0
1	1	0	1	1	0	1	0



- What number would be represented if the register value was **11001100**?

4

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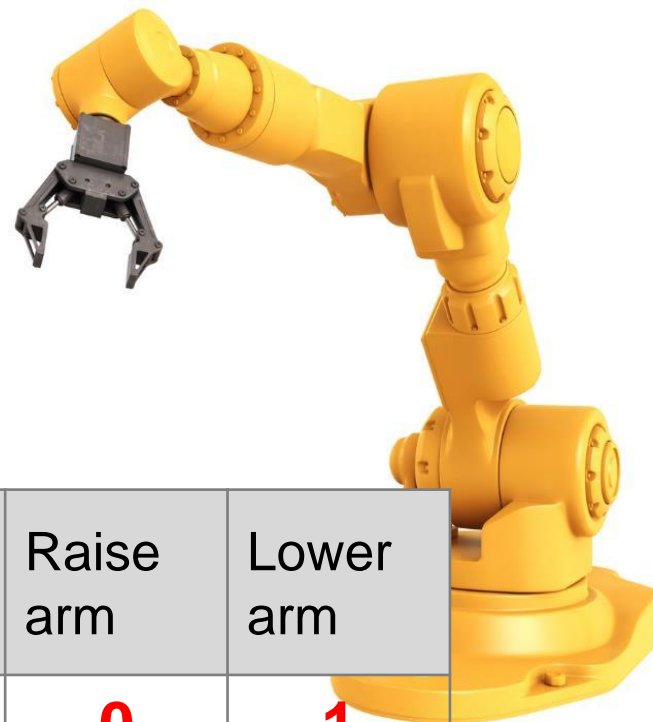




Registers in industry

- Registers can also be used to hold the state of a machine

- A robotic arm may have eight possible movements
- The register values below extend and lower the arm whilst opening the claw



Rotate left	Rotate right	Open claw	Close claw	Extend arm	Retract arm	Raise arm	Lower arm
0	0	1	0	1	0	0	1

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Checkpoint



✓ How confident are you?



Must

Recognise the use of binary in computer systems



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Define the terms bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte



Could

Convert positive denary whole numbers (0-255) into 16-bit binary numbers and vice versa





Cool Down

For your exam you **need to be able to:**

- ✓ Explain why computers use binary to represent any kind of data
- ✓ Give examples of the different types of data that computers can hold
- ✓ Convert whole numbers to binary and vice versa
- ✓ Define bit, byte, kilobyte, megabyte, gigabyte, terabyte
- ✓ Understand how registers are used in applications

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Reflect and Review

- Complete the skills ‘checklist’
- Answer the confidence question and reflect in your progress diary

How confident do you feel about this topic?
(Delete the stickers you don't need)

Date	Lesson Overview	WWW	EBI	NS

- Kahoot.it



Literacy Focus

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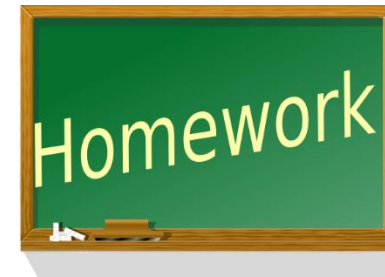
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Homework

You will find the homework in the notebook. You should complete it by Wednesday



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