Starter

- Every device on the planet needs an **IP** (internet protocol) address **to connect to the internet**.

- In **1981 IPv4** was born. Every time your device connects to the internet it is given a unique address like…

162.168.254.201

Starter

The maximum number it can go to is
255.255.255.255

Because:

11111111.11111111.11111111.11111111

Starter

- How many different numbers can we make from…

255 x 255 x 255 x 255 = 4,228,250,625

- How many people have access to the internet?

4,536,248,808

- How many people live in the world?

7,716,223,209

IGCSE CS

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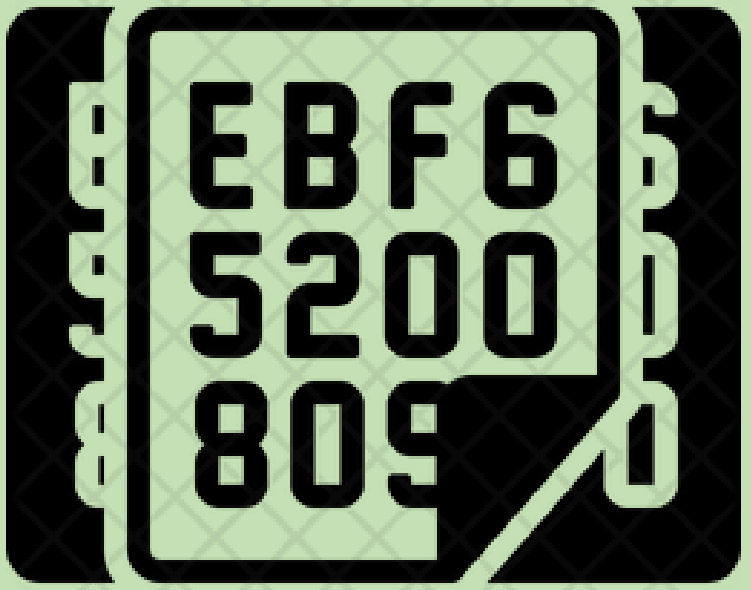
Cambridge Assessment International Education

Cambridge International School

1.1.2 Hexadecimal



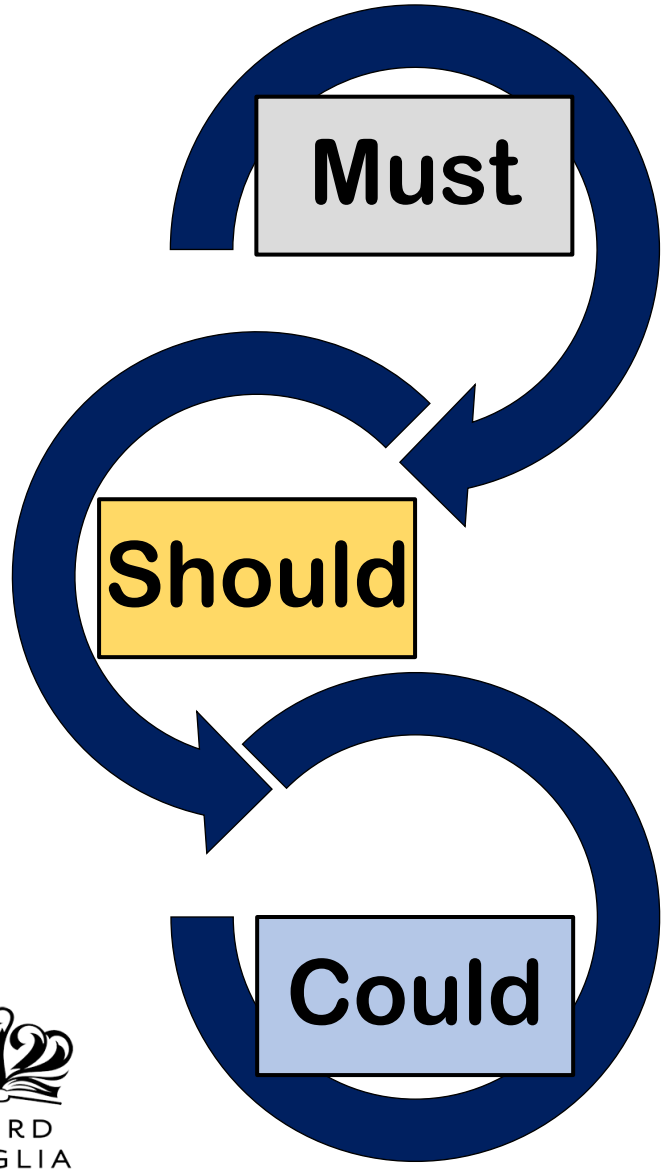
Unit 1
Data Representation

Mr. Teasdale

Today we are going to…

To understand the use of hexadecimal in computer systems

Success Criteria



Identify current uses of hexadecimal numbers in computing

Convert between binary and hexadecimal

Convert positive denary whole numbers to hexadecimal and vice versa

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Binary to denary conversion

- Practice converting binary to denary and back again
- Convert the following:

128	64	32	16	8	4	2	1	
0	1	0	1	1	0	0	1	99
1	1	0	0	0	0	1	0	194

- 14
- 105

Literacy Focus

- Hexadecimal
- Denary
- Conversion
- IPV6
- Colour chart
- HTML
- Debugging
- RGB Colour Model
- MAC address

My Success Criteria

- Identify current uses of hexadecimal numbers in computing
- Convert between binary and hexadecimal
- Convert positive denary whole numbers to hexadecimal and vice versa

Hexadecimal

- Hexadecimal (or hex) is a number system which uses base 16
- As we only have 10 digits, it uses 0-9 and then letters A to F

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

- What is E in denary?
- What is 10 in hex?

Literacy Focus

- ❑ Hexadecimal
- ❑ Denary
- ❑ Conversion
- ❑ IPV6
- ❑ Colour chart
- ❑ HTML
- ❑ Debugging
- ❑ RGB Colour Model
- ❑ MAC address

My Success Criteria

- ❑ Identify current uses of hexadecimal numbers in computing
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Hex to denary conversion

- Converting two-digit hexadecimal numbers

16s		Units	
2		7	
	+		= in denary

- Multiply the left-hand digit by 16, then add the units
- What is hex 27 in denary?

Literacy Focus

- Hexadecimal
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My Success Criteria

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Denary to hex conversion

- Divide the denary number by 16 to get the number of 16s (the left-hand hex digit)
- The remainder gives you the units

  Denary 18 becomes:

  18 / 16 = 1 r 2 so the hex value for 18 is 12

  (*Spoken, 'One Two', not 'Twelve'*)

- What is denary 27 in hex?
- What is denary 44 in hex?

Literacy Focus

- ❑ Hexadecimal
- ❑ Denary
- ❑ Conversion
- ❑ IPV6
- ❑ Colour chart
- ❑ HTML
- ❑ Debugging
- ❑ RGB Colour Model
- ❑ MAC address

My Success Criteria

- ❑ Identify current uses of hexadecimal numbers in computing
- ❑ Convert between binary and hexadecimal
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Worksheet 2

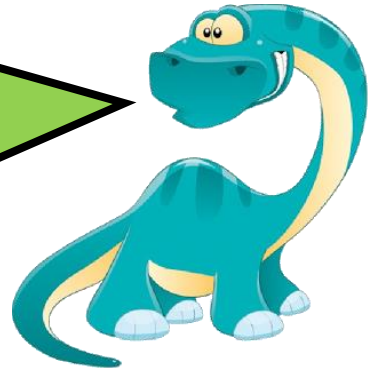
- Complete **Task 1 Question 1**

Need some help?

Checkout the need help section in your notebooks

Challenge?

Checkout the want to go further section in your notebooks



My Success Criteria

- ❑ Identify current uses of hexadecimal numbers in computing
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Binary to hex conversion

- Take a binary word of 8 bits
  1 1 1 0 0 1 0 1
- Divide into two nibbles of 4 bits
  1 1 1 0 0 1 0 1
- Convert each nibble into its hex value and rejoin
  1 1 1 0 = 14 = E in Hex + 0 1 0 1 = 5 in Hex
  So 1 1 1 0 0 1 0 1 = E5 in Hex

Literacy Focus

- Hexadecimal
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Hex to binary conversion

- What is 3B in binary?

  Split the two hex characters

  3 = 0011 in binary and B = 1011

  So 3B = 0011 1011 in binary

What is hex 21 in binary?

What is hex A5 in binary?

Literacy Focus

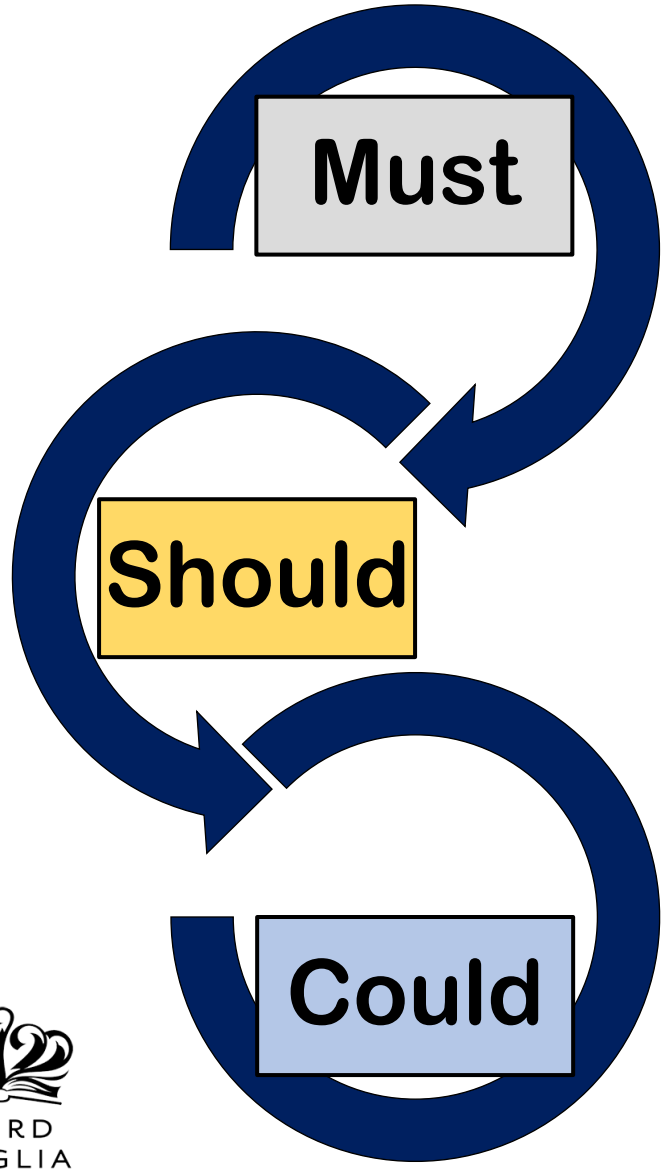
- ❑ Hexadecimal
- ❑ Denary
- ❑ Conversion
- ❑ IPV6
- ❑ Colour chart
- ❑ HTML
- ❑ Debugging
- ❑ RGB Colour Model
- ❑ MAC address

My Success Criteria

- ❑ Identify current uses of hexadecimal numbers in computing
- ❑ Convert between binary and hexadecimal
- ❑ Convert positive denary whole numbers to hexadecimal and vice versa

Checkpoint

✓How confident are you?



Identify current uses of hexadecimal numbers in computing

Convert between binary and hexadecimal

Convert positive denary whole numbers to hexadecimal and vice versa

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Worksheet 2

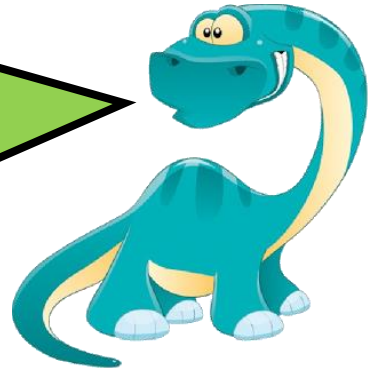
- Complete **Task 1 Question 2**

Need some help?

Checkout the need help section in your notebooks

Challenge?

Checkout the want to go further section in your notebooks



My Success Criteria

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Why use hex?

- A hexadecimal value is much easier to read and remember than a string of binary digits
- It is quicker to write or type, since a hex digit takes up only one character, not four
- There is less chance of making an error when typing hex characters than a string of 1s and 0s
- It is easy to convert to and from binary

Literacy Focus

- ❑ Hexadecimal
- ❑ Denary
- ❑ Conversion
- ❑ IPV6
- ❑ Colour chart
- ❑ HTML
- ❑ Debugging
- ❑ RGB Colour Model
- ❑ MAC address

My Success Criteria

- ❑ Identify current uses of hexadecimal numbers in computing
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Where is it used? Colour charts…

- HTML (HyperText Markup Language) is used to create web pages

```
h1 {color: #ffa347;}
```

	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
Row 1	FFFFFF	000000	333333	666666	999999	CCCCCC	CCCC99	9999CC	666699
Row 2	660000	663300	996633	003300	003333	003399	000066	330066	660066
Row 3	990000	993300	CC9900	006600	336666	0033FF	000099	660099	990066
Row 4	CC0000	CC3300	FFCC00	009900	006666	0066FF	0000CC	663399	CC0099
Row 5	FF0000	FF3300	FFFF00	00CC00	009999	0099FF	0000FF	9900CC	FF0099
Row 6	CC3333	FF6600	FFFF33	00FF00	00CCCC	00CCFF	3366FF	9933FF	FF00FF
Row 7	FF6666	FF6633	FFFF66	66FF66	66CCCC	00FFFF	3399FF	9966FF	FF66FF
Row 8	FF9999	FF9966	FFFF99	99FF99	66FFCC	99FFFF	66CCFF	9999FF	FF99FF
Row 9	FFCCCC	FFCC99	FFFFCC	CCFFCC	99FFCC	CCFFFF	99CCFF	CCCCFF	FFCCFF

Literacy Focus

- ❑ Hexadecimal
- ❑ Denary
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Using hexadecimal

- One common use of hexadecimal numbers is to set colours on web pages
- A colour is defined by the amount of red, green and blue it contains: e.g. = 3D7EB5
- Each of these RGB values can be in the range
  0 to 255 (decimal) or 00 to FF (hexadecimal)
- This gives a possible 256 x 256 x 256 colours, which is more than 16 million
- How many bits are used to represent a single colour?

Literacy Focus

- ❑ Hexadecimal
- ❑ Denary
- ❑ Conversion
- ❑ IPV6
- ❑ Colour chart
- ❑ HTML
- ❑ Debugging
- ❑ RGB Colour Model
- ❑ MAC address

My Success Criteria

- ❑ Identify current uses of hexadecimal numbers in computing
- ❑ Convert between binary and hexadecimal
- ❑ Convert positive denary whole numbers to hexadecimal and vice versa

Worksheet 2

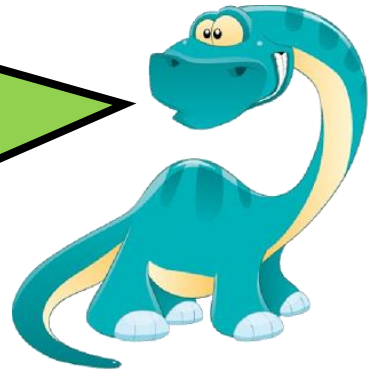
- Complete **Task 2 Questions 3 and 4**

Need some help?

Checkout the need help section in your notebooks

Challenge?

Checkout the want to go further section in your notebooks



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- ❑ Identify current uses of hexadecimal numbers in computing
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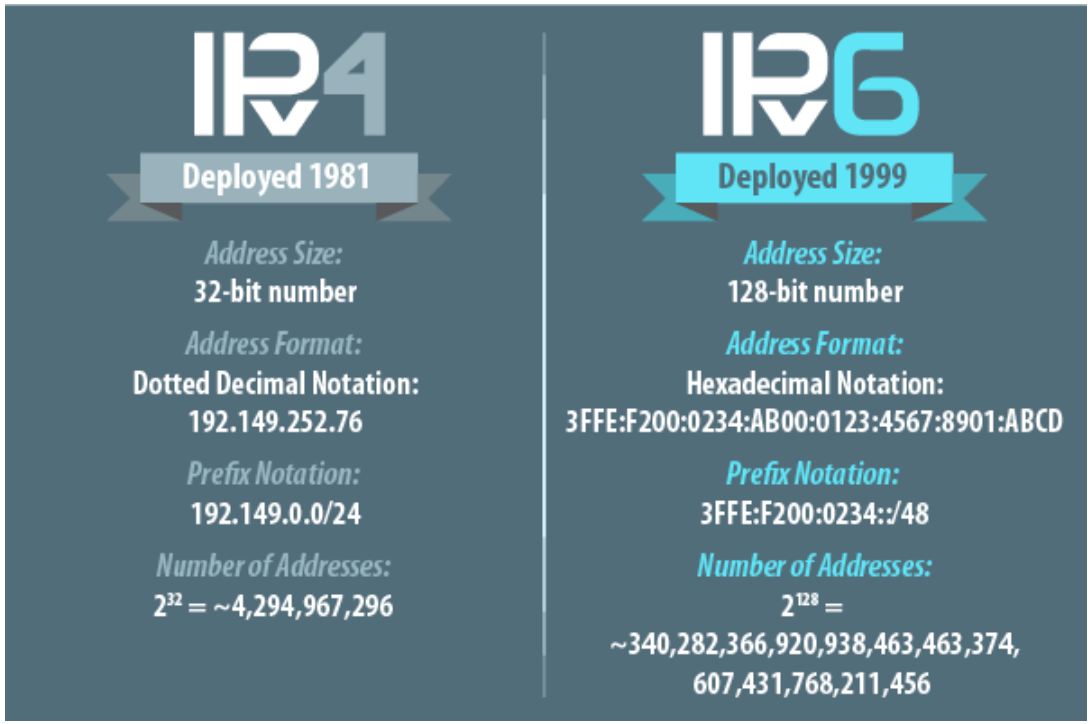
Where is it used?

- **Internet Protocol version 6 (IPv6)…**



Literacy Focus

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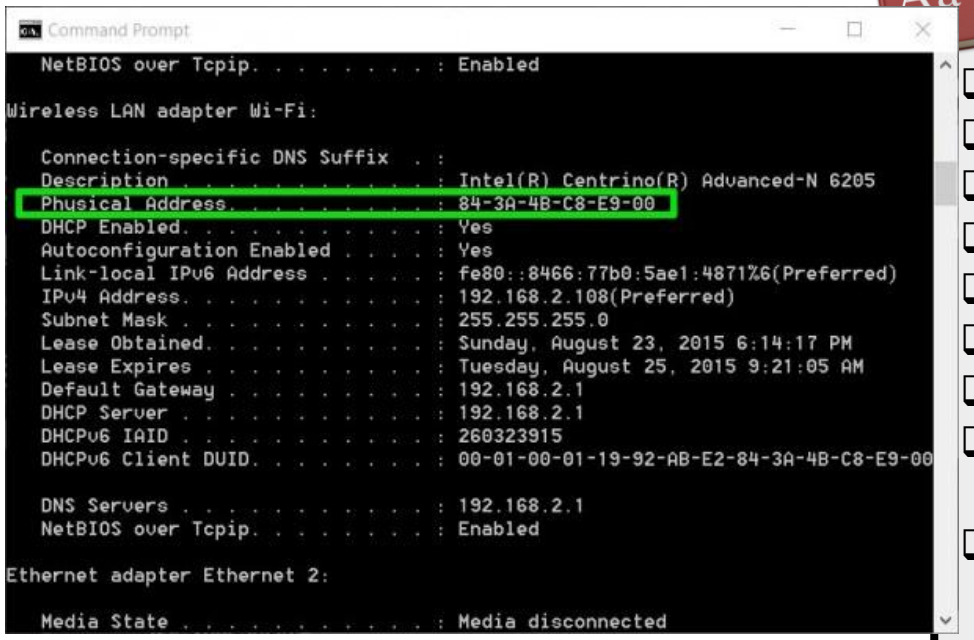
L/A: To understand the use of hexadecimal in computer systems

Where is it used? MAC Addresses...

4A:32:BE:5D:A4:4F

- Your PC, mobile phone and other devices will each have a unique MAC address by which they can be identified
- The MAC address is usually 48 bits long



Literacy Focus

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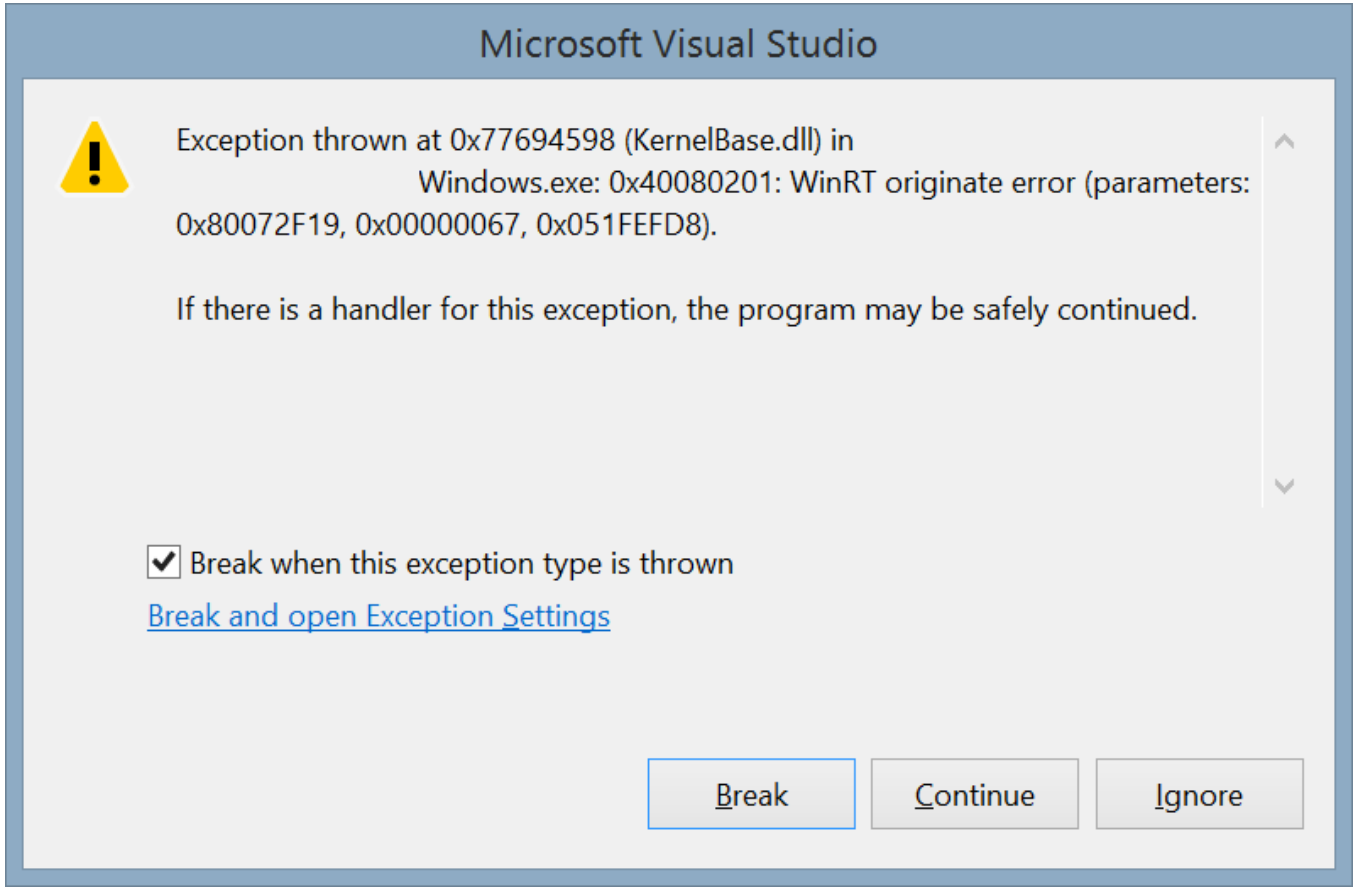
Where is it used? Error codes…



Literacy Focus

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Using hex for debugging

- Programmers sometimes need to examine what is going on in a program by looking at the contents of memory
- Printed out in binary, it might look something like this:

00011001 10011001 11110001 00011001 10101010 01001100 00111101 10001110 etc.

- It is much easier to debug or find a particular value if it printed out in hex!

19 99 F1 19 AA 4C 3D 8E etc.

Literacy Focus

- ❑ Hexadecimal
- ❑ Denary
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My Success Criteria

- ❑ Identify current uses of hexadecimal numbers in computing
- ❑ Convert between binary and hexadecimal
- ❑ Convert positive denary whole numbers to hexadecimal and vice versa

Worksheet 2

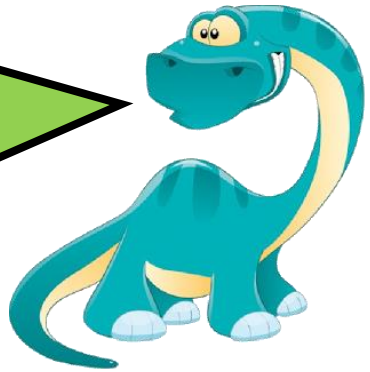
- Now complete **Task 3, Questions 5 and 6**

Need some help?

Checkout the need help section in your notebooks

Challenge?

Checkout the want to go further section in your notebooks



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Let's summarise

- **Hexadecimal** is used by programmers instead of binary because it is easier to write and remember, and people are less likely to make errors writing a hex number
- It is also used, for example, to define colours in web pages, in MAC addresses and in assembly languages and machine code
- Assembly language will be covered in the Software unit

Literacy Focus

- ❑ Hexadecimal
- ❑ Denary
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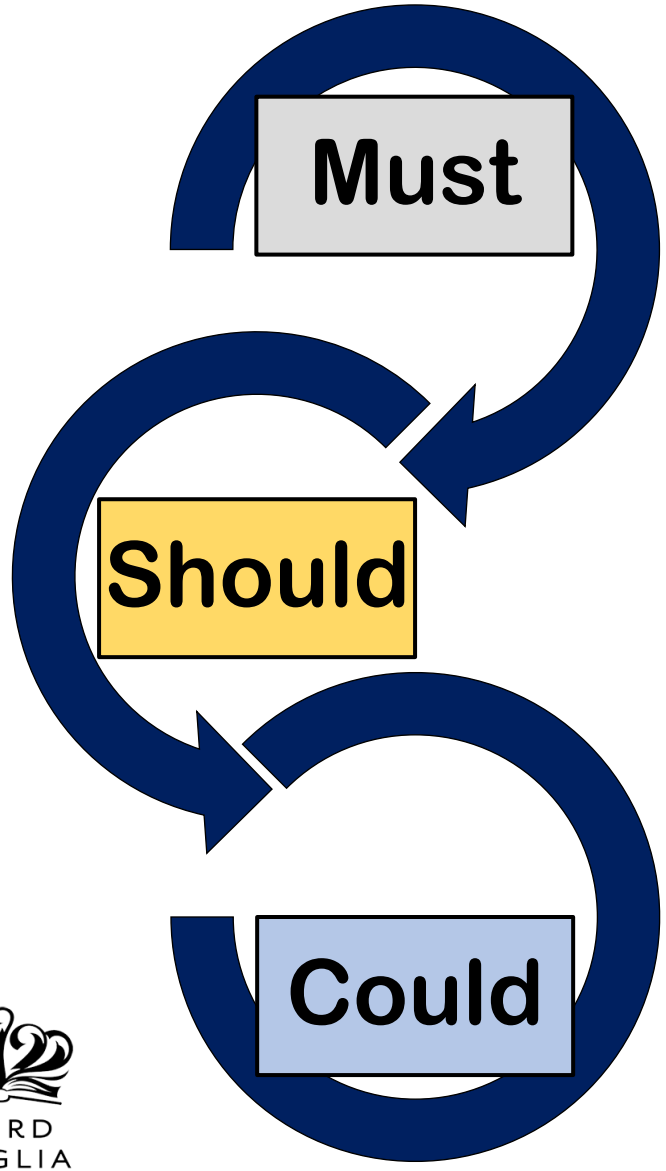
Checkpoint

✓How confident are you?



Identify current uses of hexadecimal numbers in computing

Convert between binary and hexadecimal

Convert positive denary whole numbers to hexadecimal and vice versa

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Cool down

1. Complete the skills 'checklist'
2. Answer the confidence question

3. Reflect on your learning

4. Kahoot.it

Kahoot!

Literacy Focus

- ❑ Hexadecimal
- ❑ Denary
- ❑ Conversion
- ❑ IPV6
- ❑ Colour chart
- ❑ HTML
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- ❑ RGB Colour Model
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Let's Review

Must

Should

Could

SILVER

Identify current uses of hexadecimal numbers in computing

GOLD

Convert between binary and hexadecimal

PLATINUM

Convert positive denary whole numbers to hexadecimal and vice versa

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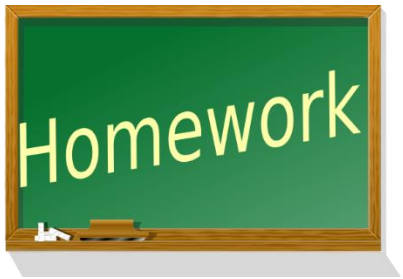
Homework

Homework is in your notebooks, complete for <u>next</u> lesson!



Literacy Focus

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