2 - Binary, Decimal, and Hexadecimal Systems Review

September 22, 2020 5:37 PM

Learning Goals:

- Be able to explain the difference between binary and hexadecimal systems
- Be able to convert between binary and hexadecimal systems
- Compare binary and hexadecimal representations of data

Understanding Hex Numbers

- Hexadecimal numbers are **base 16**.
-
- For hex numbers after 9, letters are used instead:

  A = 10 D = 13

  B = 11 E = 14

  C = 12 F = 15

- Each hex digit represents **four** bits (also called a ***nibble***!) – so bytes (8 bits) can be represented as just two hexadecimal digits, ranging from 00 to FF (…what is FF in **binary**?)

To convert from decimal to hexadecimal:

1. Find the binary equivalent of the decimal value
2. Split the binary number into groups of 4 digits, working from right to left
3. Convert each group into its hex value equivalent

Decimal -> Binary -> Hexadecimal

To convert from hexadecimal to decimal:

1. Convert each hex digit to its binary equivalent (this will give you a binary number)
2. Convert the binary number to its decimal equivalent

Hexadecimal -> Binary -> Decimal

Example 1: Convert 101_2 (binary) to hexadecimal

What is "weird" about this example?

- We had less than 4 binary digits so there was only 1 group

- Be careful with the subscripts - this result could be mistaken for a decimal value
- Remember, hex digits consist of **more** than just 1s and 0s
- 1 hex digit (without letters) can represent decimal values up to 15 (0 - 9) so for these values, we have to be careful about specifying whether we mean the decimal system or the hexadecimal system.
    - Ex: "221", "131", "987" ….. Are these decimal or hexadecimal values? **Specify** with a subscript

Why is hexadecimal useful?

- Hexadecimal is also used to represent computer memory addresses (the label for the location data is stored) in an efficient way
- Is useful in programming (e.g. colour codes in HTML)

Example 2: Convert 1001101_2 (binary) to Hex

Example 3: Convert $1AB_{16}$ to decimal

Example 4: Convert $2FB9_{16}$ to binary

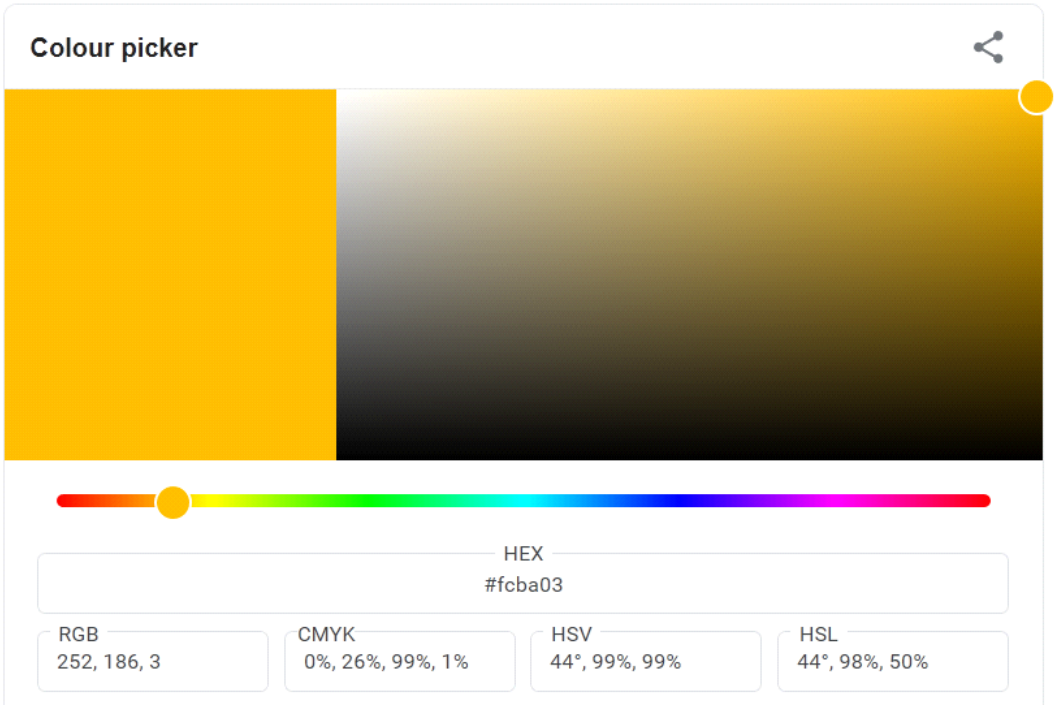
Other Useful Conversions…. Colours!

Google “Colour Picker” and select a colour of your choice.

Make a note of the RGB value – RGB values range from 0,0,0 to 255, 255, 255 (note: these are **decimal** numbers) and you can convert these values to hexadecimal.

Make sure you can convert this example from the Hex value to its RBG value!

Hint: fc -> 252, ba -> 186, 03 -> 3



Try converting your colour’s RGB value into hexadecimal – verify your answer by checking the colour picker.