Template Week 1 – Bits & Bytes

Student number: 585902

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

Bit (binary digit) is the smallest unit of data in computing, having only two states as complimentary pairs which is the representative of 0/1 or false/true or on/off which all boil down to whether or not the associated transistor has electric charge in it

Byte on the other hand is a set of 8 bits which is the standard unit to represent data more meaningfully such as characters, numbers and machine instructions. Its also the typical measurement unit of storage

What is a nibble? It's a unit of data which is half a byte in bits, being 4 bits

What relationship does a nibble have with a hexadecimal value?

Since a nibble has four bits it can represent 16 values which is the equivalent of one hexadecimal digit

Why is it wise to display binary data as hexadecimal values?

Since every four slots will now be converted into a single slot it becomes more human readable. So while it becomes less error prone, the information will stay the exact same. Hence it will be easier to write and debug which contributes to the code's portability

What kind of relationship does a byte have with a hexadecimal value?

Since a byte has 8 bits and every 4 bits represent a single hexadecimal character with 16 possibilities then a byte would be a pair of two hexadecimal digits (a 2 digit hexadecimal number). With 256 possibilities (0-255) which is common

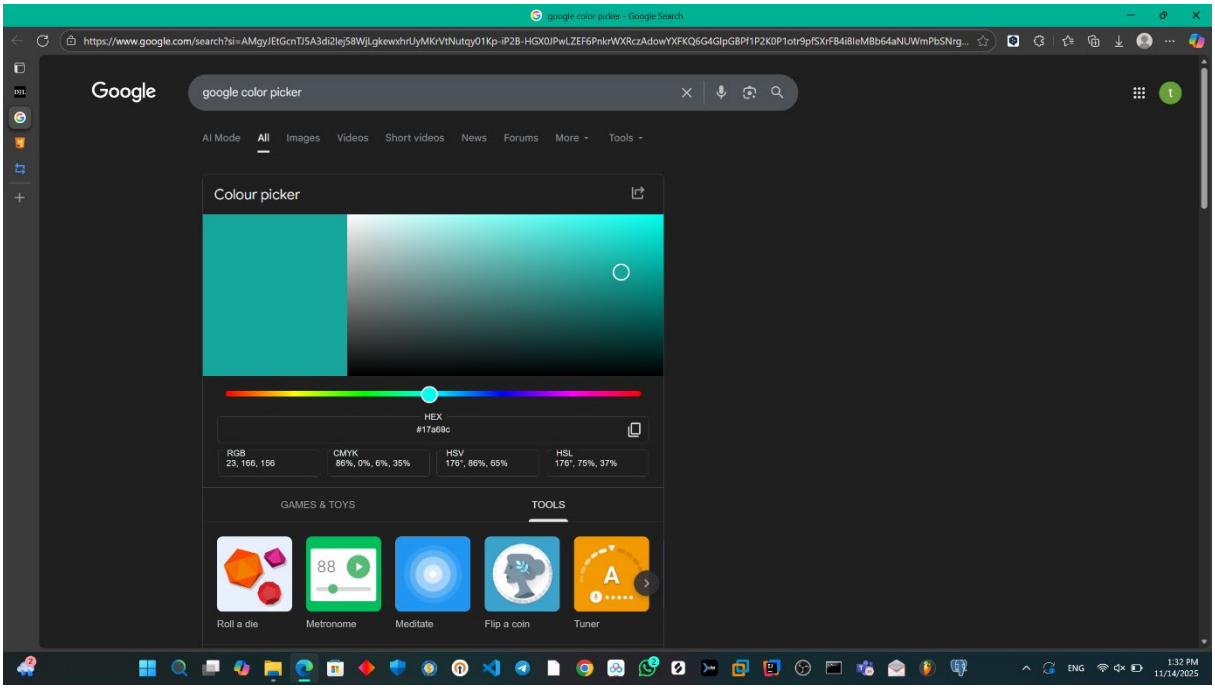
An IPv4 subnet is 32-bit, show with a calculation why this is the case.

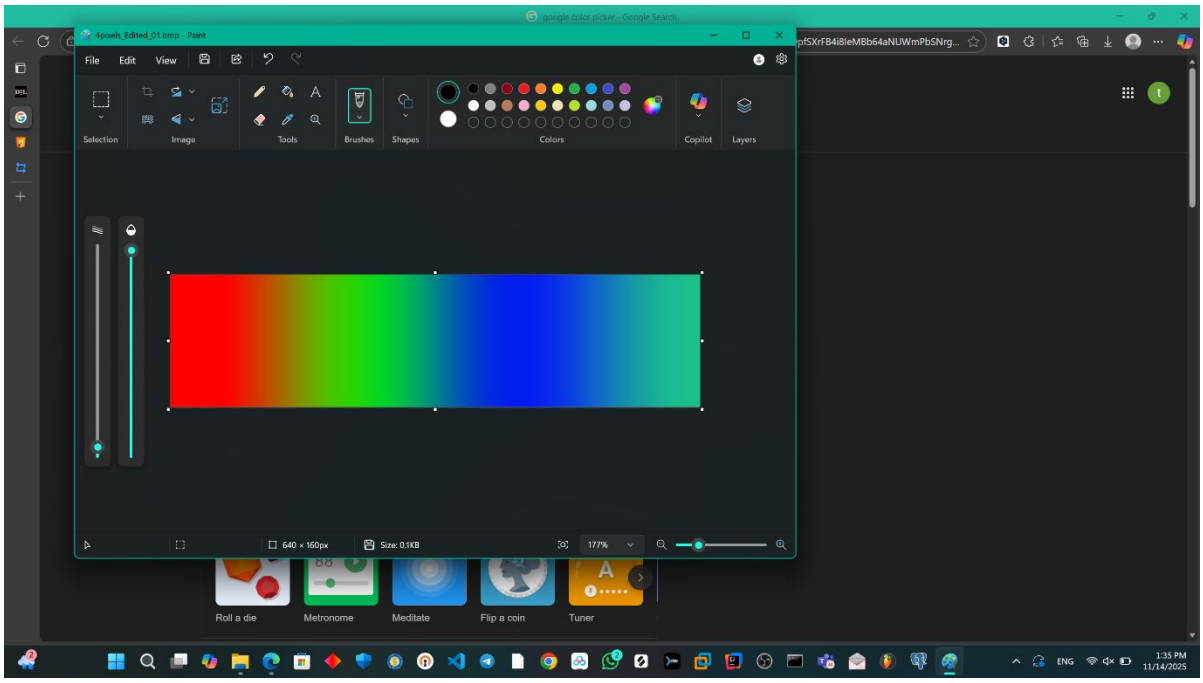
For this lets take the admin ip address in my ubuntu as an example which goes like 192.139.168.128

It has four groups of 8-bit numbers (the numbers themselves are decimals but they fall into a range of 0-255 values from 8-bit) so 4 * 8 gives 32

Assignment 1.2: Your favourite color

Hexadecimal color code: 17 A6 9C

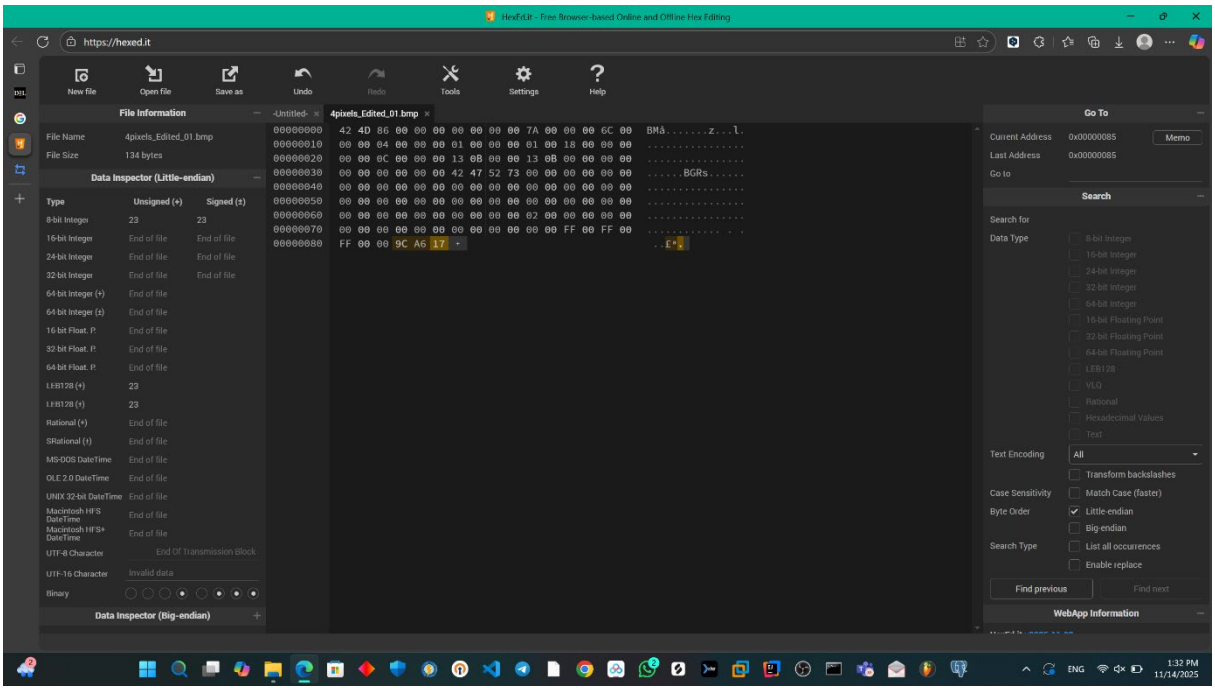




Assignment 1.3: Manipulating binary data

Color	Color code hexadecimaal (RGB)	Big Endian	Little Endian
RED	FF 00 00	FF 00 00	00 00 FF
GREEN	00 FF 00	00 FF 00	00 FF 00
BLUE	00 00 FF	00 00 FF	FF 00 00
WHITE	FF FF FF	FF FF FF	FF FF FF
Favourite (previous assignment)	17 A6 9C	17 A6 9C	9C A6 17

Screenshot modified BMP file in hex editor:



Assignment 1.4: Student number to HEX and Binary

Convert your student number to a hexadecimal number and a binary number.

Explain in detail that the calculation is correct. Use the PowerPoint slides of week 1.

Student number : 585902

585902 -> divided by 2 -> 292951 -> remainder = 0

292951 -> divided by 2 -> 146475 -> remainder = 1

146475 -> divided by 2 -> 73237 -> remainder = 1

73237 -> divided by 2 -> 36618 -> remainder = 1

36618 -> divided by 2 -> 18309 -> remainder = 0

18309 -> divided by 2 -> 9154 -> remainder = 1

9154 -> divided by 2 -> 4577 -> remainder = 0

4577 -> divided by 2 -> 2288 -> remainder = 1

2288 -> divided by 2 -> 1144 -> remainder = 0

1144 -> divided by 2 -> 572 -> remainder = 0

572 -> divided by 2 -> 286 -> remainder = 0

286 -> divided by 2 -> 143 -> remainder = 0

143 -> divided by 2 -> 71 -> remainder = 1

71 -> divided by 2 -> 35 -> remainder = 1

35 -> divided by 2 -> 17 -> remainder = 1

17 -> divided by 2 -> 8 -> remainder = 1

8 -> divided by 2 -> 4 -> remainder = 0

4 -> divided by 2 -> 2 -> remainder = 0

2 -> divided by 2 -> 1 -> remainder = 0

1 -> divided by 2 -> 0 -> remainder = 1

Final binary = 10001111000010101110

To make that I combined all the remainder numbers from bottom to top representing left to right binary.

To convert that to hexadecimal i separated groups of four :

1000, 1111, 0000, 1010, 1110

binary	Its decimal equivalent	Its hex equivalent
1000	$(1\times2^3) + (0\times2^2) + (0\times2^1) + (0\times2^0)$ $= 2^3 = 8$	8
1111	$(1\times2^3) + (1\times2^2) + (1\times2^1) + (1\times2^0)$ $= 15$	F
0000	$(0\times2^3) + (0\times2^2) + (0\times2^1) + (0\times2^0)$ $= 0$	0
1010	$(1\times2^3) + (0\times2^2) + (1\times2^1) + (0\times2^0)$ $= 10$	A
1110	$(1\times2^3) + (0\times2^2) + (0\times2^1) + (0\times2^0)$ $= 14$	E

Then combine them in the original order so the final hexadecimal number is : 8F0AE

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