Template Week 1 – Bits & Bytes

Student number: 580606

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

A bit is a single place or symbol in a binary number, represented by a value of either 0 or 1. A byte is group of eight bits. It is also used as the standard unit to represent data.

What is a nibble?

A nibble is a 4-bit number or half a bite.

What relationship does a nibble have with a hexadecimal value?

A nibble corresponds to one symbol in a hexadecimal number.

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

Firstly, binary data is represented by long sequences of 0s and 1s, which is hard for humans to read and comprehend. Secondly, it is easier to convert numbers between binary and hexadecimal than between binary and decimal, because each symbol in a hexadecimal number stands for four symbols in a binary number. For instance, 10011100 binary translates to 9C hexadecimal and 156 decimal. It is possible to predict how the binary number looks based on the hexadecimal, while the relationship is not as clear with the decimal number. Therefore, displaying binary data as hexadecimal numbers makes understanding it and working with it easier.

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

A byte can be represented with two hexadecimal symbols.

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

An IPv4 subnet consists of four numbers between 0 and 256. Each of the numbers can be represented by a byte, so there are 4 bytes in an IPv4 subnet. Each byte consists of 8 bits, so the overall number of bits is: 4 * 8 = 32 (bits).

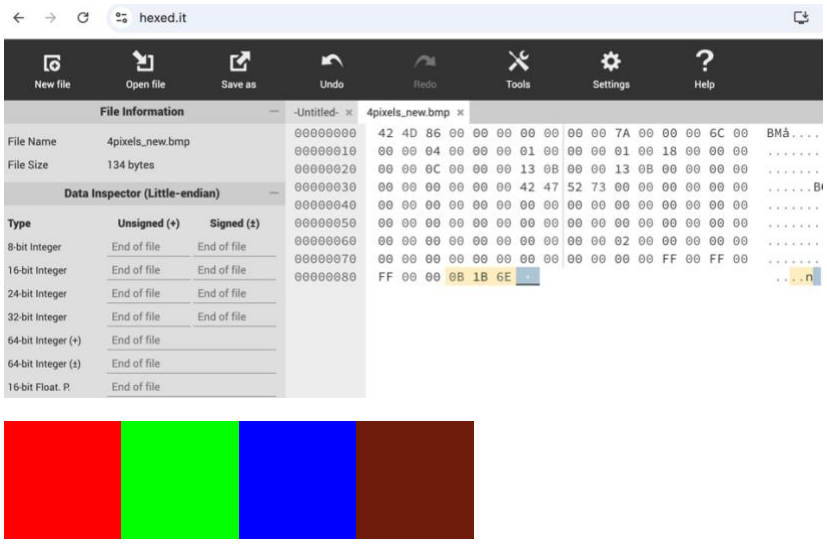
Assignment 1.2: Your favourite color

Hexadecimal color code: 6E1B0B

Assignment 1.3: Manipulating binary data

Color	Color code hexadecimaal (RGB)	Big Endian	Little Endian
RED	FF0000	FF 00 00	00 00 FF
GREEN	00FF00	00 FF 00	00 FF 00
BLUE	0000FF	00 00 FF	FF 00 00
WHITE	FFFFFF	FF FF FF	FF FF FF
Favourite (previous assignment)	6E1B0B	6E 1B 0B	0B 1B 6E

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.

Converting 580606 to binary

1. 580606 ÷ 2 = 290303 (remainder 0)
2. 290303 ÷ 2 = 145151 (remainder 1)
3. 145151 ÷ 2 = 72575 (remainder 1)
4. 72575 ÷ 2 = 36287 (remainder 1)
5. 36287 ÷ 2 = 18143 (remainder 1)
6. 18143 ÷ 2 = 9071 (remainder 1)
7. 9071 ÷ 2 = 4535 (remainder 1)
8. 4535 ÷ 2 = 2267 (remainder 1)
9. 2267 ÷ 2 = 1133 (remainder 1)
10. 1133 ÷ 2 = 566 (remainder 1)
11. 566 ÷ 2 = 283 (remainder 0)
12. 283 ÷ 2 = 141 (remainder 1)
13. 141 ÷ 2 = 70 (remainder 1)
14. 70 ÷ 2 = 35 (remainder 0)
15. 35 ÷ 2 = 17 (remainder 1)
16. 17 ÷ 2 = 8 (remainder 1)
17. 8 ÷ 2 = 4 (remainder 0)
18. 4 ÷ 2 = 2 (remainder 0)
19. 2 ÷ 2 = 1 (remainder 0)
20. 1 ÷ 2 = 0 (remainder 1)

Reading the remainders from finish to start, we get the number 10001101101111111110 binary

Converting 580606 to hexadecimal

We already have the binary representation of 580606, so let's convert it to hexadecimal.

1. Group the binary digits into sets of four: 1000 1101 1011 1111 1110
2. Convert each group:
    a. 1000 bin = 1 * 8 + 0 * 4 + 0 * 2 + 0 * 1 = 8 hex
    b. 1101 bin = 1 * 8 + 1 * 4 + 0 * 2 + 1 * 1 = D hex
    c. 1011 bin = 1 * 8 + 0 * 4 + 1 * 2 + 1 * 1 = B hex
    d. 1111 bin = 1 * 8 + 1 * 4 + 1 * 2 + 1 * 1 = F hex
    e. 1110 bin = 1 * 8 + 1 * 4 + 1 * 2 + 0 * 1 = E hex
3. Combine the hexadecimal digits: 580606 decimal is 8D9FE hexadecimal