Week 1 – Bits & Bytes

Student number: 578438

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

Bit is the smallest unit of the data in a computer which represents value of 0 or 1.

Bytes is the standard unit used to represent a character of data. 1 Byte consists of 8 bits.

What is a nibble?

A nibble consists of 4 bits.

What relationship does a nibble have with a hexadecimal value?

1 nibble is equivalent to 1 hexadecimal value.

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

Because it is easier and simpler to write and read compared to binary data.

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

2 hexadecimal digit is equivalent to 1 byte.

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

An IPv4 is split in 4 spaces, with 8 bits in each space, if we multiply the 4 spaces by the 8 bits that are in each space, we get the result 4 * 8 = 32.

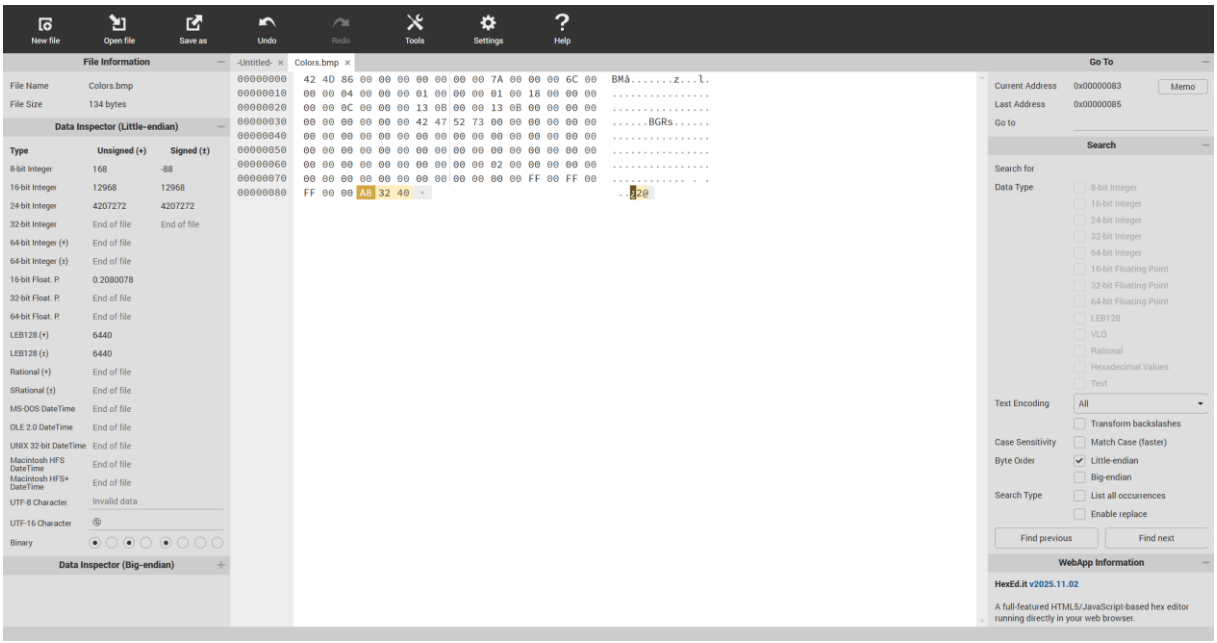
Assignment 1.2: Your favourite color

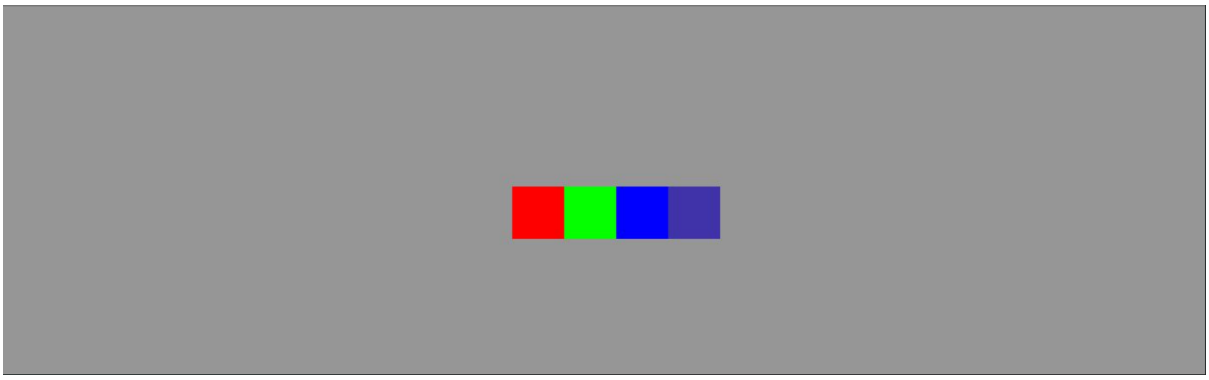
Hexadecimal color code: 4032A8

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	00FF00
BLUE	0000FF	00 00 FF	FF 00 00
WHITE	FFFFFF	FF FF FF	FF FF FF
Favourite (previous assignment)	4032A8	40 32 A8	A8 32 40

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: 578438

Student number in Binary: 10001101001110000110

578438/2 = 289219 0

289219/2 = 144609 1

144609/2 = 72304 1

72304/2 = 36152 0

36152/2 = 18076 0

18076/2 = 9038 0

9038/2 = 4519 0

4519/2 = 2259 1

2259/2 = 1129 1

1129/2 = 564 1

564/2 = 282 0

282/2 = 141 0

141/2 = 70 1

70/2 = 35 0

35/2 = 17 1

17/2 = 8 1

8/2 = 4 0

4/2 = 2 0

2/2 = 1 0

1/2 = 0 1

To convert a decimal number to binary, we divide the decimal number by 2, and keep track of the remainders, after that, we read the remainders from last to first, and that is the binary representation of the decimal number.

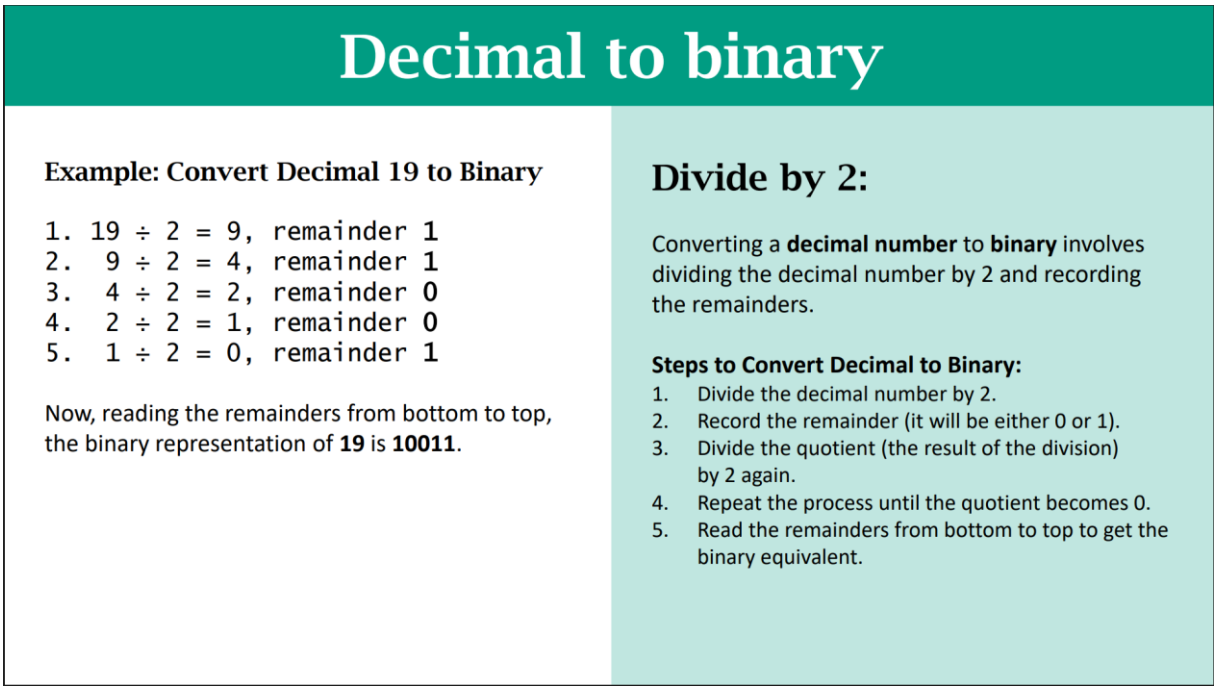


Fig: From Slide 30

Student number in Hexadecimal: 8D386

578438 / 16 = 36152 | 6

36152/16 = 2259 | 8

2259/16 = 141 | 3

141/16 = 8 | 13

8/16 = 0 | 8

The conversion of decimal to hexadecimal applies the same logic as the decimal to binary conversation, but instead of dividing by 2, we divide the decimal value by 16. If we wanted to convert from hexadecimal directly to Binary, we would have to convert each hexadecimal digit to binary (Using the same logic of decimal to Binary, since the digits carry the same value) taking into consideration that each digit corresponds to 4 binary digits, and then combine the binary groups

Decimal to hexadecimal

Example: Convert Decimal 945 to Hexadecimal

```
1. 945 ÷ 16 = 59, remainder 1
2.  59 ÷ 16 = 3,  remainder 11(B in hex)
3.   3 ÷ 16 = 0,  remainder 3
```

Reading the remainders from bottom to top, the hexadecimal representation of **945** is **3B1**.

Divide by 16:

To convert a **decimal number** to **hexadecimal** (base-16), you divide the number by **16** and use the remainders to form the hexadecimal equivalent.

1. Divide the decimal number by 16.
2. Record the remainder, which will be a value from 0 to 15.
3. Divide the quotient by 16.
4. Repeat until the quotient becomes 0.
5. Read the remainders from bottom to top to get the hexadecimal value.

MY Student number in hexadecimal to binary: 8D383 = 10001011001110000110

8D383

8 / 2 = 4 | 0

4 / 2 = 2 | 0

2 / 2 = 1 | 0

1 / 2 = 0 | 1

8 = 1000

D = 13 / 2 = 6 | 1

6 / 2 = 3 | 0

3 / 2 = 1 | 1

1 / 2 = 0 | 1

D = 1101

3 / 2 = 1 | 1

1 / 2 = 0 | 1

3 = 0011

8 / 2 = 4 | 0

4 / 2 = 2 | 0

2 / 2 = 1 | 0

1 / 2 = 0 | 1

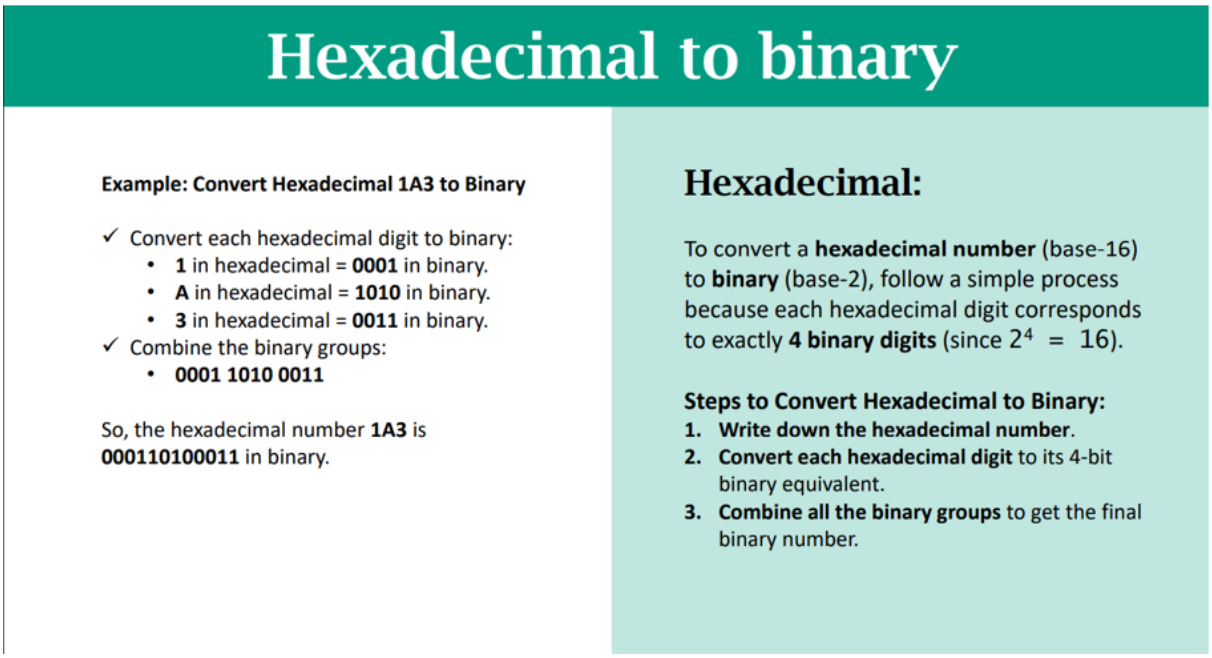
8 = 1000

6 / 2 = 3 | 0

3 / 2 = 1 | 1

1 / 2 = 1 | 1

6 = 0110



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