Template Week 1 – Bits & Bytes

Student number: 593201

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

- A bit (binary digit) is the smallest unit of data in computing and can have a value of 0 or 1.
- A byte is a group of 8 bits.
- Bytes are commonly used to represent characters, numbers, and other data.

What is a nibble?

- A nibble is a group of 4 bits.
- It is exactly half of a byte.

What relationship does a nibble have with a hexadecimal value?

- One hexadecimal digit represents 4 bits, which is exactly one nibble.
- Example:
  - Binary **1010** = Hexadecimal **A**
  - Binary **1111** = Hexadecimal **F**

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

- Binary numbers are long and difficult to read.
- Hexadecimal shortens binary data while remaining easy to convert back.
- Each hex digit maps cleanly to 4 bits, reducing errors and improving readability.
- Example:
  - Binary: **110101001011**
  - Hex: **D4B**

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

- A byte (8 bits) is represented by two hexadecimal digits.
- Since:
  - 1 hex digit = 4 bits
  - 2 hex digits = 8 bits = 1 byte
- Example:
  - Binary: **11111111**
  - Hex: **FF**

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

- An IPv4 address consists of 4 octets.
- Each octet is 8 bits.
- Calculation:
  - **4 octets × 8 bits = 32 bits**
- Therefore, an IPv4 subnet is 32-bit.

Assignment 1.2: Your favourite color

Hexadecimal color code: #00FFFF

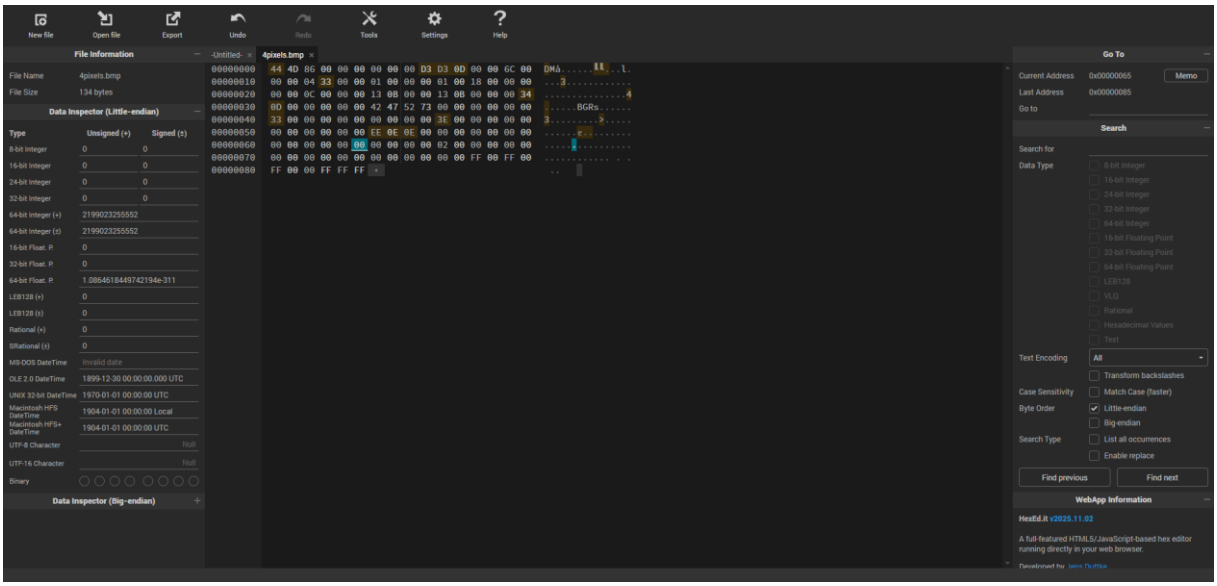
Explanation:

- Cyan is made by combining green and blue light at full intensity, with no red.
- In hexadecimal RGB format:
  - Red: **00**
  - Green: **FF**
  - Blue: **FF**
- This results in the hex color code **#00FFFF**.

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)	#00FFFF	00 FF FF	FF FF 00

Screenshot modified BMP file in hex editor:



Assignment 1.4: Student number to HEX and Binary

Student number: 593201

- Hexadecimal: 0x90D31
- Binary: 10010000110100110001

Hexadecimal is base-16, meaning each digit represents a power of 16 from right to left.

$0x90D31 = (9 \times 16^4) + (0 \times 16^3) + (13 \times 16^2) + (3 \times 16^1) + (1 \times 16^0)$

Calculate each term:

- $9 \times 16^4 = 9 \times 65536 = 589824$
- $0 \times 16^3 = 0 \times 4096 = 0$
- $13 \times 16^2 = 13 \times 256 = 3328$
- $3 \times 16^1 = 3 \times 16 = 48$
- $1 \times 16^0 = 1 \times 1 = 1$

Add the results: $589824 + 0 + 3{,}328 + 48 + 1 = 593201$