Template Week 1 – Bits & Bytes

Student number:

577534

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 the value **0 or 1**.
A **byte** is a collection of **8 bits**, used as the basic unit for storing data (for example, one character in ASCII takes 1 byte).

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 **nibble (4 bits)** can represent exactly **one hexadecimal digit (0–F)**.
Example:
4 bits → 0000 to 1111 → 0 to 15 → hex 0 to F.

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

Hexadecimal is much shorter and easier to read than binary.

- 1 hex digit replaces 4 bits
- Long binary values become compact (e.g. 111110101100 → 0xFAC)
  This reduces human error and makes debugging and data inspection easier

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

A byte contains **8 bits**, which equals **two nibbles**, so **1 byte = 2 hex digits**.
Example:
Binary: 11001010
Hex: CA

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

IPv4 addresses use **four 8-bit numbers** (one byte per octet):

- 4 octets × 8 bits = **32 bits**

Example:
192.168.1.10 →
192 = 11000000
168 = 10101000
1 = 00000001
10 = 00001010

Total = **32 bits**

Assignment 1.2: Your favourite color

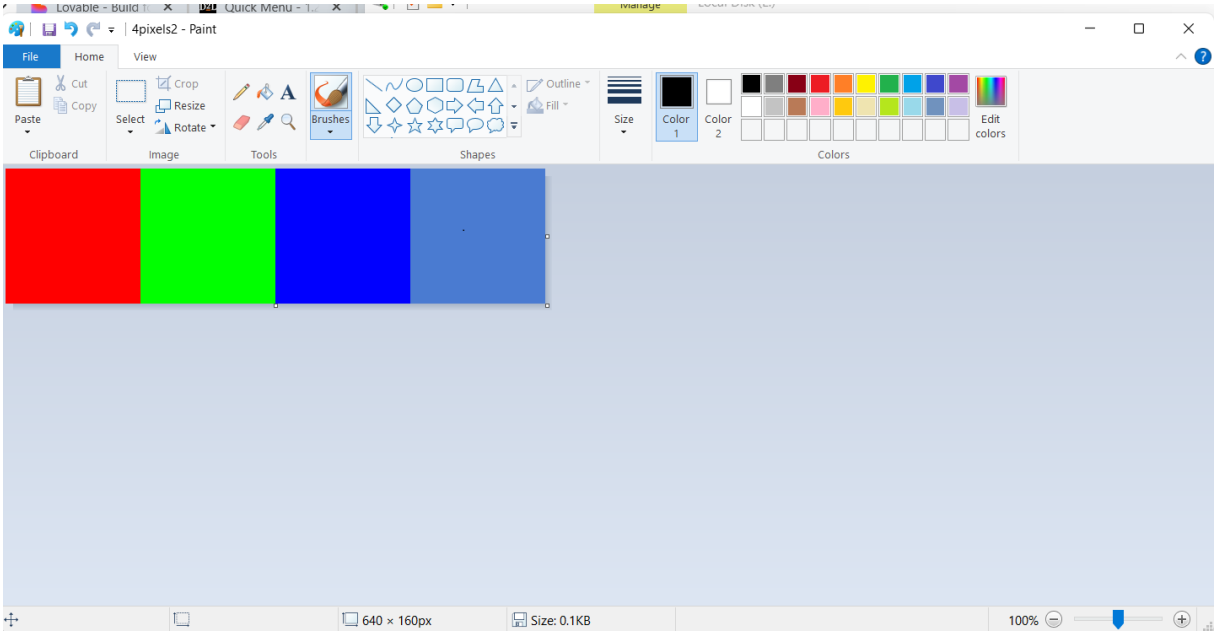
Hexadecimal color code:

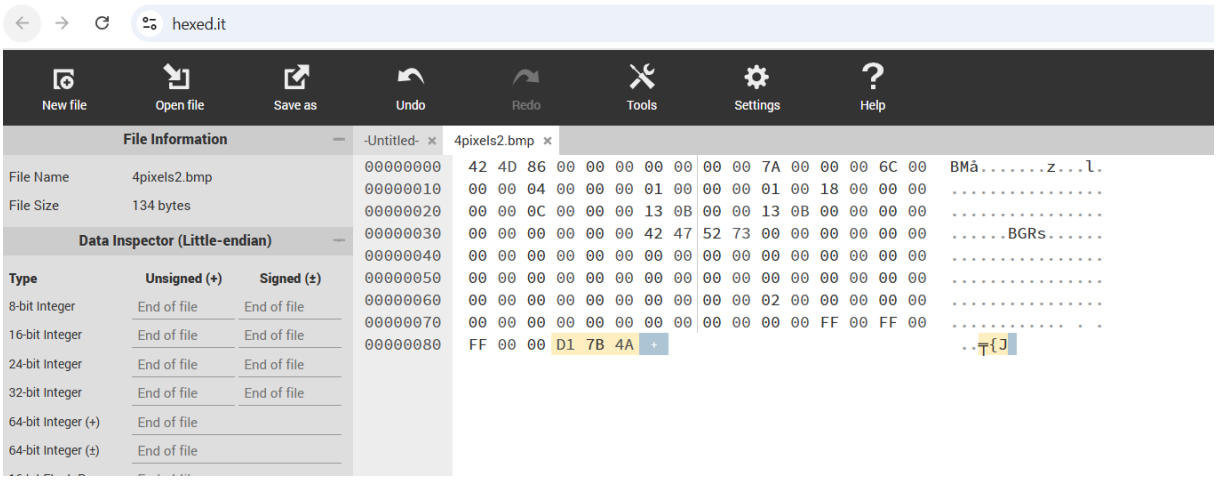
#4A7BD1

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)	**#4A7BD1**	4A 7B D1	D1 7B 4A

Screenshot modified BMP file in hex editor:




hexed.it
New file
Open file
Save as
Undo
Redo
Tools
Settings
Help
File Information
File Name 4pixels2.bmp
File Size 134 bytes
Data Inspector (Little-endian)
Type
Unsigned (+)
Signed (±)
8-bit Integer
16-bit Integer
24-bit Integer
32-bit Integer
64-bit Integer (+)
64-bit Integer (±)
End of file
-Untitled-
4pixels2.bmp
00000000 42 4D 86 00 00 00 00 00 00 00 7A 00 00 00 6C 00 BMå.....z...l.
00000010 00 00 04 00 00 00 01 00 00 00 01 00 18 00 00 00 ....
00000020 00 00 0C 00 00 00 13 0B 00 00 13 0B 00 00 00 00 ....
00000030 00 00 00 00 00 00 42 47 52 73 00 00 00 00 00 00 ......BGRs......
00000040 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
00000050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
00000060 00 00 00 00 00 00 00 00 00 00 02 00 00 00 00 00 ....
00000070 00 00 00 00 00 00 00 00 00 00 00 00 FF 00 FF 00 ....
00000080 FF 00 00 D1 7B 4A ..╤{J

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.

1. Convert to hexadecimal

We convert 577534 to hex:

577534 ÷ 16 = 36095 remainder 14 (E)
36095 ÷ 16 = 2255 remainder 15 (F)
2255 ÷ 16 = 140 remainder 15 (F)
140 ÷ 16 = 8 remainder 12 (C)
8 ÷ 16 = 0 remainder 8

577534 = 8CFFE

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2. Convert to binary

Convert each hex digit:

Hex	Binary
8	1000
C	1100
F	1111
F	1111
E	1110

So:

577534 = 8CFFE = 1000 1100 1111 1111 1110_2

Ready? Save this file and export it as a pdf file with the name: **week1.pdf**