Template Week 1 – Bits & Bytes

Student number: 578634

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

A bit is a single place or a symbol in a binary number. Each bit can be either 0 or 1. In order to represent anything more complex we use a sequence of bits, grouped by sets of eight. These sets are called bytes.

What is a nibble?

A 4-bit number, a half of a byte, is called a nibble.

What relationship does a nibble have with a hexadecimal value?

Since a nibble is 4 bits it maps perfectly to a hexadecimal digit since it can represent 16 different values which the digit system uses (0-9 and A-F). Example mapping:

- 0 = 0000 = 0x0
- 1 = 0001 = 0x1
- 2 = 0010 = 0x2
- 10 = 1010 = 0xA
- 11 = 1011 = 0xB
- 15 = 1111 = 0xF

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

Displaying binary data as hexadecimal is much more compact and easier to read. Each hexadecimal digit represents four binary bits, so long binary strings can be shortened significantly without losing information. This reduces errors when reading or writing binary data and makes patterns in the data easier to recognize. For example, 11110101 00101011 is much easier to read as 0xF52B.

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

A byte is an eight-bit sequence which is equal to two hexadecimal digits (each hex digit is a nibble). So a byte maps to a hex value from 0x00 to 0xFF.

- 00000000 (binary) = 0x00 (hex) = 0 (decimal)
- 11111111 (binary) = 0xFF (hex) = 255 (decimal)
- 10100101 (binary) = 0xA5 (hex) = 165 (decimal)

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

An IPv4 subnet is written by using 4 octets where octet equals 8 bits.

So: **4 octets times 8 bits each = 4 * 8 = 32 bits**

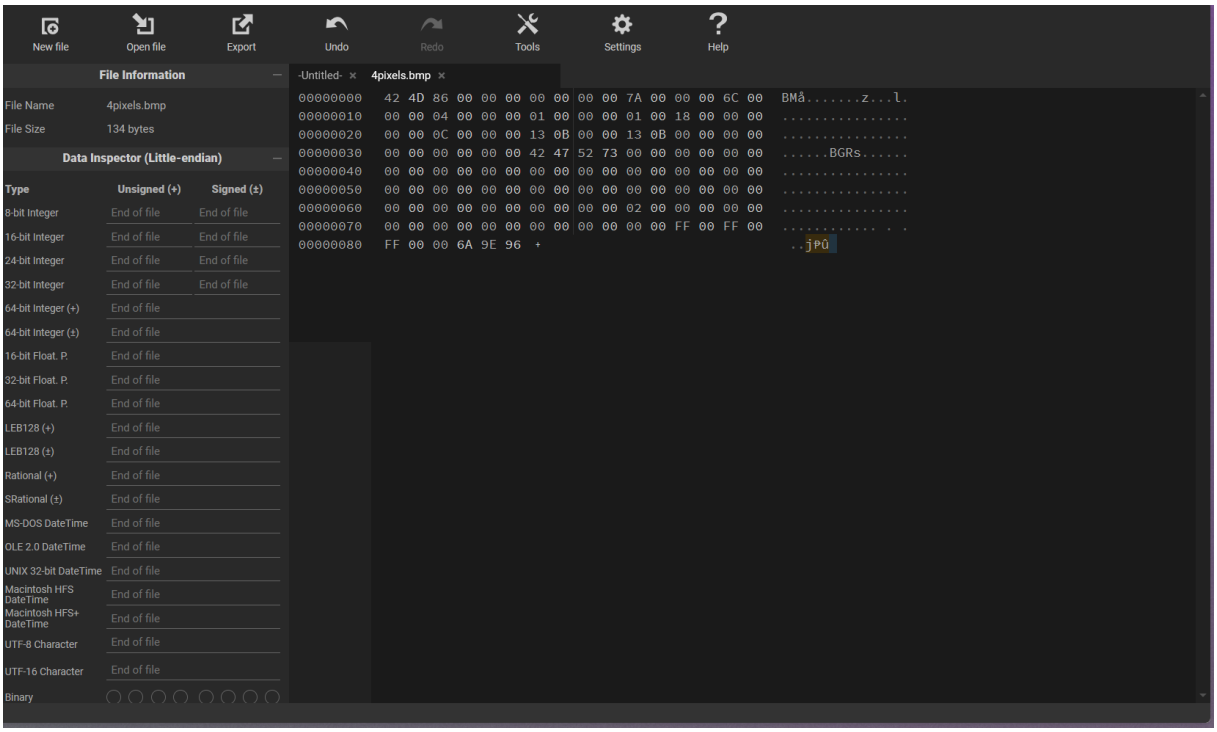
Assignment 1.2: Your favourite colour

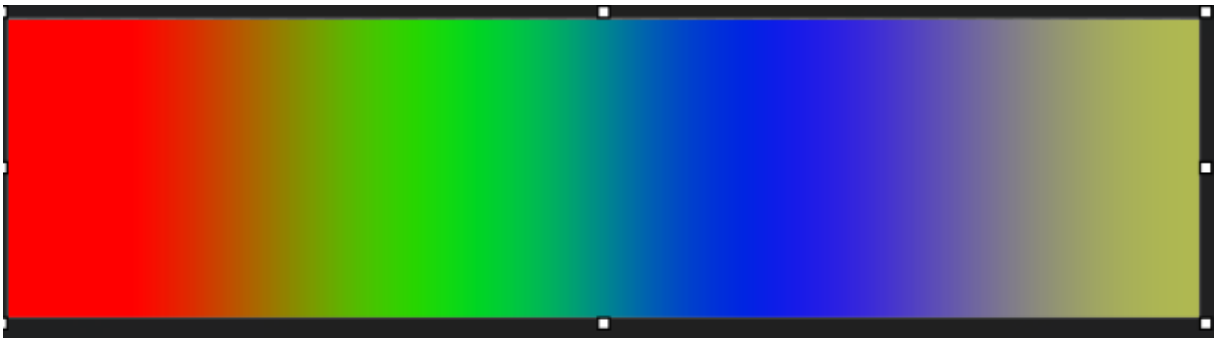
Hexadecimal colour code: **#6a9e96**

Assignment 1.3: Manipulating binary data

Color	Color code hexadecimaal (RGB)	Big Endian	Little Endian
RED	FF0000	FF0000	0000FF
GREEN	00FF00	00FF00	00FF00
BLUE	0000FF	0000FF	FF0000
WHITE	FFFFFF	FFFFFF	FFFFFF
Favourite (previous assignment)	6A9E96	6A9E96	969E6A

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: 578634

To Hexadecimal:

$578634_{10} = 8D44A_{16}$

Calculation:

578634 / 16 = 36164, remainder 10 -> A
36164 / 16 = 2260, remainder 4
2260 / 16 = 141, remainder 4
141 / 16 = 8, remainder 13 -> D
8 / 16 = 0, remainder 8

To Binary (from Hexadecimal):

$8D44A_{16} = 1000\ 1101\ 0100\ 0100\ 1010_2$

Calculation:

Divide by digits -> 8 D 4 4 A

8 / 2 = 4, remainder 0
4 / 2 = 2, remainder 0
2 / 2 = 1, remainder 0
1 / 2 = 0, remainder 1

$8_{10} = 1000_2$

D -> 13

13 / 2 = 6 remainder 1
6 ÷ 2 = 3 remainder 0
3 ÷ 2 = 1 remainder 1
1 ÷ 2 = 0 remainder 1
$D_{16} = 13_{10} = 1101_2$

4

4 / 2 = 2, remainder 0
2 / 2 = 1, remainder 0

1 / 2 = 0, remainder 1
$4_{10} = 0100_2$

A -> 10
10 / 2 = 5, remainder 0
5 / 2 = 2, remainder 1
2 / 2 = 1, remainder 0
1 / 2 = 0, remainder 1
$A_{16} = 10_{10} = 1010_2$

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