

Week 1 – Bits & Bytes

Student number: 547201

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

Inside PC is a Central Processing Unit, or CPU. It's basically a piece of silicon with billions of microscopic switches called transistors. Depending on the flow of electricity, they can be on or off, kind of like a light bulb, which gives us two states: 1 and 0. The value at one of these switches is called a "bit". One bit by itself doesn't really do much. But put them together, a group of 8 bits is called a "byte" and can have 256 different combinations of 0s and 1s.

What is a nibble?

Nibble is half a byte, or 4 bits.

What relationship does a nibble have with a hexadecimal value?

Four binary bits can take any value from 0 to 15. Hexadecimal uses 0-9 and A-F, to represent those values, so a group of four bits can be replaced by one hexadecimal digit.

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

It is readable for human than binary. A single byte in binary requires 8 digits which is long and easy to mistake when reading. The same byte in hexadecimal is just two clean digits and one hex digit is 4 bits.

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

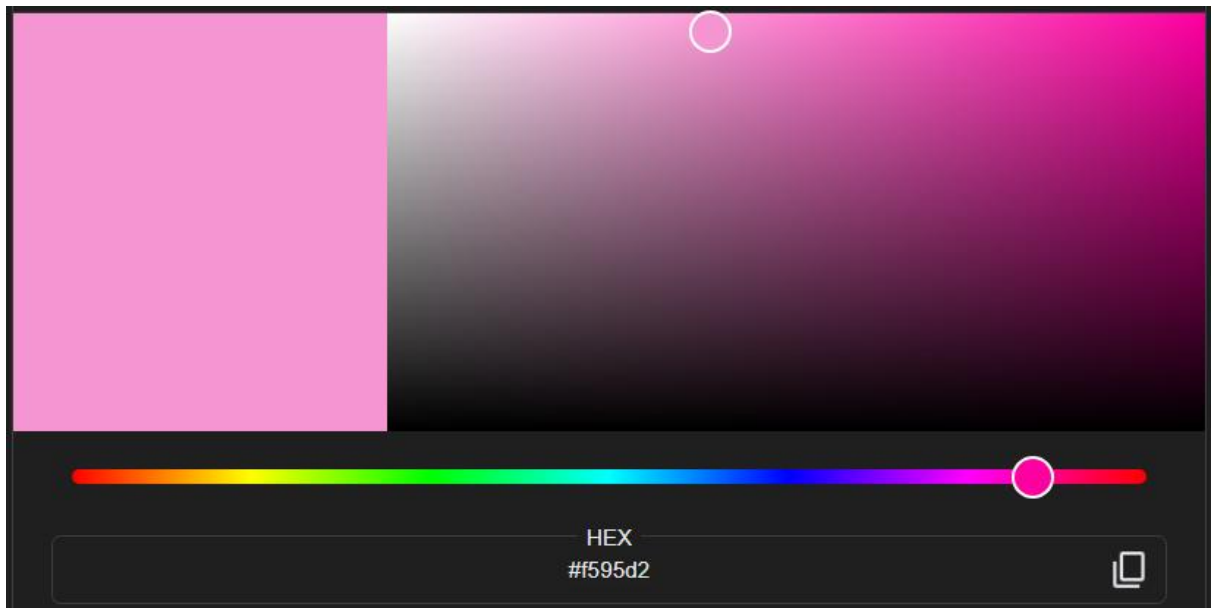
A byte is 8 bits, and one hex digit represents 4 bits, it takes two hex digits to represent one byte. The first hex digit is for the first 4 bits and the second hex digit is for the last 4 bits.

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

The simplest IP address I know is 1.1.1.1, it has four sections. Each section can be from 0 to 255. In a computer, each of these sections is stored as one byte (8 bits). So, 4 sections x 8 bits each = 32 bits total.

Assignment 1.2: Your favourite color

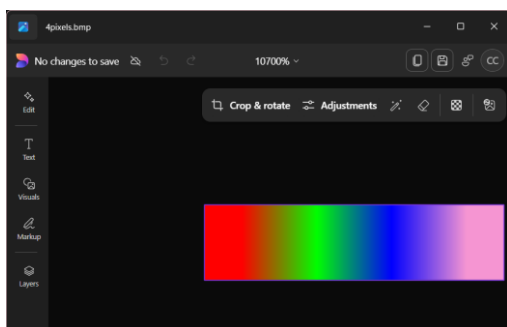
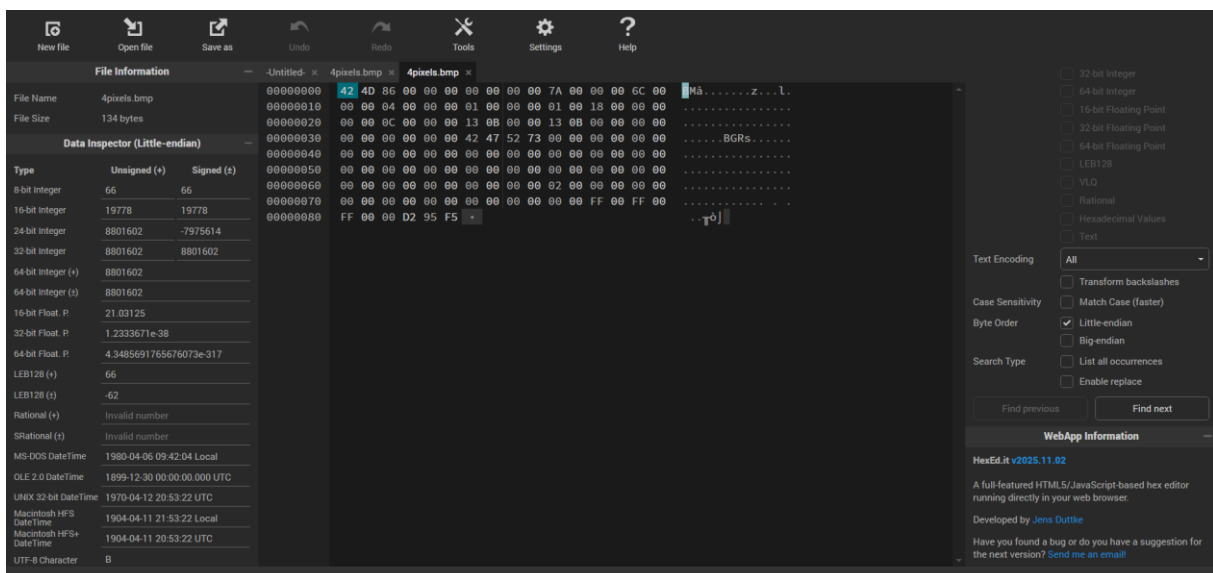
Hexadecimal color code: #f595d2



Assignment 1.3: Manipulating binary data

Color	Color code hexadecimal (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)	F595D2	F5 95 D2	D2 95 F5

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.

$$547201/16 = 34200 \text{ r}1$$

$$34200/16 = 2137 \text{ r}8$$

$$2137/16 = 133 \text{ r}9$$

$$133/16 = 8 \text{ r}5$$

$$8/16 = 0 \text{ r}8$$

$$547201 \text{ to hexadecimal} = 85981$$

$$547201 \text{ to binary} = 85981 \text{ hex to binary (or dividing 547201 by 2)}$$

$$= 1000\ 0101\ 1001\ 1000\ 0001$$

verify

$$85981 = (8 \times 16^4) + (5 \times 16^3) + (9 \times 16^2) + (8 \times 16^1) + (1 \times 16^0)$$

$$= (8 \times 65536) + (5 \times 4096) + (9 \times 256) + (8 \times 16) + (1 \times 1)$$

$$= 524288 + 20480 + 2304 + 128 + 1$$

$$= 547201$$