

Week 1 – Bits & Bytes.

Student number:

578856

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

Bits are the smallest units of data, they can be either 0 or 1. Bytes are the groups of 8 bits, they usually represent the single characters, like a letters or numbers.

What is a nibble?

Nibble is a group of 4 bits, which is a half of the byte.

What relationship does a nibble have with a hexadecimal value?

A nibble has a direct relationship with a hexadecimal digit — each nibble corresponds to exactly one hex digit.

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

Displaying binary data in hexadecimal values makes it shorter, clearer, and easier to work with, while still showing the exact same information.

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

One byte of data is two hexadecimal digits, so the relationship is one-to-two.

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

An IPv4 address is 32 bits long. It is divided into 4 octets of 8 bits each. For example, if the IPv4 is 192.168.1.1, then 192 is 8 bits, 168 is 8 bits, 1 is 8 bits and 1 is also 8 bits. If we convert decimal numbers to binary numbers, we will get 192.168.1.1 -> 11000000.10101000.00000001.00000001.

If we count the bits: $8 + 8 + 8 + 8 = 32$ bits.

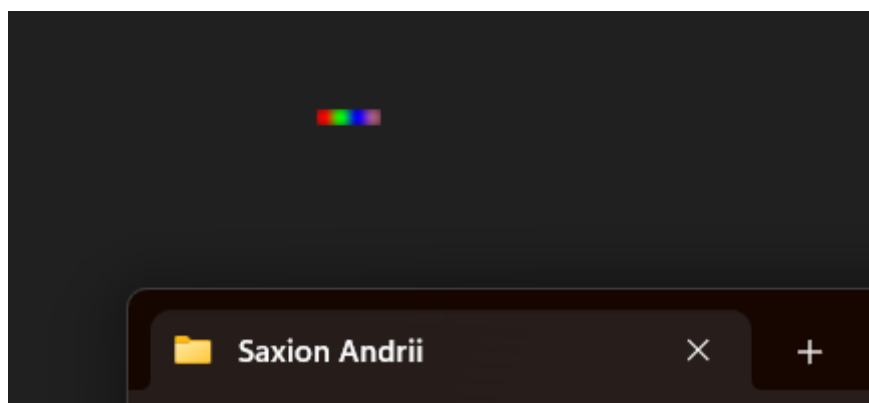
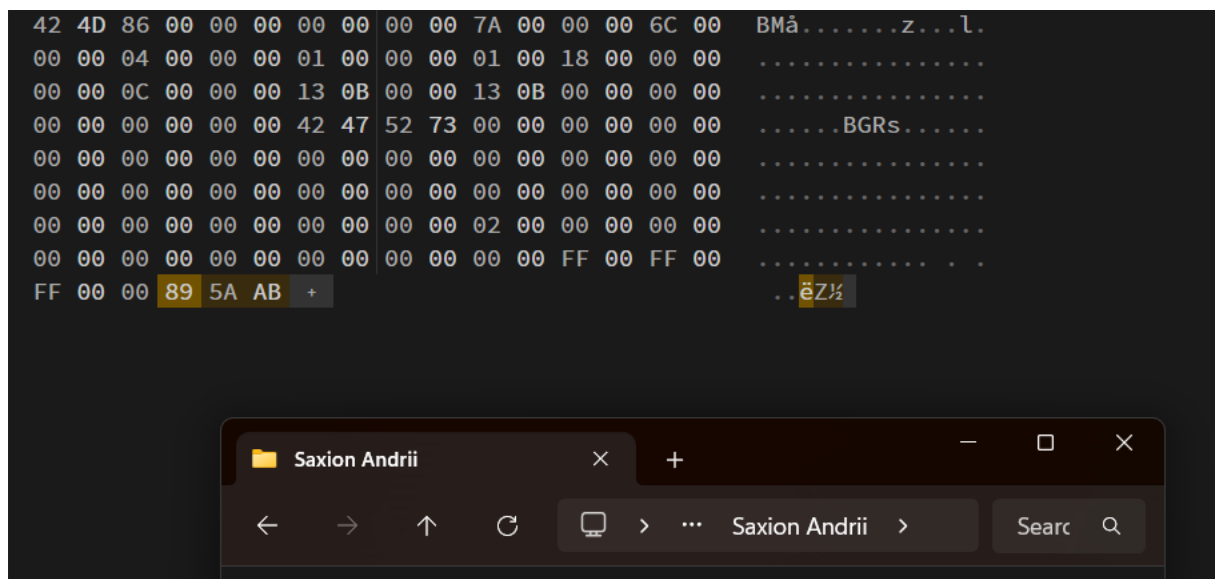
Assignment 1.2: Your favourite color

Hexadecimal color code: #ab5a89

Assignment 1.3: Manipulating binary data

Color	Color code hexadecimal (RGB)	Big Endian	Little Endian
RED	FF 00 00	FF 00 00	00 00 FF
GREEN	00 FF 00	00 FF 00	00 FF 00
BLUE	00 00 FF	00 00 FF	FF 00 00
WHITE	FF FF FF	FF FF FF	FF FF FF
Favourite (previous assignment)	AB 5A 89	AB 5A 89	89 5A AB

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.

My student number is 578856. To convert it to a binary number, we repeatedly divide the number by 2, recording the remainders, until the result of the division is 0. Reversing the order of the remainders gives the binary representation:

$578856/2 = 289428$, remainder is 0;

$289428/2 = 144714$, remainder is 0;

$144714/2 = 72357$, remainder is 0;

$72357/2 = 36178$, remainder is 1;

$36178/2 = 18089$, remainder is 0;

$18089/2 = 9044$, remainder is 1;

$9044/2 = 4522$, remainder is 0;

$4522/2 = 2261$, remainder is 0;

$2261/2 = 1130$, remainder is 1;

$1130/2 = 565$, remainder is 0;

$565/2 = 282$, remainder is 1;

$282/2 = 141$, remainder is 0;

$141/2 = 70$, remainder is 1;

$70/2 = 35$, remainder is 0;

$35/2 = 17$, remainder is 1;

$17/2 = 8$, remainder is 1;

$8/2 = 4$, remainder is 0;

$4/2 = 2$, remainder is 0;

$2/2 = 1$, remainder is 0;

$1/2 = 0$, remainder is 1;

Now we take remainders from bottom to top: 10001101010100101000 – **binary number**.

To convert the student number to hexadecimal number, we need to do the same as with binary number, but now we divide the decimal number by 16, recording the remainders.

$578856/16 = 36178$, remainder is 8;

$36178/16 = 2261$, remainder is 2;

$2261/16 = 141$, remainder is 5;

$141/16 = 8$, remainder is 13;

$8/16 = 0$, remainder is 8;

13 in hexadecimal is D, so:

Hexadecimal = 8D528.

The answer is:

- 1) 578856 in binary is **10001101010100101000**;
- 2) 578856 in hexadecimal is **8D528**;