

Template Week 1 – Bits & Bytes

Student number:

563790

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

A bit is the smallest unit of data in a computer, representing a value of either 0 or 1.

A byte consists of 8 bits and is the standard unit used to represent a character of data, such as a letter or symbol.

What is a nibble?

A nibble is four consecutive binary digits or half of an 8-bit byte.

What relationship does a nibble have with a hexadecimal value?

A nibble can be represented by a single hexadecimal digit and is called a hexadecimal digit.

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

Hex is useful because large numbers can be represented using fewer digits.

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

Two hex digits can represent a byte, since each hex digit represents a 4-bit pattern.

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

IPv4 consists of 4 section with range 0 – 255 (so 256 possible digits)

$$256 = 2^8$$
$$2^8 * 2^8 * 2^8 * 2^8 = 2^{32}$$

Assignment 1.2: Your favourite colour

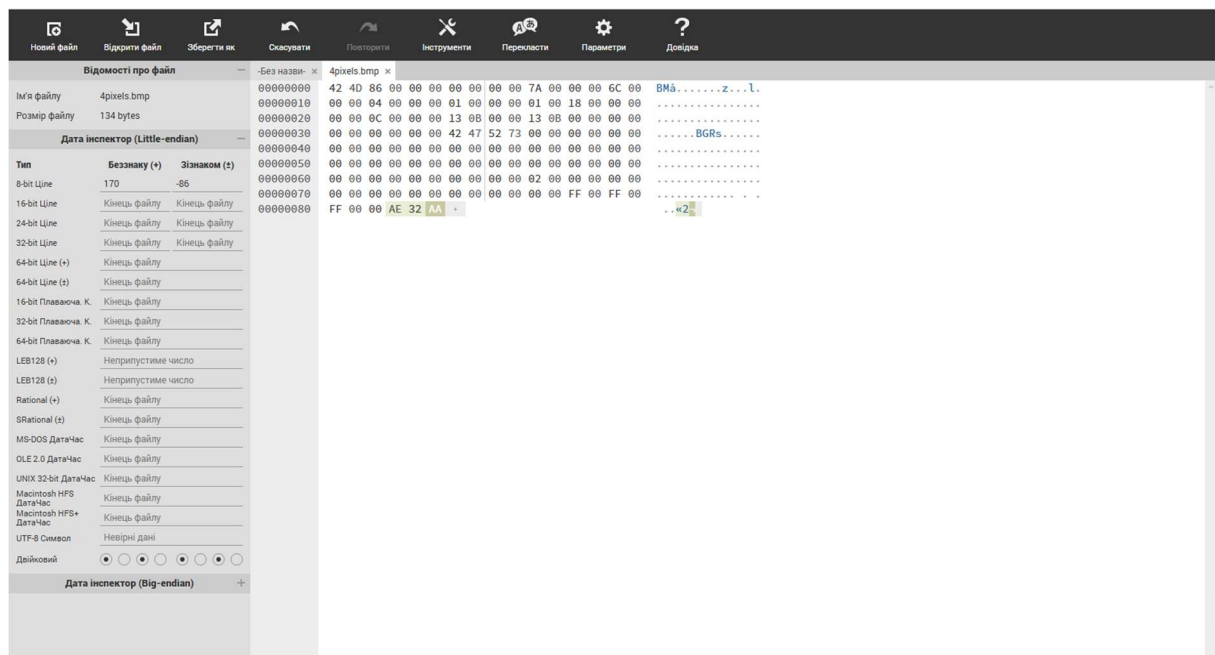
Hexadecimal colour code:

AE32AA

Assignment 1.3: Manipulating binary data

Colour	Colour code hexadecimal (RGB)	Big Endian	Little Endian
RED	FF0000	FF0000	0000FF
GREEN	00FF00	00FF00	00FF00
BLUE	0000FF	0000FF	FF0000
WHITE	FFFFFF	FFFFFF	FFFFFF
Favourite (previous assignment)	AE32AA	AE32AA	AA32AE

Screenshot modified BMP file in hex editor:



Bonus point assignment – week 1

Convert your student number to a hexadecimal number and a binary number.

Hexadecimal

Steps:

$$563790/16 = 35236$$

$$35,236/16 = 2,202$$

$$2,202/16 = 137$$

$$137/16 = 8$$

$$8/16 = 0$$

Remainders:

14 - E

4

10 - A

9

8

89A4E

Binary

Steps:

$$563790/2 = 281,895 \quad 35236/2 = 17618 \quad 2202/2 = 1101 \quad 137/2 = 68 \quad 8/2 = 4$$

$$281895/2 = 140947 \quad 17618/2 = 8809 \quad 1101/2 = 550 \quad 68/2 = 34 \quad 4/2 = 2$$

$$140947/2 = 70473 \quad 8809/2 = 4404 \quad 550/2 = 275 \quad 34/2 = 17 \quad 2/2 = 1$$

$$70473/2 = 35236 \quad 4404/2 = 2202 \quad 275/2 = 137 \quad 17/2 = 8 \quad 1/2 = 0$$

Remainders:

0 0 0 1 0

1 0 1 0 0

1 1 0 0 0

1 0 1 1 1

1000 1001 1010 0100 1110

Explain in detail that the calculation is correct. Use the PowerPoint slides of week 1.

For hexadecimal I followed this algorithm:

Divide by 16:

To convert a **decimal number** to **hexadecimal** (base-16), you divide the number by **16** and use the remainders to form the hexadecimal equivalent.

1. Divide the decimal number by 16.
2. Record the remainder, which will be a value from 0 to 15.
3. Divide the quotient by 16.
4. Repeat until the quotient becomes 0.
5. Read the remainders from bottom to top to get the hexadecimal value.

For binary I followed this algorithm:

Divide by 2:

Converting a **decimal number** to **binary** involves dividing the decimal number by 2 and recording the remainders.

Steps to Convert Decimal to Binary:

1. Divide the decimal number by 2.
2. Record the remainder (it will be either 0 or 1).
3. Divide the quotient (the result of the division) by 2 again.
4. Repeat the process until the quotient becomes 0.
5. Read the remainders from bottom to top to get the binary equivalent.

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