Template Week 1 – Bits & Bytes

Student number:566741

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

Bit - is the basic smallest unit of digital data in computers and other devices, taking binary values either 0 or 1. A collection of bits makes up digital information.

Byte – A byte is eight bits used for digitally encoding a single character or information values with nine-bit bytes also known as octets. In other words, use of one letter 'A' requires for instance eight bits converted to a byte in ASCII codes.

What is a nibble?

A **nibble** is referred to as four bits the standard size of a nibble. A nibble is a half of a byte simply because a byte has two nibbles.

What relationship does a nibble have with a hexadecimal value?

The nibble can be used to represent 16 digits in the hexadecimal number system, from 0 through 15.

This corresponds directly to the 16 values in the hexadecimal system (from 0 to F). Each hexadecimal digit represents exactly one nibble, making it a convenient way to express binary values in a shorter format.

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

It is wise because of hexadecimal representation is shorter and more readable than binary, as it takes only one hexadecimal digit to represent 4 binary digits. That is, for instance, eight binary bits designated as 11001010 can be easily represented using hexadecimal as simply CA.

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

With 8 bits making up a byte, the byte is further segmented into two halves, each of which carries one hex value. Each byte can be written as two hex values displaying it. If one considers the binary 11110000 byte, one will see that it corresponds to F0 in hex.

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

IPv4 addresses are subdivided into 8 octets, each characterizing by 8 bits.

Correspondingly, 4 octets×8 bits=32 bits

Therefore, it can be further concluded that this is the IP address, written with 192.168.1.1.

Assignment 1.2: Your favourite colour

Hexadecimal colour code:

Light Pink: #FFB6C1

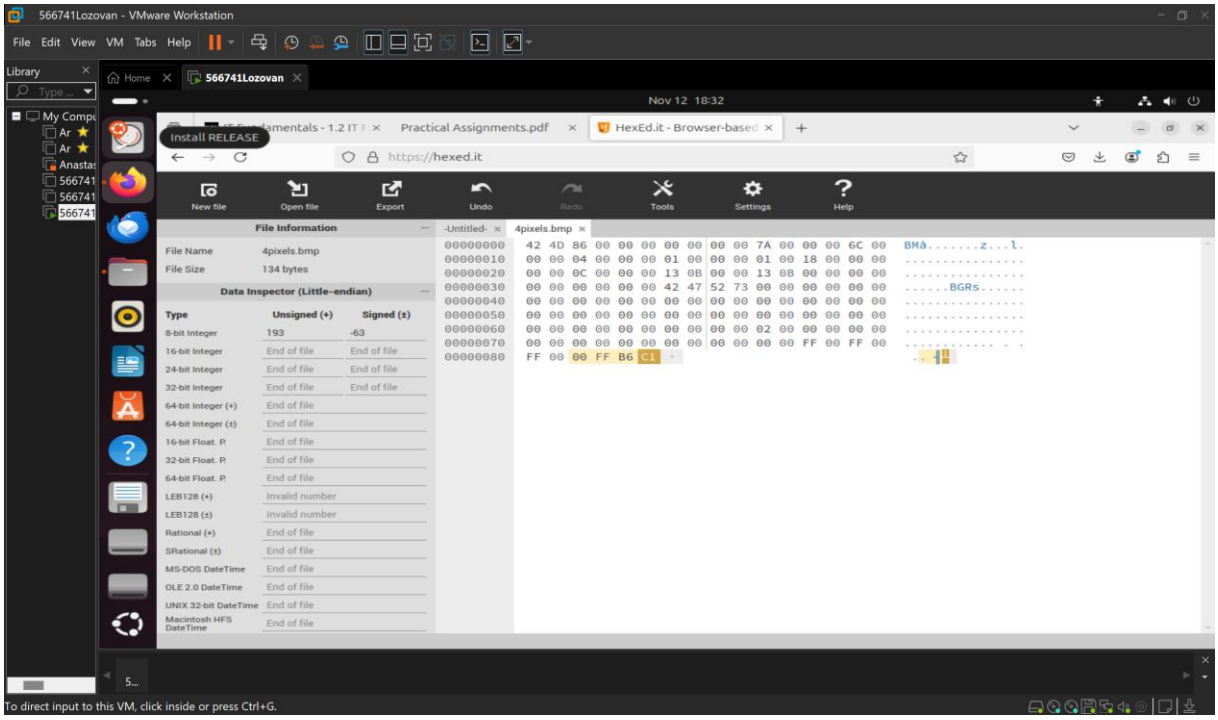
Purple: #800080

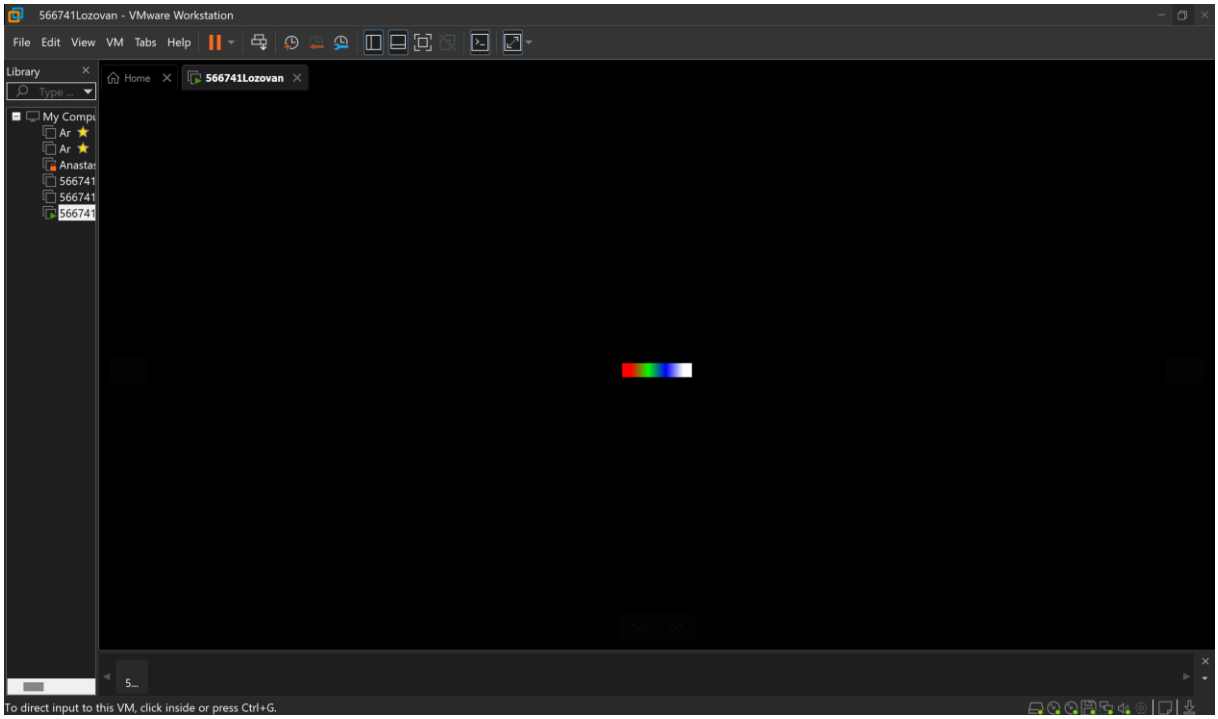
Light Blue: #ADD8E6

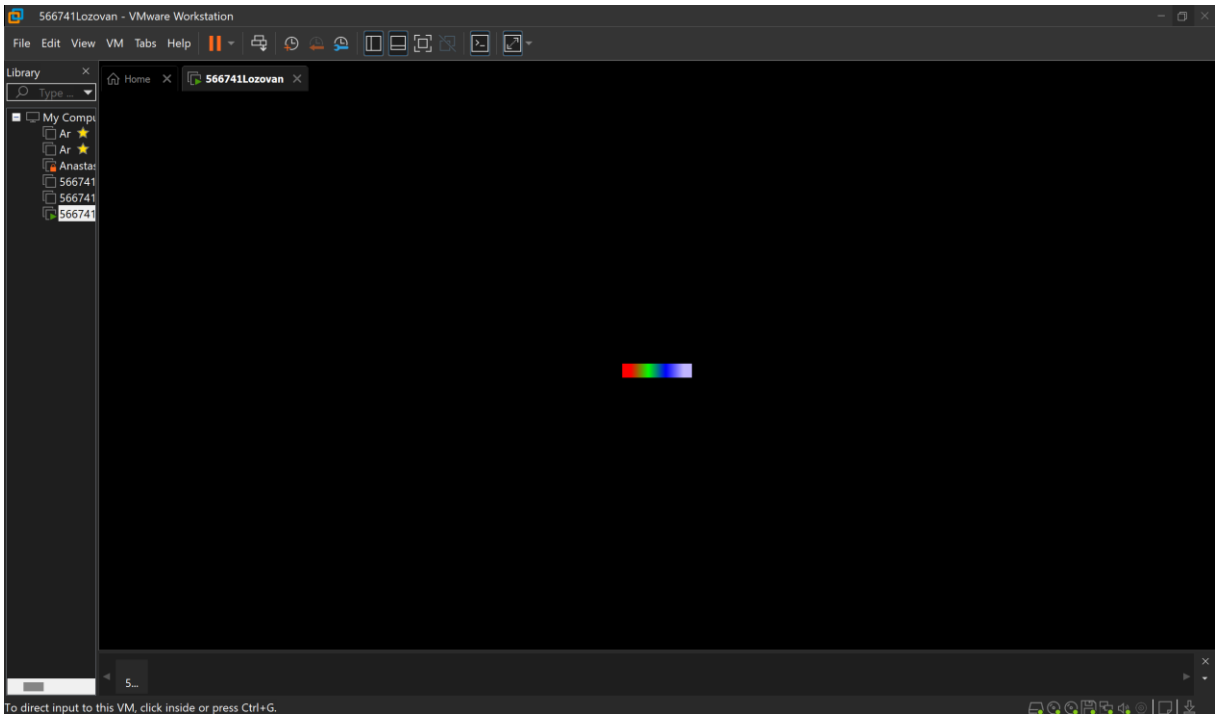
Assignment 1.3: Manipulating binary data

Colour	Colour 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)	#FFB6C1	FF B6 C1	C1 B6 FF

Screenshot modified BMP file in hex editor:







Bonus point assignment – week 1

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 (Decimal): 566741

Hexadecimal: 0x8A5D5

Binary: 10001010010111010101

Explanation of The Hexadecimal Conversion:

Calculation:

566741 ÷ 16 = 35421, remainder 5

35421 ÷ 16 = 2213, remainder 13 (which is D in hexadecimal)

2213 ÷ 16 = 138, remainder 5

138 ÷ 16 = 8, remainder 10 (which is A in hexadecimal)

8 ÷ 16 = 0, remainder 8

To adjust decimal numbers to hexadecimal, can be used division by 16. Looking at this interpretation, each reminder serves as the required hexadecimal digit where they are arranged in ascending order from the right to the left, for example, 8A5D5, which represents 566741 in hexadecimal, when this number is reversed.

Binary Conversion Explanation:

For binary, we divided by 2 at each step. Each remainder represents a binary digit, with 0s and 1s corresponding to even and odd quotients, respectively.

When we read the remainders in reverse, we get 10001010010111010101, which is the binary equivalent of 566741.

Calculation:

566741 ÷ 2 = 283370, remainder 1

283370 ÷ 2 = 141685, remainder 0

141685 ÷ 2 = 70842, remainder 1

70842 ÷ 2 = 35421, remainder 0

35421 ÷ 2 = 17710, remainder 1

17710 ÷ 2 = 8855, remainder 0

8855 ÷ 2 = 4427, remainder 1

4427 ÷ 2 = 2213, remainder 1

2213 ÷ 2 = 1106, remainder 1

1106 ÷ 2 = 553, remainder 0

553 ÷ 2 = 276, remainder 1

276 ÷ 2 = 138, remainder 0

138 ÷ 2 = 69, remainder 0

69 ÷ 2 = 34, remainder 1

34 ÷ 2 = 17, remainder 0

17 ÷ 2 = 8, remainder 1

8 ÷ 2 = 4, remainder 0

4 ÷ 2 = 2, remainder 0

2 ÷ 2 = 1, remainder 0

1 ÷ 2 = 0, remainder 1

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