Template Week 1 – Bits & Bytes

Student number:582777

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

A bit is the smallest unit of data (0 or 1). A byte consists of 8 bits and represents data like characters or colors.

What is a nibble?

A nibble is 4 bits.

What relationship does a nibble have with a hexadecimal value?

One hexadecimal digit represents exactly one nibble (4 bits).

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

Hexadecimal is shorter and easier to read than binary while still mapping directly to binary data.

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

One byte (8 bits) equals two hexadecimal digits.

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

IPv4 has 4 octets, and each octet is 8 bits:
4 × 8 = 32 bits

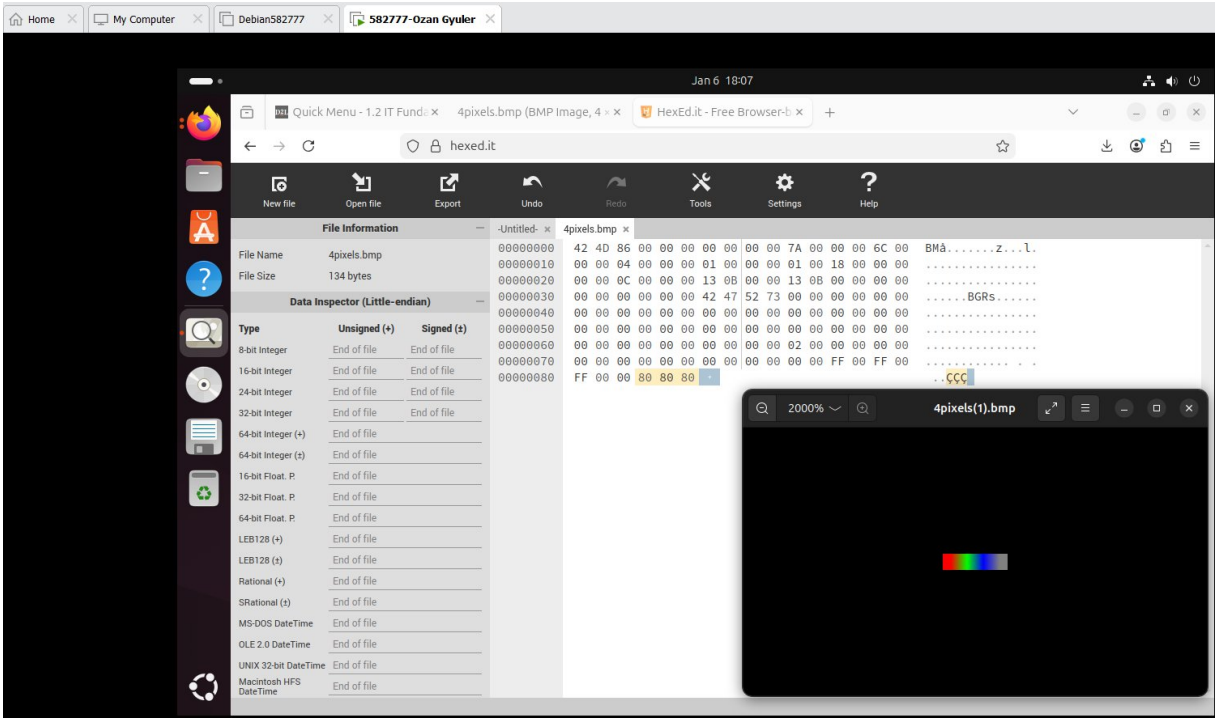
Assignment 1.2: Your favourite color

Hexadecimal color code: #808080

Assignment 1.3: Manipulating binary data

Color	Color 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)	#808080	80 80 80	80 80 80

Screenshot modified BMP file in hex editor:



Assignment 1.4: Student number to HEX and Binary

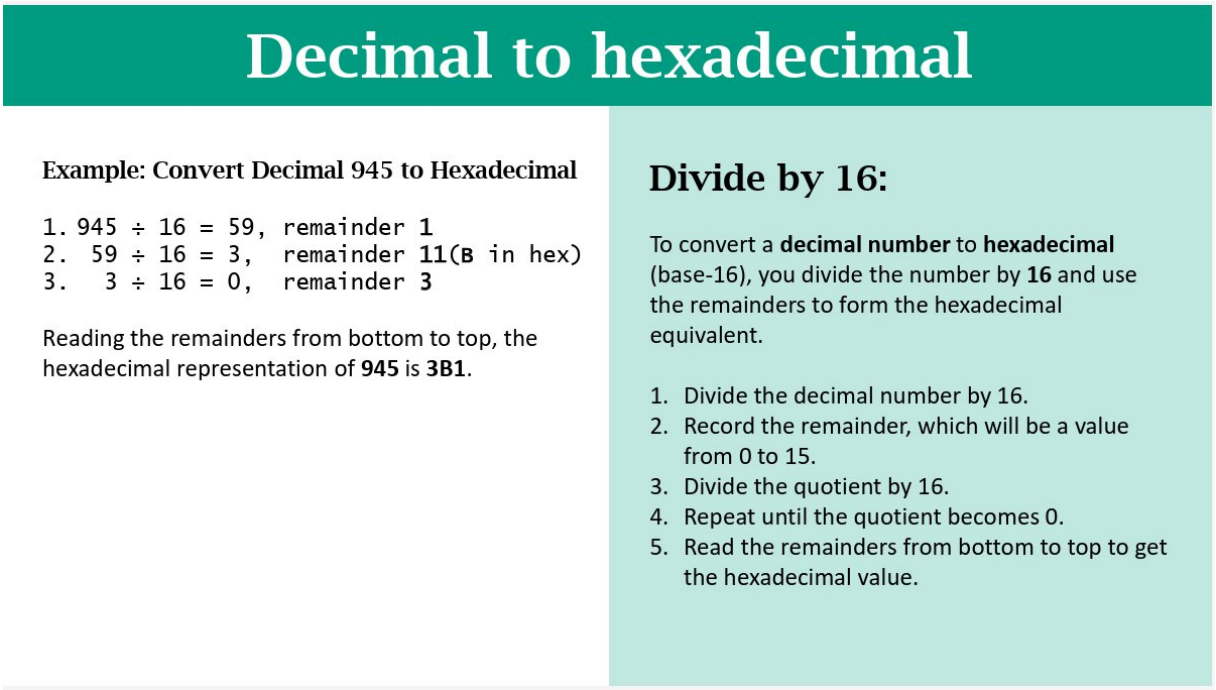
Convert your student number to a hexadecimal number and a binary number.

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

582777 ÷ 16	36423	9
36423 ÷ 16	2276	7
2276 ÷ 16	142	4
142 ÷ 16	8	14 (E)
8 ÷ 16	0	8

Hexadecimal = 8E479

For hexadecimal basically we divide the number by 16 and keeping track of each quotient. Moreover, we can create the number by reading remainders bottom to top.



582777 ÷ 2 =291388 -- 1

291388 ÷ 2 =145694 -- 0

145694 ÷ 2 =72847 -- 0

72847 ÷ 2 =36423 -- 1

36423 ÷ 2 =18211 -- 1

18211 ÷ 2 =9105 -- 1

9105 ÷ 2 =4552 -- 1

4552 ÷ 2 =2276 -- 0

2276 ÷ 2 =1138 -- 0

1138 ÷ 2 =569 -- 0

569 ÷ 2 =284 -- 1

284 ÷ 2 =142 -- 0

142 ÷ 2 =71 -- 0

71 ÷ 2 =35 -- 1

35 ÷ 2 =17 1

17 ÷ 2 =8 1

8 ÷ 2 =4 0

4 ÷ 2 =2 0

2 ÷ 2 =1 0

1 ÷ 2 =0 1

Binary=10001110010001111001

The binary number is obtained by repeatedly dividing the decimal value by 2 and reading the remainders from bottom to top, where each remainder represents one binary bit.

Decimal to binary

Example: Convert Decimal 19 to Binary

1. 19 ÷ 2 = 9, remainder **1**
2. 9 ÷ 2 = 4, remainder **1**
3. 4 ÷ 2 = 2, remainder **0**
4. 2 ÷ 2 = 1, remainder **0**
5. 1 ÷ 2 = 0, remainder **1**

Now, reading the remainders from bottom to top, the binary representation of **19** is **10011**.

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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