

Template Week 1 – Bits & Bytes

Student number: 588963

Assignment 1.1: Bits & Bytes intro

What are Bits & Bytes?

A bit is a single place or symbol in a decimal number is short for binary digit. Each bit can either be 0 or 1.

A byte is a group of 8 bits, so computer use bytes because it is more useful and bigger than bit. A byte allows for 256 combinations.

What is a nibble?

A nibble is a half byte, so 4 bits and it allows for 16 combinations from 0 to 15.

What relationship does a nibble have with a hexadecimal value?

Hexadecimal also has a base from 16

0-9 and A-F

Letters represent the following numbers from 10 to 15

So, one nibble = one hexadecimal digit

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

Hexadecimal is shorter and easier to read, a binary number with 8 bits is in hexadecimal with 2 hexadecimal digits.

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

1 byte = 8 bits

8 bits = 2 nibbles

1 nibble = 1 hex digit

So, 1 byte = 2 hexadecimal digits

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

An IPv4 is from 4 parts, each part is called an octet and has a range from 0 to 255.

0 to 255 is 256 values

$256 = 2^8$ so, each octet has 8 bits, and there are 4 octet: $4 \times 8 = 32$ bits in total.

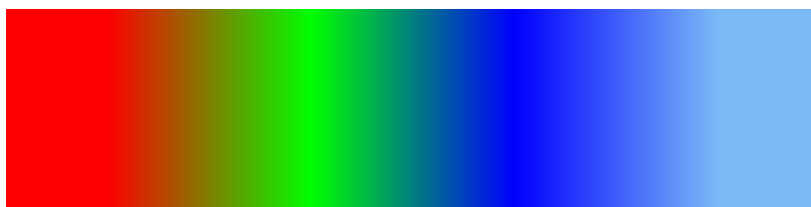
Assignment 1.2: Your favourite colour

Hexadecimal colour code: **7CBAF7**

Assignment 1.3: Manipulating binary data

Color	Color 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)	7CBAF7	7CBAF7	7FABC&

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.

Student number to hexadecimal:

Divide the number to 16 and note the remainder:

1. $588963 \% 16 = 36810$ remainder 3
2. $36810 \% 16 = 2300$ remainder 10 → A in hex
3. $2300 \% 16 = 143$ remainder 12 → C in hex
4. $143 \% 16 = 8$ remainder 15 → F in hex
5. $8 \% 16 = 0$ remainder 8

Now you take the remainders from bottom to top:

8FCA3

To check it we convert it back to decimal:

$$8 \times 16^4 = 542288$$

$$F = 15, 15 \times 16^3 = 61440$$

$$C = 12, 12 \times 16^2 = 3072$$

$$A = 10, 10 \times 16^1 = 160$$

$$3 \times 16^0 = 3$$

We add all the numbers together, then we get 588963. So, it is correct.

Student number to binary:

Divide the number to 2 and note the remainder 0 or 1:

1. $588963 \% 2 = 294481$ remainder 1
2. $294481 \% 2 = 147240$ remainder 1
3. $147240 \% 2 = 73620$ remainder 0
4. $73620 \% 2 = 36810$ remainder 0
5. $36810 \% 2 = 18405$ remainder 0
6. $18405 \% 2 = 9202$ remainder 1
7. $9202 \% 2 = 4601$ remainder 0
8. $4601 \% 2 = 2300$ remainder 1
9. $2300 \% 2 = 1150$ remainder 0
10. $1150 \% 2 = 575$ remainder 0
11. $575 \% 2 = 287$ remainder 1
12. $287 \% 2 = 143$ remainder 1
13. $143 \% 2 = 71$ remainder 1
14. $71 \% 2 = 35$ remainder 1
15. $35 \% 2 = 17$ remainder 1
16. $17 \% 2 = 8$ remainder 1
17. $8 \% 2 = 4$ remainder 0

- 18. $4 \% 2 = 2$ remainder 0
- 19. $2 \% 2 = 1$ remainder 0
- 20. $1 \% 2 = 0$ remainder 1

Now you take the remainders from bottom to top:

10001111110010100011

To check it we convert it back to decimal:

The bits with number 1 are on position: 0, 1, 5, 7, 10, 11, 12, 13, 14, 15, 19

$$2^{19} = 524288$$

$$2^{15} = 32768$$

$$2^{14} = 16384$$

$$2^{13} = 8192$$

$$2^{12} = 4096$$

$$2^{11} = 2048$$

$$2^{10} = 1024$$

$$2^7 = 128$$

$$2^5 = 32$$

$$2^1 = 2$$

$$2^0 = 1$$

We add all the numbers together, then we get 588963. So, it is correct

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