Sistemas Informáticos (Computer Systems)

Unit 02. Activities 01

Authors: Sergi García, Alfredo Oltra

Updated September 2023

UNIT 02. ACTIVITIES 01

1. EXERCISE 01

Convert to decimal the following values:

a) $1001_{(2}$ b) $110010_{(2}$ c) $1010_{(2}$ d) $100101,101_{(2}$ e) $1011_{(2}$

2. EXERCISE 02

Convert to binary the following values:

a) $8_{(10}$ b) $512_{(10}$ c) $20,625_{(10}$ d) $255_{(10}$ e) $3560,75_{(10}$

3. EXERCISE 03

Convert to hex the following values:

a) $100100101_{(2}$ b) $1000000000_{(2}$ c) $1001001_{(2}$ d) $11111_{(2}$

4. EXERCISE 04

Convert to binary the following values:

a) $5A43_{(16}$ b) $BEA_{(16}$ c) $23A_{(16}$ d) $100_{(16}$ e) $F410_{(16}$

5. EXERCISE 05

Convert to octal the following values:

a) $100101_{(2}$ b) $11101_{(2}$ c) $110011_{(2}$ d) $100_{(2}$ e) $11010101_{(2}$

6. EXERCISE 06

Convert to binary the following values:

a) $521_{(8}$ b) $1234_{(8}$ c) $100_{(8}$ d) $7543_{(8}$ e) $111_{(8}$

7. EXERCISE 07

Convert to decimal the following values:

a) $F2A3_{(16}$ b) $4227_{(16}$ c) $4227_{(8}$ d) $AAFF_{(16}$

8. EXERCISE 08

Convert to hex the following values:

a) $16_{(10}$ b) $427_{(10}$ c) $255_{(10}$ d) $534_{(10}$

9. EXERCISE 09

Convert to octal the following values:

a)$16_{(10}$ b) $427_{(10}$ c) $255_{(10}$ d) $534_{(10}$

10. EXERCISE 10

Add the numbers 45 + 31 in binary code. Check the result by performing the conversion to decimal.

11. EXERCISE 11

Subtract the numbers 80 – 46 in binary code. Check the result by performing the conversion to decimal.

12. EXERCISE 12

Subtract the numbers 109 – 23 in binary code. Check the result by performing the conversion to decimal.

13. EXERCISE 13

Multiply the numbers 30 * 6 in binary code. Check the result by performing the conversion to decimal.

14. EXERCISE 14

What is the negative representation of 58 in binary code? Give the result in sign and magnitude, 1's complement, 2's complement and Excess-K with K = 2^{n-1}, all for a value of 8-bit word.

15. EXERCISE 15

What is the decimal value of 10101010 if it is represented using Excess-K with K = 2n-1?

16. EXERCISE 16

Perform the following logical operations:

a) NOT (10001001 OR 10111001) b) 11011011 XOR 10111001

c) 00000111 AND 11111111 d) 00000111 XOR 11111111

17. EXERCISE 17

How many bits we need to represent the number 62?

18. EXERCISE 18

With a 12 bits binary number, how many numbers can we represent?

19. EXERCISE 19

What is UNICODE? How many bits use it to encode?

20. EXERCISE 20

Encode in decimal, octal and hex the phrase “Sistemas de representación” using the ASCII code. **Note that the ó is accentuated.**

21. EXERCISE 21

What is the decimal value of C19E0000? The number is represented using 32 bits IEEE754 format.

22. EXERCISE 22

Perform the following conversions:

a) 34 TB → MB b) 1200 GB → EB c) 100 Mb → kB d) 6Mb/s → GB/week

23. EXERCISE 23

Divide the numbers 105/5 in binary code. Check the result by performing the conversion to decimal.

24. EXERCISE 24

How long will it take (maximum) to download a 3.5 GB film if your Internet provider tells you that it provides 100 Mb/s ? And if they told you that the error rate is 5% ?

25. EXERCISE 25

In computer systems, when representing a colour an RGB coding is used, so that any colour is defined by the amount of Red, Green and Blue that it contains. The range of values each component can take depends on what is called colour depth, but a general value could be 255 (or 11111111 or FF). In this way the red colour would be represented by 255,0,0 or $11111111000000000000000000_{(2}$ o $FF0000_{(16}$ and an orange would be something like 255,128,0 or $11111111100000000000000000000000_{(2}$ o $FF8000_{(16}$.

With this information, you must draw (with colours, obviously), the image that represents the binary code that is indicated below. To do this, use the HTML code provided.

The only thing you have to do is change the colour by the code in each of the <td> of the code.

By default, is green (#00FF00). The image is 6 x 6 pixels (or cells ;) :

000000001111111100000000 000000001111111100000000 000000001111101000101000
000000001111101000101000 000000001111111100000000 000000001111111100000000
000000001111111100000000 000000001111101000101000 101010101010101011111111
101010101010101011111111 000000001111101000101000 000000001111111100000000
000000001111111100000000 000000001111101000101000 101010101010101011111111

10101010101010101111111 00000000111110100010100 00000000111111100000000
00000000111111100000000 00000000111110100010100 00000000111110100010100
00000000111110100010100 00000000111110100010100 00000000111111100000000
00000000111111100000000 11101110111011010101010 11101110111011010101010
11101110111011010101010 11101110111011010101010 00000000111111100000000
11101110110111010110011 00000000111111100000000 11101110110111010110011
11101110110111010110011 00000000111111100000000 11101110110111010110011

26. EXERCISE 26

To save memory, many programmers use a “word” (as we study in unit 1, the minimum storage unit in memory that has a computer system) to indicate for each of the bits a state. For example, if the word is 4 bits you could use the first one to know if the player is alive, the second one to know if he plays with a keyboard or a joystick, the third one to know if he has extra life and the fourth one to know if it's a network game. Thus, instead of using 16 bits (4 data to be stored, each 4-bit), it only uses 4.

The problem arises when you have to activate or deactivate one of these bits and, of course, get the value you save. With what you already know about binary operations, can you think of any way to do it easily?

For instance, with the word 0101:

- How can I activate bit 1 to get the word 0111?
- And disable bit 0 to get the word 0110?
- And how can I get the state of the bit 3 (zero)?

Share the solution of the last 3 exercises and your doubts in the forum! If a classmate has trouble with him or her, try to help :)