Computer Systems – Activities

UD 01. INFORMATION REPRESENTATION

Computer Systems
CFGS DAW

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Licencia

Nomenclatura

A lo largo de este tema se utilizarán distintos símbolos para distinguir elementos importantes dentro del contenido. Estos símbolos son:

Actividad opcional. Normalmente hace referencia a un contenido que se ha comentado en la documentación por encima o que no se ha hecho, pero es interesante que le alumno investigue y practique. Son tipos de actividades que no entran para examen

Atención. Hace referencia a un tipo de actividad donde los alumnos suelen cometer equivocaciones.

UD02. INFORMATION REPRESENTATION
Activities

(1) Convert to decimal the following values:

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

(2) Convert to binary the following values:

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

(3) Convert to hex the following values:

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

(4) Convert to binary the following values:

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

(5) Convert to octal the following values:

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

(6) Convert to binary the following values:

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

(7) Convert to decimal the following values:

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

(8) Convert to hex the following values:

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

(9) Convert to octal the following values:

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

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

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

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

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

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

(16) Perform the following logical operations:

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

c) 00000111 AND 11111111 d) 00000111 XOR 11111111

(17) 👁 How many bits I need to represent the number 62?

(18) 👁 With a 12 bits binary number, how many numbers can we represent?

(19) What is UNICODE? How many bits use it to encode?

(20) Encode in decimal, octal and hex the phrase "Sistemas de representación" using the ASCII code. Note that the o is accentuated.

(21) 👁 What is the decimal value of C19E0000? The number is represented using 32 bits IEEE754

(22) Perform the following conversions:

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

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

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

(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 $1111111100000000000000000000_{(2}$ o $FF0000_{16}$ and an orange would be something like 255,128,0 or $111111111000000000000000000000000000000000000000_{(2}$ 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

101010101010101011111111 000000001111101000101000 000000001111111100000000

000000001111111100000000 000000001111101000101000 000000001111101000101000

000000001111101000101000 000000001111101000101000 000000001111111100000000

000000001111111100000000 111011101110111010101010 111011101110111010101010

111011101110111010101010 111011101110111010101010 000000001111111100000000

111011101101110101100110 000000001111111100000000 111011101101110101100110

111011101101110101100110 000000001111111100000000 111011101101110101100110

(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.