

Exercises about representation of information

Add a few explanations to demonstrate how to perform each conversion. For example, from decimal to binary we use powers and then explain the corresponding operations.

1. Convert from decimal to binary

To convert to binary from decimal, we need to divided by 2 the decimal number, until the number can't be divided anymore. The binary number is the result of concatenate the remainders in above process in reverse order

a. $234 = 234/2 = 117 /2 = 58/2 = 29/2 = 14/2 = 7/2 = 3/2 = 1 = 11101010$ Binary

b. $555 = 1000100111$

c. $12321 = 11000000100001$

d. $153 = 10011001$

e. $32768 = 1\ 000\ 000\ 000\ 000\ 000$

2. Convert from binary to decimal

To convert to decimal from binary we need to sum the result of multiply each number and the number of digits ,

a. $1\ 000\ 000\ 00 = 1 \times 2^8 + 0 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 = 256$ Decimal

b. $1\ 011\ 110\ 100 = (512+0+128+64+32+16+0+4+0+0) = 756$ Decimal

c. $1\ 001\ 110\ 1 = (128+0+0+16+8+4+0+1) = 157$ Decimal

d. $1\ 111\ 111\ 111\ 1 = (1024+512+256+128+64+32+16+8+4+2+1) = 2047$ Decimal

3. Convert from hexadecimal to binary

a. $45A0 = 4(0100)\ 5(0101)\ A(1010)\ 0(0000) = 10001011010$

b. $CF = C(1100)\ F(1111) = 11001111$

c. $AAB2 = A(1010)\ A(1010)\ B(1011)\ 2(0010) = 1010101010110010$

d. $3020 = 3(0011)\ 0(0000)\ 2(0010)\ 0(0000) = 11000000100000$

4. Convert from binary to hexadecimal

a. $110001000 = (0001=1)\ (1000=8)\ (1000=8) = 188$ Hexadecimal

b. $100010110 = (0001=1)\ (0001=1)\ (0110=6) = 116$ Hexadecimal

5. Complete the following conversions related to octal numeral system:

a. Convert the numbers from exercise 4 to octal.

i. $110\ 001\ 000 = (110=6)\ (001=1)\ (000=0) = 610$ Octal

ii. $100\ 010\ 110 = (100=4)\ (010=2)\ (110=6) = 426$ Octal

b. Convert the octal 3020 to binary = $(3=011)\ (0=000)\ (2=010)\ (0=000) = 11000010000$ Binary

6. Fill in the gaps, using all the conversion you need. You have to write the steps to transform each number.

BINARY	DECIMAL	HEXADECIMAL	OCTAL
100001	33	21	41
11111111	255	FF	377
11111111	255	FF	377
10 0001	33	21	41

7. How many bits do you need to represent the following numbers in binary?

a. hexadecimal:

- 4B = 01001011 7 DIGITS = 7bits
- 4AA = 010010101010 11 DIGITS = 11bits
- FF4FA = 1111111101001111010 20 DIGITS = 20bits
- 345F = 14 DIGITS = 14bits

b. decimal:

- 100 = 7 DIGITS = 7bits
- 256 = 9 DIGITS = 9bits
- 255 = 8 DIGITS = 8bits
- 32 = 6 DIGITS = 6bit
- 31 = 5 DIGITS = 5bit
- 3 = 2 DIGIT = 2bit
- 4350 = 13 DIGITS = 13bit
- 1024 = 11 DIGITS = 11bit
- 45 = 6 DIGITS = 6bit
- $2^{30} = 1073741824$ (31 DIGITSS) = 31bits
- 63 = 6 DIGITS = 6bit

8. Solve the following parts using ASCII extended (8 bits)

- Write a random text, which contains letters, numbers and other alphanumeric characters.
- Encode to hexadecimal, according to ASCII table
- Convert to binary.

Year 2022 = Tiger			
CARACTER	ASCII	HEXADECIMAL	BINARY
Y	89	59	01011001
e	101	65	01100101
a	97	61	01100001
r	114	72	01110010
	32	20	00100000
2	50	32	00110010
0	48	30	00110000
2	50	32	00110010
2	50	32	00110010
	32	20	00100000
=	61	3D	00111101
	32	20	00100000
T	84	54	01010100
l	105	69	01101001
g	103	67	01100111
e	101	65	01100101
r	114	72	01110010
FINAL NUMBER IS 01011001 01100101 01100001 01110010 00100000 00110010 00110000 00110010 00110010 00100000 00111101 00100000 01010100 01101001 01100111 01100101 01110010			