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.

$2^0 = 1$
$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$
$2^9 = 512$
$2^{10} = 1024$
$2^{11} = 2048$
$2^{12} = 4096$
$2^{13} = 8192$
$2^{14} = 16384$
$2^{15} = 32768$
$2^{16} = 65536$
$2^{17} = 131072$
$2^{18} = 262144$
$2^{19} = 524288$
$2^{20} = 1048576$

1. Convert from decimal to binary:

TO PASS DECIMAL TO BINARY, I did it with the table that we can see above, I start with the number that it's near to the decimal one, then I subtract that number . Example 234 I look in the table and I see that 128 is the nearest and 256 pass the number 234 so we don't use it, we choose 128 , so it will be 234 minus 128 and we get 106, we do same as before 64 it doesn't pass 106 so we do 106 minus 64 and like that every time until the end that we get 0.

   a. 234=11101010
      234-128=106-64=42-32=10-8=2-2=0
   b. 555=1000101011
      555-512=43-32=11-8=3-2-1=0
   c. 12321=11000000100001

   d. 152=10011000
   e. 32768=1000000000000000

2. Convert from binary to decimal:

   In this case it's binary to decimal. I count where the number one (1) and in which position it is, to look at it in the table, that way when I have all the positions that has the number one, I can add the numbers. Example the first exercise, it's in the position 9 i look the table it's 2^8→256

   a. 100000000=256
   b. 1011110100=756
   c. 10011101=157

d. 11111111111=2047

3. Convert from hexadecimal to binary:
If we pass hexadecimal to binary we know that each number it will be 4bits, and with this bits we have until 16(decimal) will be 1111 (bits) and F(hexadecimal) Example→ 45A0 → 4 will be 0100→ 5 will be 0101→ A will be 1010 and → 0 will be 0000
   a. 45A0=0100 0101 1010 0000
   b. CF= 1100 1111
   c. AAB2= 1010 1010 1011 0010
   d. 3020= 0011 0000 0010 0000

4. Convert from binary to hexadecimal:
BINARY TO HEXADECIMAL: has before our numbers will has to be separated in 4bits and then we have 8 4 2 1 decimal will be 1111 binary to pass binary to hexadeciam we just need to see where are the number one(1) were it is we look the position and we plus the numbers. Example a)
   a. 1 1000 1000 = 188 → 1=1 1000=8 1000=8
   b. 1 0001 0110= 116 → 1=1 0001=1 0110= 4+2=6
      BINARY TO OCTAL
   110001000 = 610
   100010110= 426

5. Complete the following conversions related to octal numeral system:
BINARY TO OCTAL: we seperate the numbers into 3bits and as with the hexadecimal we look where are the one(1) and the position and then we add. 4 2 1 (decimal) 111 (binary) 7 (octal) example
   a. Convert the numbers from exercise 4 to octal.
      BINARY TO OCTAL
      110 001 000 = 610 → 110=4+2=6 001=1 000=0
      100 010 110= 426→ 100=4 010=2 110=4+2=6
   b. Convert the octal 3020 to binary.

OCTAL TO BINARY: we have a big number we take the single number example 3020 we take the number 3 we know that it will need 3bits 4 2 1(decimal) 111 (binary) 7 (octal) example.
so number 3 will be 2+1 and in binary 011

3020=011 000 010 000 → 011=2+1=3 000=0 010=2 000=0

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

BINARY	DECIMAL	HEXADECIMAL	OCTAL
100001	**33**	21	41
1111 1111	255	**FF**	377
011 111 111	255	FF	**377**
10 0001	65	21	41

7. How many bits do you need to represent the following numbers in binary?
   a. hexadecimal: 4B, 4AA, FF4FA, 345F

4B= 0100 1011→ 7bits
4AA= 0100 1010 1010 →11bits
FF4FA=1111 1111 0100 1111 1010→20 bits
345F= 0011 0100 0101 1111→14bits

   b. decimal: 100, 256, 255, 32, 31, 3, 4350, 1024, 45, 2^{30}, 63

100=1100100→7bits
256=100000000→9bits
255=11111111→8bits
32=100000→6bits
31=11111→5bits
3=11→2bits
4350=1000011111110→13 bits
1024=1000000000 →10 bits
45=101101→6bits
2^{30} =1000000000000000000000000000000→ 31 bits
63=111111→6bits

8. Solve the following parts using ASCII extended (8 bits).
   a. Write a random text, which contains letters, numbers and other alphanumeric characters.

We are on 23 of february 2022 we are right now in modul systems.

   b. Encode to hexadecimal, according to the ASCII table.

20 20 20 20 57 65 20 61 72 65 20 6F 6E 20 32 33 20 6F 66 20 66 65 62 72 75 61 72 79 20 32 30 32 32 20 77 65 20 61 72 65 20 72 69 67 68 74 20 6E 6F 77 20 69 6E 20 6D 6F 64 75 6C 20 73 79 73 74 65 6D 73 2E

c. Convert to binary.

00100000 00100000 00100000 00100000 01010111 01100101 00100000 01100001
01110010 01100101 00100000 01101111 01101110 00100000 00110010 00110011
00100000 01101111 01100110 00100000 01100110 01100101 01100010 01110010
01110101 01100001 01110010 01111001 00100000 00110010 00110000 00110010
00110010 00100000 01110111 01100101 00100000 01100001 01110010 01100101
00100000 01110010 01101001 01100111 01101000 01110100 00100000 01101110
01101111 01110111 00100000 01101001 01101110 00100000 01101101 01101111
01100100 01110101 01101100 00100000 01110011 01111001 01110011 01110100
01100101 01101101 01110011 00101110