Assignment N° 2

Coding and representation of data/information

Exercise 1:

1. How many values can be coded in 7 bits and 10 bits?
2. What is the least number of bits needed to represent: $(65)_{10}$, $(120)_{10}$ and the range 0 to 256
3. In 10 bits, what is the largest number and the smallest number representable using:
   a) Signed magnitude
   b) 1's complement
   c) 2's complement
4. Give in 10 bits then in 16 bits the representations of the following decimal values:
   $(-127)_{10}$; $(+226)_{10}$; $(-1358)_{10}$; $(+512)_{10}$; $(-512)_{10}$; (+1024), (-1024).
   a) Using Signed magnitude
   b) Using 1's complement
   c) Using 2's complement

Exercise 2:

Let x= 0x9AB be integer stored on a machine with a word size of 12 bits, Give the signed decimal value of this number:

- If this number is encoded using signed magnitude representation
- If this number is encoded using 1's complement representation
- If this number is encoded using 2's complement representation

Exercise 3: In fixed-point, perform the following transformations (conversions):

1- $(12,625)_{10} = (\ ?)_2$; $(0,0269)_{10} = (\ ?)_2$;

2- $(10110011,11101)_2 = (\ ?)_8 = (\ ?)_{10} = (\ ?)_{16}$

3- $(100110,110101)_2 = (\ ?)_{10}$

4- A= $(2AE,62)_{16} = (\ ?)_2 = (\ ?)_8$; B=$(65,71)_8 = (\ ?)_2 = (\ ?)_{16}$

Exercise 4:

The IEEE 754 half-precision standard defines a binary representation for floating point values using three fields.

- The significand or Mantissa (1 to the left of the binary point) is represented in 10 (0→9)
- Exponent in 5 bits (10→14)
- Bit of the sign (bit 15)

1	5	10
sign	exponent	Mantissa/significand

1. Give in octal form the internal representation corresponding the following decimal numbers:
   N1= + 13,75 ; N2= - 0,1875
2. Write in the form of (+ or -) $\mathbf{a * 2^b}$ (where a and b are decimal integer numbers); the two real numbers represented in the machine in the form of hexadecimal as follows:
   X= 0xFC80 ; Y = 0x72D0

Exercise 5:

- Using the table below of ASCII codes, give the binary representation of the following string: "A computer"
- What is the size (in bits and bytes) of the memory space required to store this string?
- Decode the following message using ASCII code:

00101000	01000010	01101001	01110011	01101011	01110010	01100001	00101001

- Code the following numbers $(384)_{10}$ and $(167)_{10}$ in BCD and in EXCES3?
- Give the table of Gray code from 0 to 16?
- Code the decimal number $(167)_{10}$ in Gray code?

Exercise 6:

a) Carry the following binary arithmetic operations: (1001 + 1011) , (1100 – 1000) , (1100 x 101) (100100 / 11)

b) Carry out the following binary arithmetic operations in 8 bits:

The operations	Natural binary	Signed-Magnitude	1's Complement	2's Complement
11011101+11001111				
10101010+01100111				
00011001-11011011				
01101011-00110000				

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	SOH	STH	ETH	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1	DLE	DC1	CD2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2	spc	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	DEL

The ASCII code table in hexadecimal of 128 characters