Tutorial Series 2
MACHINE STRUCTURE 01

Exercise 1:

What is the range of integers that can be represented using 8 bits and 16 bits in the following cases:

- Unsigned integers.
- Signed integers represented with Sign-Magnitude, one's complement, and two's complement.

Exercise 2:

Complete the following tables:

1) The numbers are coded using 8 bits:

Decimal	Sign-Magnitude	One's complement	Two's complement
$(+72)_{10}$	……	……	……
$(-108)_{10}$	……	……	……
……	1011 1001	……	……
……	0111 0011	……	……
……	……	1101 0001	……
……	……	1000 0111	……
……	……	……	1010 1001
……	……	……	1000 1001
……	……	……	0111 1110

2) The numbers are coded using 16 bits:

Decimal	Sign-Magnitude	One's complement	Two's complement
……	……	1111 1110 1111 1111	……
……	……	……	1111 1110 0011 1100
……	1000 0001 0010 1100	……	……
$(+1050)_{10}$	……	……	……

Exercise 3:

Let be the following hexadecimal numbers: $N1=(57)_{16}$, $N2=(97)_{16}$, $N3=(32)_{16}$, $N4=(AB)_{16}$, and $N5(E8)_{16}$.

- We consider that:

- N2 and N5 are coded with one's complement.
- N4 is coded with two's complement.
- N1 and N3 are coded with sign-Magnitude.

- Calculate:

- N1 + N2 and N4 + N5 using one's complement representation.
- N3 + N4 and N1 + N5 using two's complement representation.
- N1 + N3 using one's complement and N2 + N4 using two's complement. What do you notice about the results?

Exercise 4:

Let be the fractional numbers $\mathbf{X_1} = (-12{,}75)_{10}$, $\mathbf{X_2} = -0{,}0011101 \times 2^5$, and $\mathbf{X_3} = (+0{,}1875)_{10}$.
We want to use a simplified representation of the floating-point representation with the following format: **1** bit for the sign, **5** bits for the biased exponent, and **10** bits for the mantissa.
Represent:

- $\mathbf{X_1}$, $\mathbf{X_2}$, and $\mathbf{X_3}$
- $\mathbf{X_1} + \mathbf{X_2}$

Exercise 5:

Represent the numbers given in ***exercise 4***: $\mathbf{X_1}$, $\mathbf{X_2}$, and $\mathbf{X_3}$ using the IEEE 754 standard representation:

- In single precision (32 bits).
- In double precision (64 bits).

Exercise 6:

Give the decimal value of the number $\mathbf{X_4}$ represented in the IEEE 754 standard representation by the hexadecimal number: C 2 5 C 0 0 0 0

Exercise 07:

1. Complete the following tables:

Decimal	**19**		**59**	
BCD Code	**…….**	**0010 0001**	**…….. …**	**0011 1010**

Number	$(111\ 1100)_2$	$(101\ 1110)_2$	$(92)_{10}$	$(74)_{10}$
Gray Code	**…….**	**…….**	**…….**	**…….**

Exercise 08:

Convert the following codes into text using the ASCII table:

* $(01010101\ 01001110\ 01001001\ 01010110)_2$

* $(42\ 45\ 4E\ 42\ 4F\ 55\ 4C\ 41\ 49\ 44)_{16}$

* $(66\ 65\ 84\ 78\ 65\ 32\ 50)_{10}$

Exercise 09:

1. Represent the following text in hexadecimal form using the ASCII table: **"COMPUTER"**
2. Change the correspondence of each character by adding $(20)_{16}$ then give the result text. What do you notice?

Exercise 10:

1. Using the extended Arabic ASCII table, encode the text in hexadecimal: **"جامعة"**
2. Using the extended Arabic ASCII table, provide the equivalent text for the code: $(11001000\ 11000111\ 11001010\ 11100100\ 11001001\ 00100000\ 00110010)_2$

Machine Structure 1

Annex TS 02: Character coding tables

ASCII Table:

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0X	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1X	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2X	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3X	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4X	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5X	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6X	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7X	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	DEL

Extended Arabic ASCII Table:

8-	€	پ	‚	ƒ	„	…	†	‡	ˆ	‰		‹	Œ	≒	ژ	
9-	ک	‘	’	“	”	•	–	—		™		›	œ	ZNJ	ZJ	
A-		،	¢	£	¤	¥	¦	§	¨	©		«	¬	-	®	¯
B-	°	±	²	³	´	µ	¶	·	¸	¹	؛	»	¼	½	¾	؟
C-		ء	آ	أ	ؤ	إ	ئ	ا	ب	ة	ت	ث	ج	ح	خ	د
D-	ذ	ر	ز	س	ش	ص	ض	×	ط	ظ	ع	غ	ـ	ف	ق	ك
E-	à	ل	â	م	ن	ه	و	ç	è	é	ê	ë	ى	ي	î	ï
F-	ً	ٌ	ٍ	َ	ô	ُ	ِ	÷	ّ	ù	ْ	û	ü	LRM	LRM	