Mansoura University   **Code: CSE 3114**   **Digital Design (1)**
Faculty of Engineering   **Total: 100 marks**   **First year**
Computer & System Dep.   **Jan. 2013**   **Time 3 hours**

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Question (1) (a) Do the following subtraction using 8's complement after converting each number to base 9. $(5432)_6 - (4240)_5 = (.......)_9$

(b) Write numbers between $(90)_{12}$ to $(110)_{12}$

(c) Using truth table to prove that :$(A \odot B \odot C \odot D) = (A \oplus B \oplus C \oplus D)'$

(d) Design a combinational circuit converts a decimal digits from the **code (4 3 2 -1)** to the **code (6 3 -2 -1)**. Use the maximum number of **(1's)** in the representation of the **input** and **output** decimal digits (**hint:** don't implement the function)   **[20 marks]**

Question (2) a) Implement full adder circuit by using only:

        i-   Decoder (size 3*8) and 2 OR gates.

        ii-   2 Decoder (size 2*4) and 2 OR gates.

        iii-   2 Multiplexers (size 8*1)

        iv-   2 Multiplexers (size 4*1)

b) For the function $F = A \oplus B \oplus C$ find:-

    1.   Truth table of F   2. F as Maxterms & Minterms

    3.   Implement F using NAND gates only   4. Implement F using NOR gates only

c) Prove that full-subtractor can be implemented with two half-subtractor + OR gate   **[28 marks]**

Question (3) a) Design a combinational circuit that accepts a three-bit number and generates an output binary number equal to the square of input number.

b) Design a three-bit magnitude comparator

c) Design a five-bit binary adder/subtractor

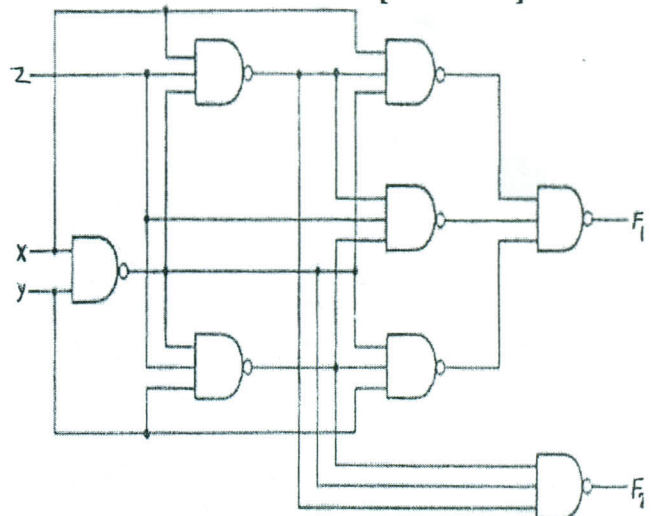d) Design a four bit binary parallel adder.   **[22 marks]**

Question (4) a) Design an encoder to convert the decimal integer N to the binary integer $(ABC)_2$, as defined by the given table using OR gate only

N	A	B	C
0	0	0	0
1	0	0	1
2	0	1	1
3	0	1	0
4	1	1	0
5	1	0	0

b) Design a decoder to convert the binary integer $(ABC)_2$ to decimal integer N, as define by the table in problem No (4-a)

c) Design a BCD adder.

d) Using ASCII table to write "Computer and System Department".

e) Analyze the two-output combinational circuits shown in fig. Obtain the Boolean functions for the two inputs and explain the circuit operation, then find $(F_1 + F_2 + F_1'F_2')$ as a sum of minterms & product of maxterms   **[30 marks]**

$B_4B_3B_2B_1$	000	001	010	011	100	101	110	111
0000	NULL	DLE	SP	0	@	P	`	p
0001	SOH	DC1	!	1	A	Q	a	q
0010	STX	DC2	"	2	B	R	b	r
0011	ETX	DC3	#	3	C	S	c	s
0100	EOT	DC4	$	4	D	T	d	t
0101	ENQ	NAK	%	5	E	U	e	u
0110	ACK	SYN	&	6	F	V	f	v
0111	BEL	ETB	'	7	G	W	g	w
1000	BS	CAN	(	8	H	X	h	x
1001	HT	EM	)	9	I	Y	i	y
1010	LF	SUB	*	:	J	Z	j	z
1011	VT	ESC	+	;	K	[	k	{
1100	FF	FS	,	<	L	\	l	|
1101	CR	GS	-	=	M	]	m	}
1110	SO	RS	.	>	N	^	n	~
1111	SI	US	/	?	O	_	o	DEL

$B_7B_6B_5$ (column headers)

ASCII Code table