

Bennett University
(SCSET)
Mid Sem Examination
CSET105
Digital Design

Max marks: 20

Max Time: 1:00 Hr.

Note: Q1 to Q7 has 2 Marks each and Q8 & Q9 have 3 marks.

Q1. Each of the following number is a signed number. Determine the decimal value in each case, if they are in (1) Sign Magnitude form (2) 2's complement form (3) 1's complement form

(a) 10111

(b) 1101010

	Sign Mag.	2's Comp	1's Comp
Q.1. (a) 10111	-7	-9	-8
(b) 1101010	-12	-22	-21

(a) $\boxed{1}0111 \Rightarrow -7$ Sign Mag.

2's Comp $\Rightarrow 10111 \Rightarrow 01000$
 $\begin{array}{r} 01000 \\ +1 \\ \hline 01001 \end{array} \Rightarrow -9$ Mag

1's Comp $\Rightarrow 10111 \Rightarrow 01000 \Rightarrow -8$

(b) $\boxed{1}101010 \Rightarrow -12$

1101010 $\Rightarrow 0010101$ (2's Comp)

$\begin{array}{r} 0010101 \\ +1 \\ \hline 0010110 \end{array} \Rightarrow -22$

1101010 $\Rightarrow 0010101 \Rightarrow -21$ (1's Comp)

Q2. Subtract 27.50 from 68.75 using 12 bit 1's Complement arithmetic.

Q.2 $+68.75 \Rightarrow 0100100.1100$
 $+(-27.50) \Rightarrow +1000. \quad (\text{1's Comp})$

$+68.75 \Rightarrow 01000100.1100$
 $-27.50 \Rightarrow 11100100.0111 \quad (\text{1's Comp})$

① $00101001.0011 \rightarrow +1$

00101001.0100

MSB = 0
Result +ive

$+41.25$ Ans

Q3. Each of the following Arithmetic operations is correct in at least one number system. Determine the possible base (Radix) in each operation.

(a) $\sqrt{41} = 5$

(b) $23 + 44 + 14 + 32 = 223$

Q3 (a) $\sqrt{41} = 5$
 $\sqrt{(41)_n} = (5)_n$
 $\sqrt{4x^1 + 1x^0} = 5x^0$
 $\sqrt{4x + 1} = 5$
 $4x + 1 = 25$
 $4x = 24$
 $x = 6$

(b) $(23)_a + (44)_a + (14)_a + (32)_a = (223)_a$
 $(2a+3) + (4a+4) + (a+4) + (3a+2) = 2a^2 + 2a + 3$
 $2a^2 - 8a - 10 = 0$
 $a^2 - 4a - 5 = 0$
 $(a-5)(a+1) = 0$
 $(a-5)(a+1) = 0$
 $a = 5$

Q4. Perform decimal addition of 679.6 and 536.8 using BCD code.

Q.4 $679.6 \Rightarrow 0110 \ 0111 \ 1001 \ . \ 0110$
 $536.8 \Rightarrow 0101 \ 0011 \ 0110 \ . \ 1000$

$1011 \ 1000 \ 1111 \ 1110$

$\textcircled{1} \ 0110 \ 0110 + 0110 \ 0110$
 $\textcircled{1} \ 0001 \ 0000 \ 0000 \ 0111 \ 0100$

$0001 \ 0010 \ 0001 \ 0110 \ . \ 0100$
 $1 \ 2 \ 1 \ 6 \ . \ 4$

Q5. Convert the following into the gray number.

(a) $(3A7)_{16}$

(b) $(527)_8$

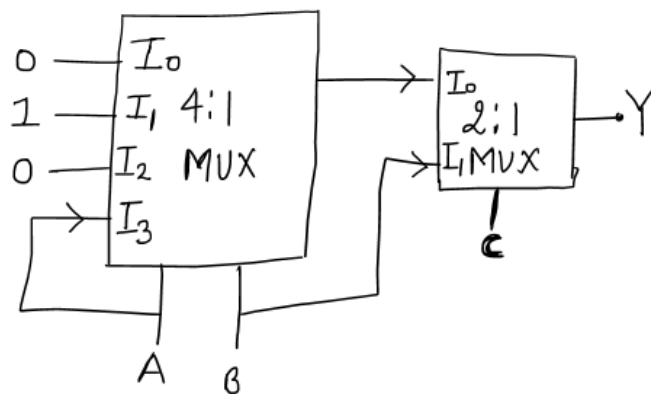
Q.5 (a) $(3A7)_{16}$

\Rightarrow $\overline{00}11\ 1010\ 0111$
 \downarrow
Gray 0010 0111 0100

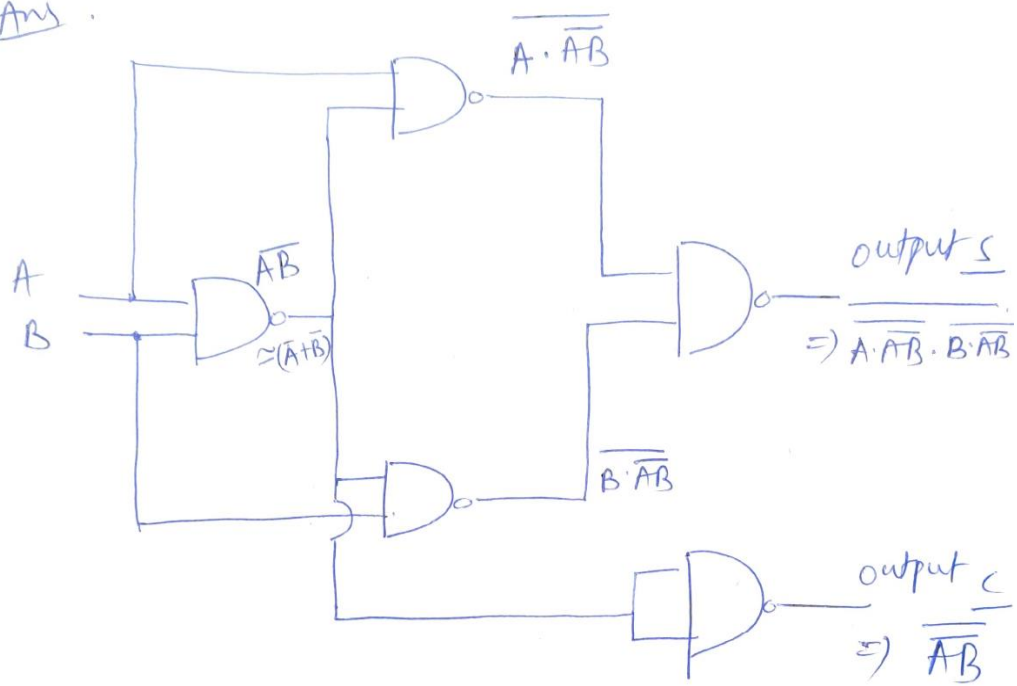
(b) $(527)_8 \Rightarrow$

$101\ 010\ 111$
 \downarrow
Gray 11111100

Q6. A Combination of multiplexers is given, Express the output Y.



Q-7
Ans.



output expression for S

$$= S \Rightarrow \overline{A \cdot \overline{A}B + \overline{A}B}$$

expression for

$$C = \overline{AB}$$

$$C = AB$$

$$= (A \cdot \overline{A}B) + (\overline{A}B)$$

$$= A \cdot (\overline{A} + B) + B \cdot (\overline{A} + B)$$

$$= A\overline{A} + AB + B\overline{A} + BB$$

$\begin{cases} B\overline{B} = 0 \\ A\overline{A} = 0 \end{cases}$

$$\Rightarrow A\overline{B} + B\overline{A}$$

$$S = A \oplus B \quad \text{(sum expression of Half Adder)}$$

Q8. Implement the logic expression with 4:1 Multiplexer (Draw Multiplexer)

$$f(A, B, C) = \sum (0, 1, 2, 5)$$

- (a) Choose (A B) as Select line
- (b) Choose (A C) as select line

Q.8

Ans.

$$f(A, B, C) = \sum m(0, 1, 2, 5)$$

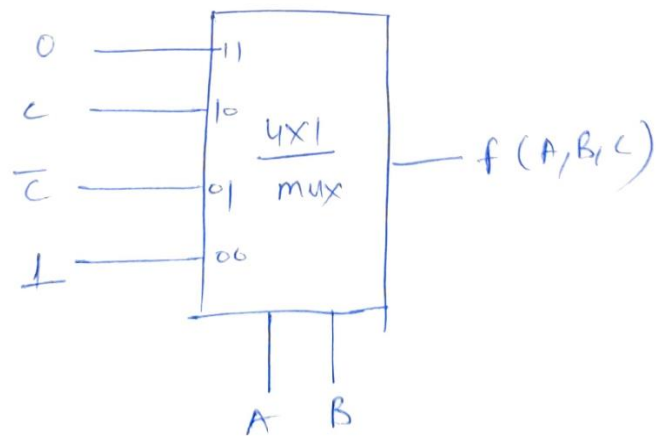
Implementation of above expr. using 4x1 mux
where

(a) A, B as select line.

then

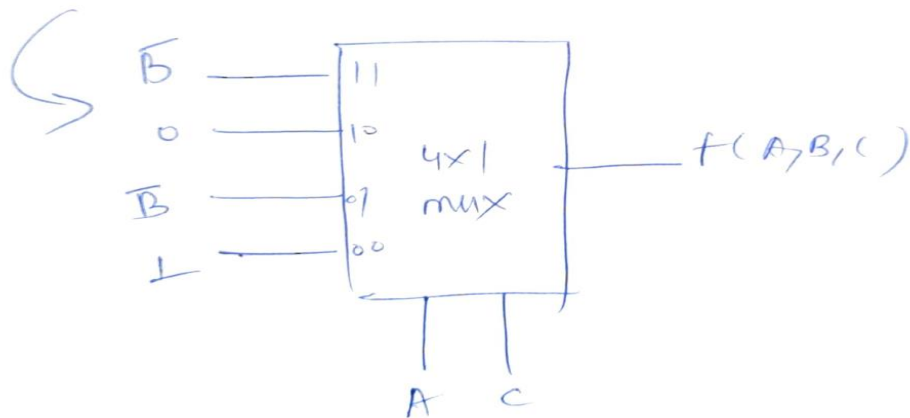
		AB			
C	0	① ₀	① ₂	4	6
	1	① ₁	3	① ₅	7
		L	\bar{C}	C	0

⇒



(b) A, c as select line

		A ₂		00		01		10		11	
B	\bar{B}	0	1	① ₀	① ₁		4		① ₅		
	B	1	0	① ₂		3		6		7	
				1	\bar{B}	0		\bar{B}			



Q9. The following truth table is given for the outputs (Z) and (Y).

Inputs				Output	Output
A	B	C	D	Z	Y
0	0	0	0	X	0
0	0	0	1	0	0
0	0	1	0	X	0
0	0	1	1	1	0
0	1	0	0	0	0
0	1	0	1	1	0
0	1	1	0	1	0
0	1	1	1	1	1
1	0	0	0	1	1
1	0	0	1	0	1
1	0	1	0	X	X

1	0	1	1	0	X
1	1	0	0	0	X
1	1	0	1	1	X
1	1	1	0	0	X
1	1	1	1	1	X

Obtained Minimized Boolean expression of Z and Y by using K-map with considering the don't care conditions.

Q-9
Solⁿ.

for Z, expression is:

$$Z(A, B, C, D) = \sum m(3, 5, 6, 7, 8, 13, 15) + \sum d(0, 2, 10)$$

CD \ AB	00	01	11	10
00	X ₀		1 ₃	X ₂
01		1 ₅	1 ₇	1 ₆
11		1 ₁₃	1 ₁₅	
10	1 ₈			X ₁₀

$$Z(A, B, C, D) = BD + \overline{A}C + \overline{B}\overline{D}$$

for Y, expression is :-

$$Y(A, B, C, D) = \sum m(7, 8, 9) + \sum d(10, 11, 12, 13, 14, 15)$$

AB \ CD	00	01	11	10
00	0	1	3	2
01	4	5	7	6
11	X ₁₂	X ₁₃	X ₁₅	X ₁₄
10	X ₈	X ₉	X ₁₁	X ₁₀

$$Y(A, B, C, D) = \underline{A + BCD}$$