Name: KEY **Id#**

COE 202, Term 131
Digital Logic Design

Quiz# 5

Date: Thursday, Nov. 28

Q1. Fill in all blank cells in the two tables below. All binary representations use 7 bits

Binary	Equivalent decimal value with the binary interpreted as:			
	Unsigned number	Signed-magnitude number	Signed-1's complement number	Signed-2's complement number
1011010	90	-26	-37	-38

Decimal	Binary representation in:		
	Signed-magnitude notation	Signed-1's complement notation	Signed-2's complement notation
- 59	1111011	1000100	1000101

b. Using 2's-complement signed arithmetic in **5 bits**, perform the following operations in binary. Show all your work. Verify that you get the expected decimal results.
Check for overflow and mark clearly any occurrences of it.

(i)

```
  11010        -6
+ 11001     + -7
 1 10011       -13
= -01101 = -13 ✓
No overflow
```

(ii)

```
  00101       +5
- 10100     - -12
              +17  > +15 → overflow expected
  00101
+ 01100
0 10001       cn ⊕ cn-1 = 1
              ∴ overflow
```

(iii)

```
  (+5)       00101
+ (-9)     + 10111
  -4       0 11100   = - 00100
                     = - 4 ✓
No overflow
```

(iv)

```
  (-6)       11010
- (+8)     - 01000
  -14        11010
           + 11000
           1 10010   = - 01110
                     = - 14 ✓
No overflow
```

c. When doing signed 2's complement arithmetic in **6 bits**, the *smallest* binary number **that will cause overflow** when *subtracted* from $101000)_2$ is $001001)_2$ ✓

$= -011000$
$= -24$

$\therefore -24 - X = -33$
$X = -24 + 33 = +9$
$= 001001$

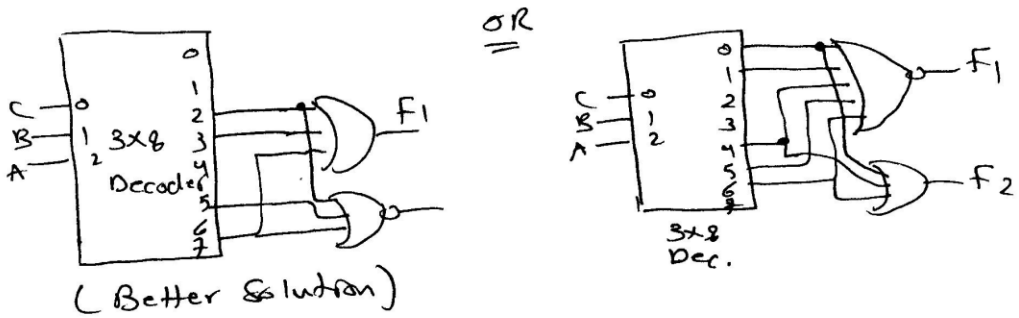
Q2.

(a) You are given **one 3-to-8 decoder**, **one NOR** gate and **one OR** gate to implement the two functions given below.

$F_1 (A,B,C) = \Pi M (0, 1, 4, 5, 6)$
$F_2 (A,B,C) = \sum m (0, 4, 6) + \sum d(1, 3)$

$F_1 = \Sigma m (2,3,7)$
$F_2 = \Pi M (2,5,7)$

Draw the circuit and properly label all input and output lines.



(Better Solution)

(b) Given the truth table below for a function with four inputs (A, B, C and D) and one output F, implement F using a 4-to-1 MUX (with 2 select lines) and additional logic. Show how you obtained your solution, and properly label all input and output lines. Apply A and B to the select inputs.

A	B	C	D	F	
0	0	0	0	0	$F = D$
0	0	0	1	1	
0	0	1	0	0	
0	0	1	1	1	
0	1	0	0	1	$F = 1$
0	1	0	1	1	
0	1	1	0	1	
0	1	1	1	1	
1	0	0	0	1	$F = \bar{C}$
1	0	0	1	1	
1	0	1	0	0	
1	0	1	1	0	
1	1	0	0	0	$F = 0$
1	1	0	1	0	
1	1	1	0	0	
1	1	1	1	0