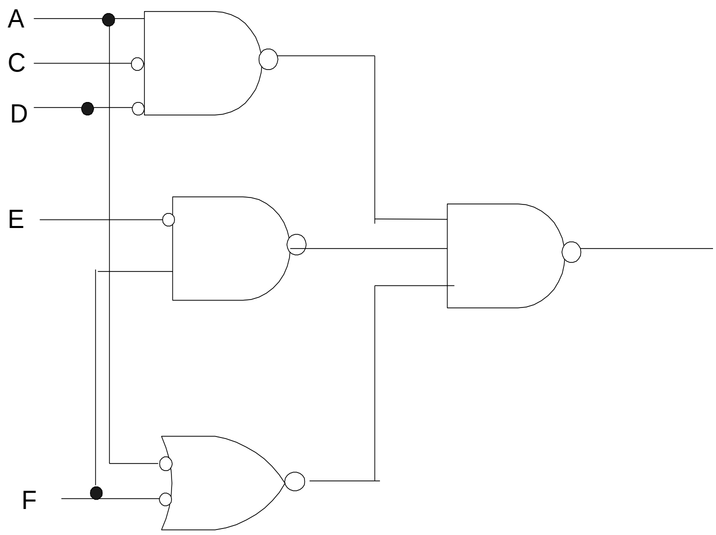
Question: 1

$$\mathbf{Y + X'Z + XY' = X + Y + Z}$$

$$\begin{aligned}
& Y + \overline{X}Z + X\overline{Y} \\
&= Y + X\overline{Y} + \overline{X}Z \\
&= (Y + X)(Y + \overline{Y}) + \overline{X}Z \\
&= Y + X + \overline{X}Z \\
&= Y + (X + \overline{X})(X + Z) \\
&= X + Y + Z
\end{aligned}$$

Question: 2

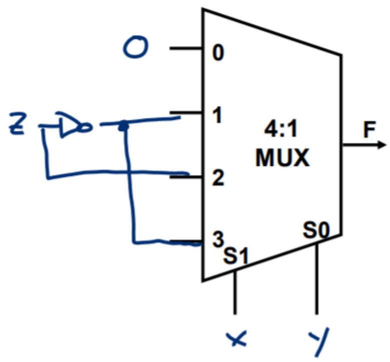
(a) Use gates to implement following logic. (You have to show circuit diagram using symbolic representation of logic gates.) $X = A\overline{C}\overline{D} + \overline{E}F + \overline{AF}$



(b) SOL:

■ Implement $F = X\overline{Y}Z + Y\overline{Z}$ with a 4:1 MUX

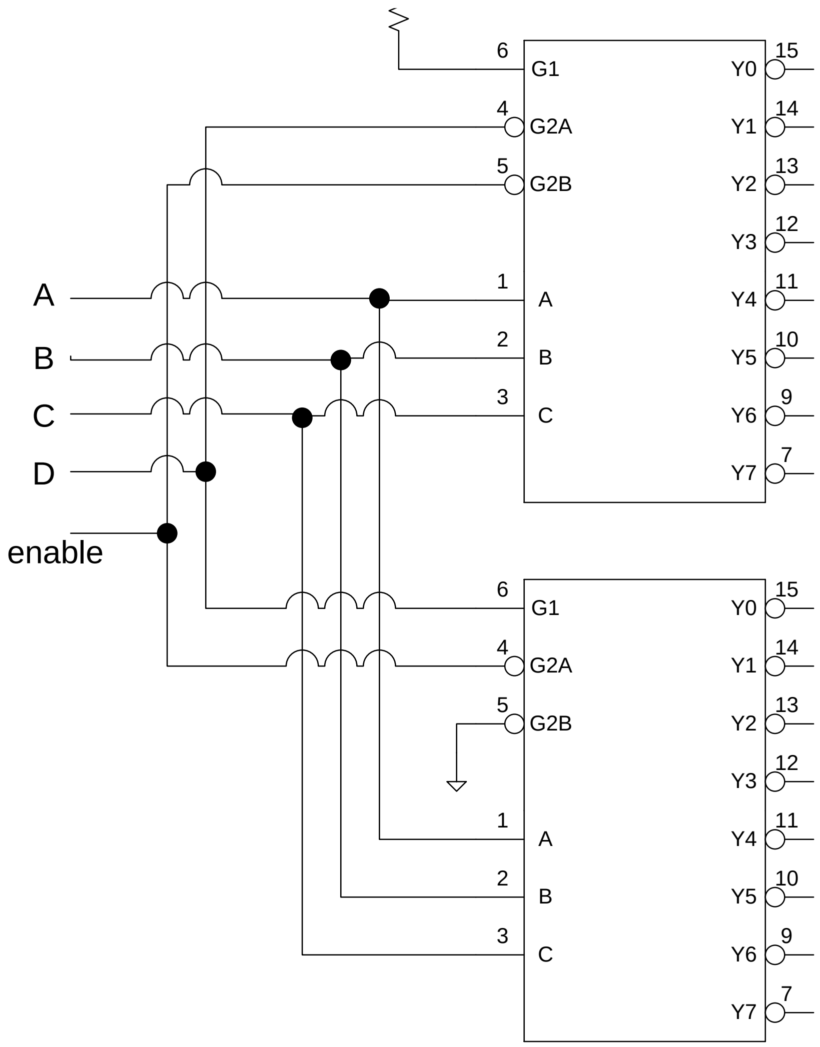
X	Y	Z	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0



Question: 3

Draw 4-to-16 Decoder using 3-to-8 Decoder

Sol 2:



4-to-16 Decoder using two 74LS139, 3-to-8 Decoder

Question: 4

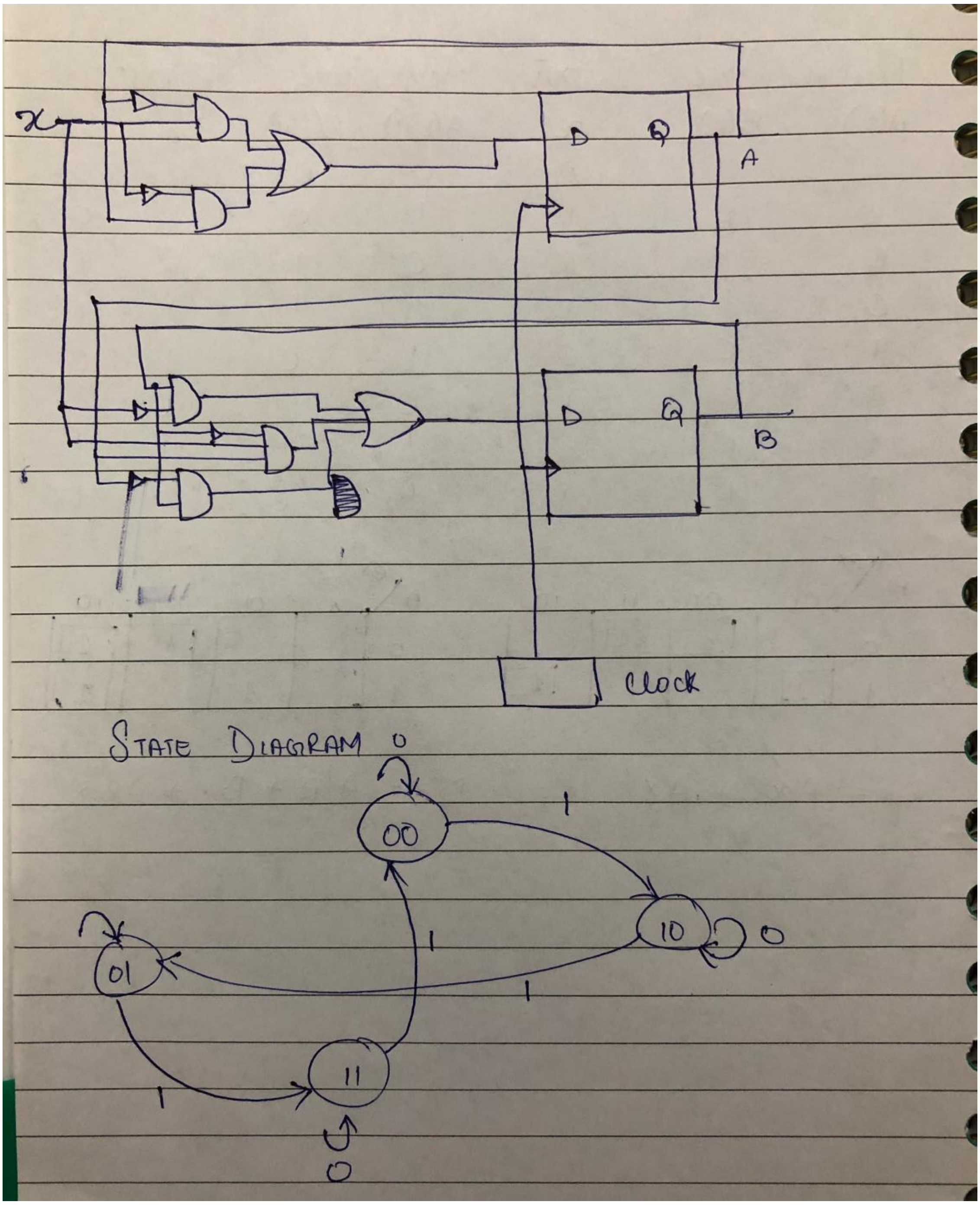
Excitation Table:

Present State		Input	Next State		FlipFlop	
A(t)	B(t)	x	A(t+1)	B(t+1)	D_A	D_B
0	0	0	0	0	0	0
0	0	1	1	0	1	0
0	1	0	0	1	0	1
0	1	1	1	1	1	1
1	0	0	1	0	1	0
1	0	1	0	1	0	1
1	1	0	1	1	1	1
1	1	1	0	0	0	0

A \ Bx	00	01	11	10
0		1	1	
1	1			1

A \ Bx	00	01	11	10
0			1	1
1		1		1

$D_A = A'x + Ax'$; $D_B = A'B + Bx' + AB'x$



Question #5

Convert the following binary numbers to decimal:

(a) 10101001.11 = 169.75
(b) 11010010 = 210
(c) 1000101.101 = 69.625

Convert following decimal numbers to binary:

(a) 243 = 11110011
(b) 7685 = 1111000000101
(c) 451 = 111000011

Convert:
(a) 6532 to octal = 14604
(b) 865 to hex = 361

Question: 6

STEP 1:
Label the inputs as X, Y, Z. X is the MSB, Z is the LSB
<u>OUTPUT is F is:</u>
1 when input is 101, 110, 111
0 when otherwise

Step 2 (Formulation)

Obtain Truth table

X	Y	Z	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

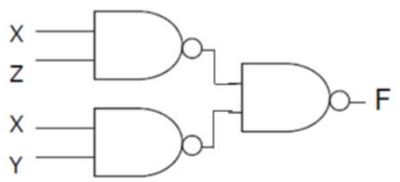
Boolean Expression:
$F = XY'Z + XYZ' + XYZ$

Step 3 (Optimization)

$F = XY'Z + XYZ' + XYZ$

$= XZ + XY$

Circuit Diagram



Question: 7

(a) SOL:

35_{10} is positive. In 8-bit two's complement format, $35_{10} = 00100011_2$.
-72_{10} is negative. In 8-bit two's complement format, $+72_{10} = 01001000_2$; flip the bits and add 1 to get two's complement of a negative number.
$-72_{10} = 10110111_2 + 00000001_2 = 10111000_2$.

Add 35_{10} and -72_{10} together in two's complement format:
$00100011_2 + 10111000_2 = 11011011_2$.

Convert to decimal: 11011011_2 in two's complement is a negative number, so flip the bits and add 1 to find its magnitude.
$00100100_2 + 00000001_2 = 00100101_2 = 32_{10} + 4_{10} + 1_{10} = 37_{10}$
The solution is -37_{10}.
$\boxed{35_{10} - 72_{10} = 11011011_2 = -37_{10}}$

(b) SOL:

65_{10} is positive, so in one's complement, $65_{10} = 01000001_2$.
-25_{10} is negative; $+25_{10} = 00011001_2$, so -25_{10} in one's complement format flips the bits of $+25_{10}$.
$-25_{10} = 11100110_2$.

$65_{10} - 25_{10} = 01000001_2 + 11100110_2 = 00100111_2 + 1$ carry bit.
One's complement uses an end-around carry if the carry bit is 1, which means add 1 to the sum:
$65_{10} - 25_{10} = 00100111_2 + 00000001_2 = 00101000_2$

Convert to decimal to check your answer:
$65_{10} - 25_{10} = 00101000_2 = 32_{10} + 8_{10} = 40_{10}$
$\boxed{65_{10} - 25_{10} = 00101000_2 = 40_{10}}$

Question: 8