MATHEMATICS II FOR COMPUTER STUDIES

MATH1205

Contents

Question 1

1. Consider the following input/output table then do part a to c:

x	y	z	Output
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

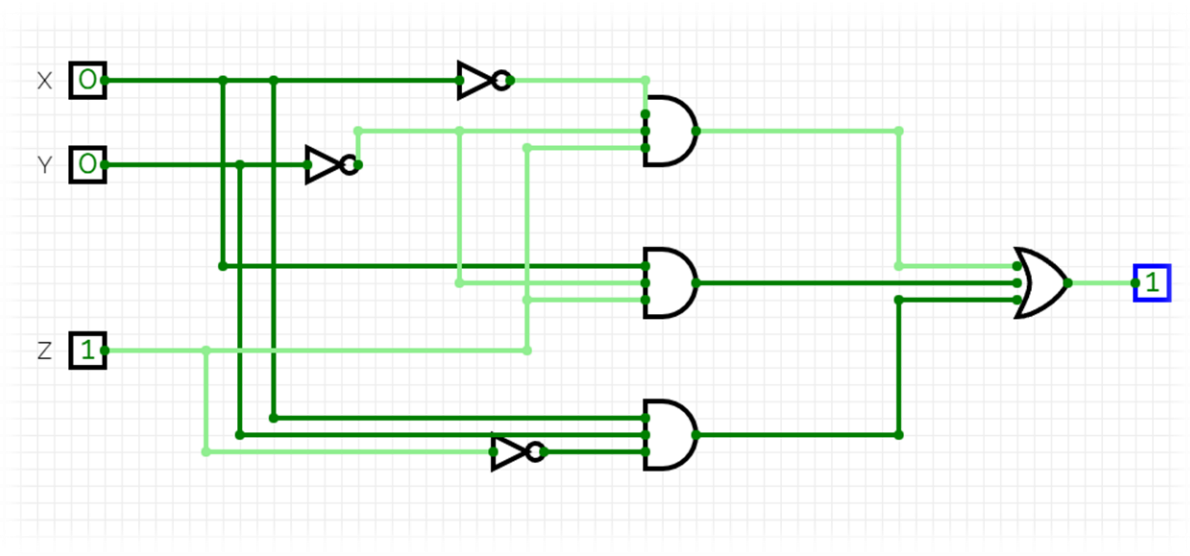
a) What is the sum of product Boolean expression for this table?
b) Create the circuit diagram for this expression.
c) Use K-Map to simplify the expression.
d) Create the circuit diagram for the simplified expression.

ANS) a)

X	Y	Z	OUTPUT
0	0	1	1
1	0	1	1
1	1	0	1

Output = (~x ∧ ~y ∧ z) ∨ (x ∧ ~y ∧ z) ∨ (x ∧ y ∧ ~z)

b)

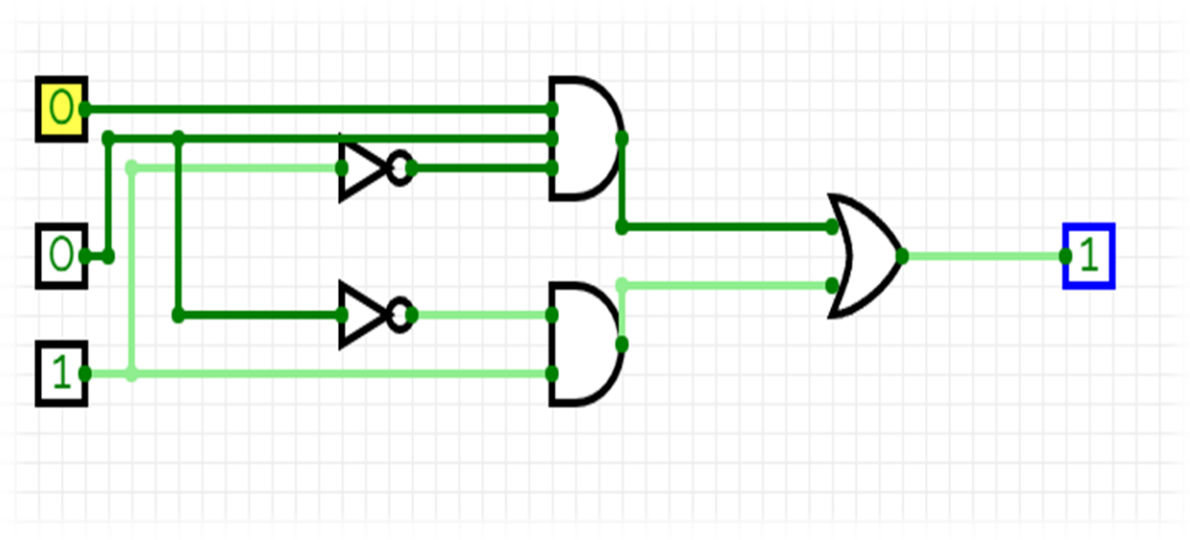


c)

	~Z	**Z**
~X~Y	0	1
~XY	0	0
XY	1	0
XY	0	1

Simplified Expression: xy~z + ~yz

d)



Question 2

2. Create the truth table (input/output table) for each Boolean expression:

a) $\bar{A} + \bar{B} + C$

b) $A(B + AC + \bar{A})$

ANS a)

A	B	C	~A	~B	~A+~B+C
0	0	0	1	1	1
0	0	1	1	1	1
0	1	0	1	0	1
0	1	1	1	0	1
1	0	0	0	1	1
1	0	1	0	1	1
1	1	0	0	0	0
1	1	1	0	0	1

b)

A	B	C	AC	~A	B+ AC +~A	A(B+ AC+ ~A)
0	0	0	0	1	1	0
0	0	1	0	1	1	0
0	1	0	0	1	1	0
0	1	1	0	1	1	0
1	0	0	0	0	0	0
1	0	1	1	0	1	1
1	1	0	0	0	1	1
1	1	1	1	0	1	1

Question 3

3. Find the sum of product for each input/output table:

a)

P	Q	R	Output
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

b)

P	Q	R	Output
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

ANS) a)

P	Q	R	OUTPUT
0	1	0	1
1	0	0	1
1	1	1	1

Output = $(\sim P \wedge Q \wedge R) \vee (P \wedge \sim Q \wedge \sim R) \vee (P \wedge Q \wedge R)$

b)

P	Q	R	OUTPUT
0	0	0	1
0	1	1	1
1	1	1	1

Output = $(\sim P \wedge \sim Q \wedge \sim R) \vee (\sim P \wedge Q \wedge R) \vee (P \wedge Q \wedge R)$

Question 4

4. (1) Find the simplified version of each Karnaugh map (K-map) and then (2) create circuit diagram for each of them?

a)

	yz	$\bar{y}z$	$\bar{y}\bar{z}$	$y\bar{z}$
x			1	1
$\bar{x}$	1	1	1	1

b)

	y	$\bar{y}$
x		
$\bar{x}$	1	1

c)

	yz	$\bar{y}z$	$\bar{y}\bar{z}$	$y\bar{z}$
x	1			1
$\bar{x}$		1	1	

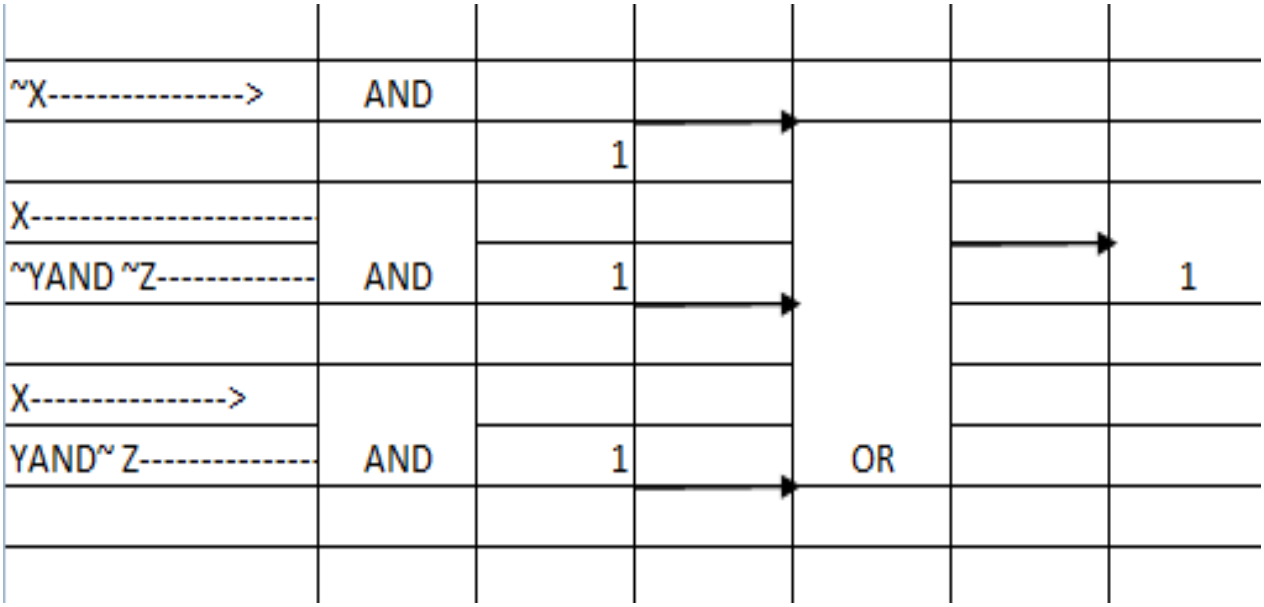
d)

	yz	$\bar{y}z$	$\bar{y}\bar{z}$	$y\bar{z}$
x	1	1	1	
$\bar{x}$	1	1	1	

ANS) a)

		YZ			
		00	01	11	10
X	1	0	1	0	1
	0	0	1	0	0

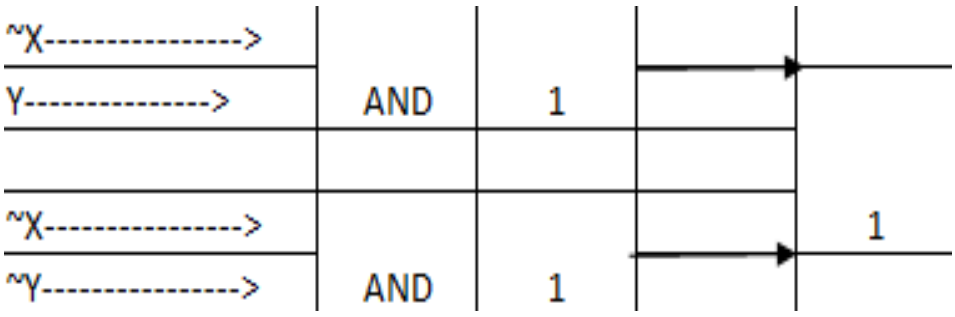
Output = (~X) ∨ (X∧Y∧~Z) ∨ (X∧Y∧~Z)



b)

	Y	~Y
X	0	0
~X	1	1

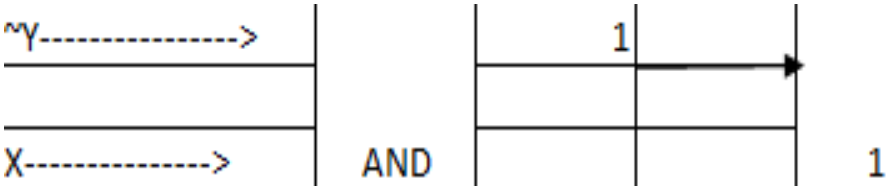
Output = $\sim X$



c)

		YZ			
		00	01	11	10
X	1	0	0	1	1
	0	1	1	0	0

Output = (~*Y*) ∨ (X)



d)

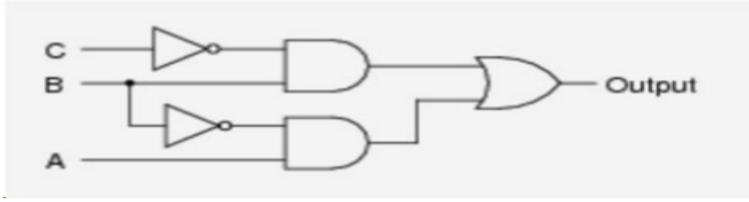
		YZ			
		00	01	11	10
X	1	1	1	1	0
	0	1	1	1	0

Output = (*U*) ∧ (*Y*∧~*Z*)

Question 5

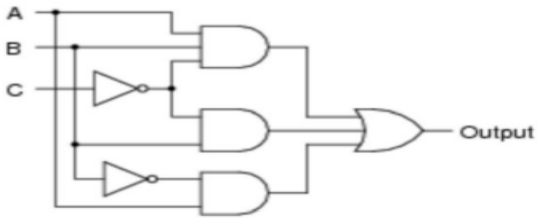
5. For each diagram 1 & 2 if the input signals are as indicated.
a) Find the output signal for each.
b) Write an input/output table for the circuit.
c) Find the Boolean expression that corresponds to the circuit.

1.



Input Signals: A = 1, B = 0, C = 0

2.



Input Signals: A = 0, B = 0, C = 1

ANS) This explanation addresses the functionality of two logic circuits and their corresponding outputs, input/output tables, and Boolean expressions.

1a) OUTPUT:

Inputs: A = 1, B = 0, C = 0

Output: 1

Explanation:

Follow the path from input C (0) to the bottom in put (0) of the topmost AND gate. Since C is 0, ~C will be 1. So the output of the topmost AND gate is AND (0,1) = 0. The bottom AND gate has inputs ~B(1) and A(1) which results in AND output of 1. Therefore, the OR gate inputs are 0 and 1. OR of 0 and 1 is 1. Thus our output is 1.

1b) INPUT/OUTPUT Table:

A	B	C	Output
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

1c) Finding the Boolean expression that corresponds to the circuit:

Disjunctive normal form = ~ab~c + a~b~c + a~bc + ab~c

Minimal Form = b~c + a~b

2a) OUTPUT:

Inputs: A = 0, B = 0, C = 1

Output: 0

Explanation:

A is 0, so topmost AND gate output will be 0. B is 0, so middle AND gate output will be 0.

Similarly A(1) is an input to the most bottom AND gate. So output of the most bottom AND gate is 0.

Therefore, input for OR gate is 0,0,0 which results in OR output of 0.

2b) INPUT/OUTPUT Table:

A	**B**	**C**	**Output**
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

2c) Finding the Boolean expression that corresponds to the circuit:

Disjunctive normal form = ~ab~c + a~b~c + a~bc + ab~c

Minimal Form = b~c + a~b