CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF DIPLOMA IN COMPUTER SCIENCE

COSC 0211: DIGITAL ELECTRONICS

STREAMS: DIP (COMP SCI) Y2S1 **TIME: 2 HOURS**

DAY/DATE:

INSTRUCTIONS:

- **Answer question one and any other two from section B**
- **Do not write on this paper**

SECTION A {compulsory}

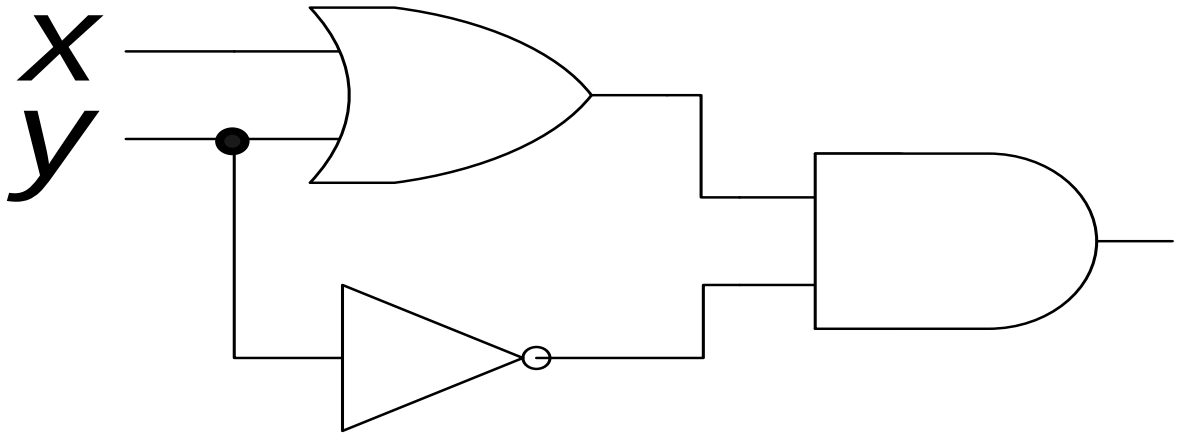
QUESTION ONE (30MARKS).

a) What is the truth table and logic symbol of a three-input OR gate? (3mrks)

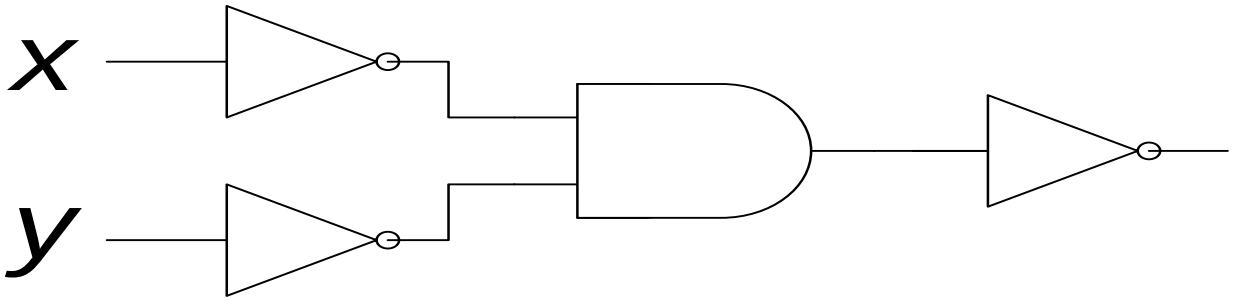
b) Write the expression for a 4-input AND gate. Construct the complete truth table showing the output for all possible cases. (3mrks)

c) Define NAND and NOR gates with their truth tables. (4mrks)

d) Construct the truth tables and develop the Boolean logic expressions for following circuits.



(5mrks)



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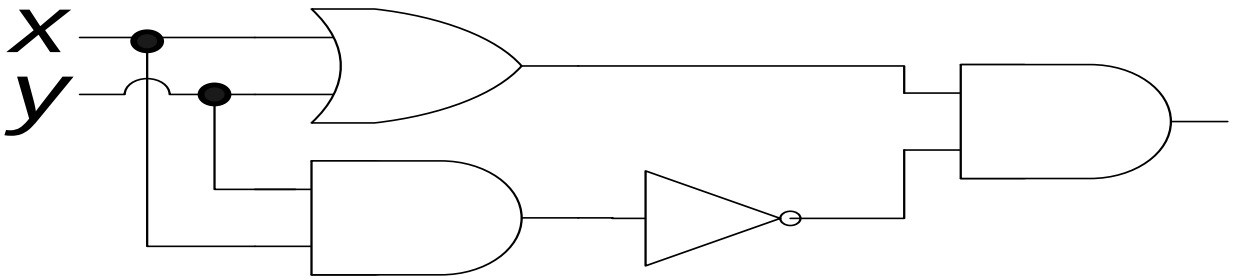


(5 marks)

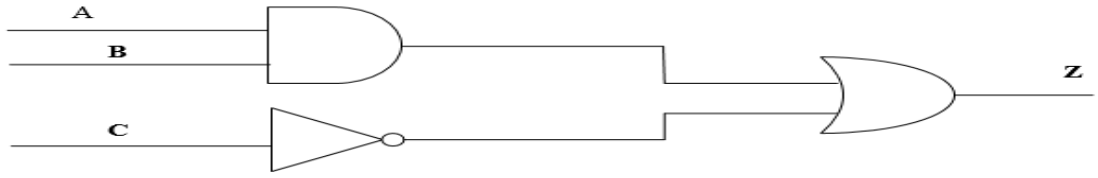
i. Write the circuits for the following Boolean algebraic expression. (3mrks)
$\overline{(x+y)}x$.

e) Convert 11001110_2 into decimal number (2mks).

SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20MKS).

a) Construct the truth table and develop the logic expression for the output Z in the following diagram. (6mks)



b) Complete the truth table below for a three –input OR Gate binary equivalent. (6marks).

A	B	C	OUT-PUT
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

c)

I. Draw the logic circuit for $Y = AB\overline{C} + ABC$.

II. Use Boolean algebra to simplify the equation, then draw the corresponding logic circuit. (8marks).

QUESTION THREE (20MKS).

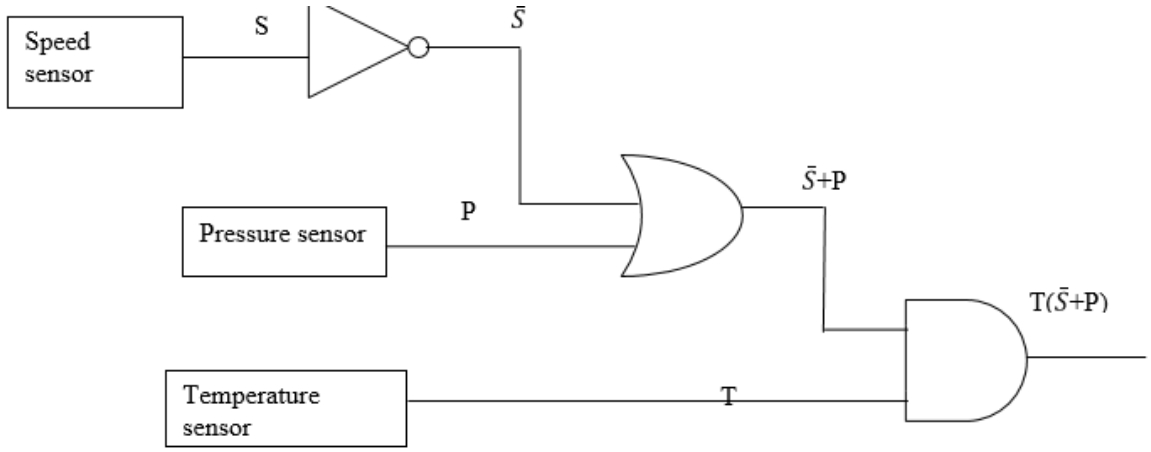
a) An aircraft engine is equipped with a safety system that turns on warning light when certain combination of engine speed, pressure and temperature occurs. The device that senses these quantities produces a 1 or 0 according to the table below.

Speed (S)	S<5000	0
	S≥5000	1
Pressure(P)	P≤200	1
	P>200	0
Temperature(T)	T>180	0
	T≤180	1

Below is the logic diagram that controls the warning light in response to the input variables S,P and T. Assuming that a 1 turns on the light, develop the overall logic expression and construct the truth table if the warning light is on when:

a) The speed is 6250, the pressure is 280 and the temp is 150. (5mks)

b) The speed is 7400, the pressure is 180 and the temp is 200. (5mks)



b) Draw the circuit diagram to implement the expression

$y = (A+B)(\bar{B} + C)$ (6marks)

c) Use Boolean rules to show that;

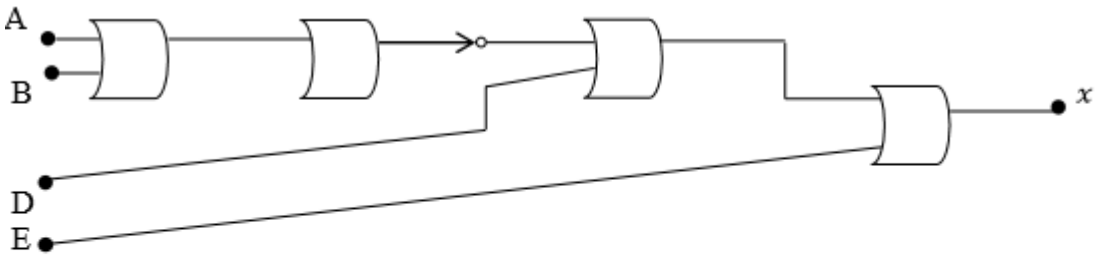
$(A + B)(A + C) = A + BC$ [4 marks].

QUESTION FOUR (20MKS).

a) State De Morgan's Laws' (2mrks)

b) Show a truth table for a 2 input XOR gate (3mrks).

c) Get the expression for the circuit below [5 mrks]



(ii) Using A = 0, B = 1, C = 1 and D = 1, find the output for the above circuit. [5 marks]

d) Draw the logic circuit for Y = A$B\ \bar{C}$ + ABC (5 marks).

QUESTION FIVE (20 MRKS)

a) Using Boolean Algebra simplify the following Boolean Functions

i. (3mrks)

$$F=AB+BC+\bar{B}\,C.$$

ii. (3mrks)

$$F=A+\bar{A}\,B.$$

iii. (4mrks)

$$F=\bar{A}\,\bar{B}\,C+\bar{A}\,BC+A\,\bar{B}.$$

b) Using a truth table show that (10 mrks)

$$(X+Y)(X+\bar{Y})(\bar{X}+Z)=XZ$$
