ASSIGNMENT

1. The output of a digital circuit Y is given by the expression $Y = (B + \bar{C}\,\bar{B}\,A)(\overline{A+C})$, where A, B and C represent inputs. Draw circuit of above equation using OR, AND and NOT gate. Find its truth table. [TU 2074]

⇒

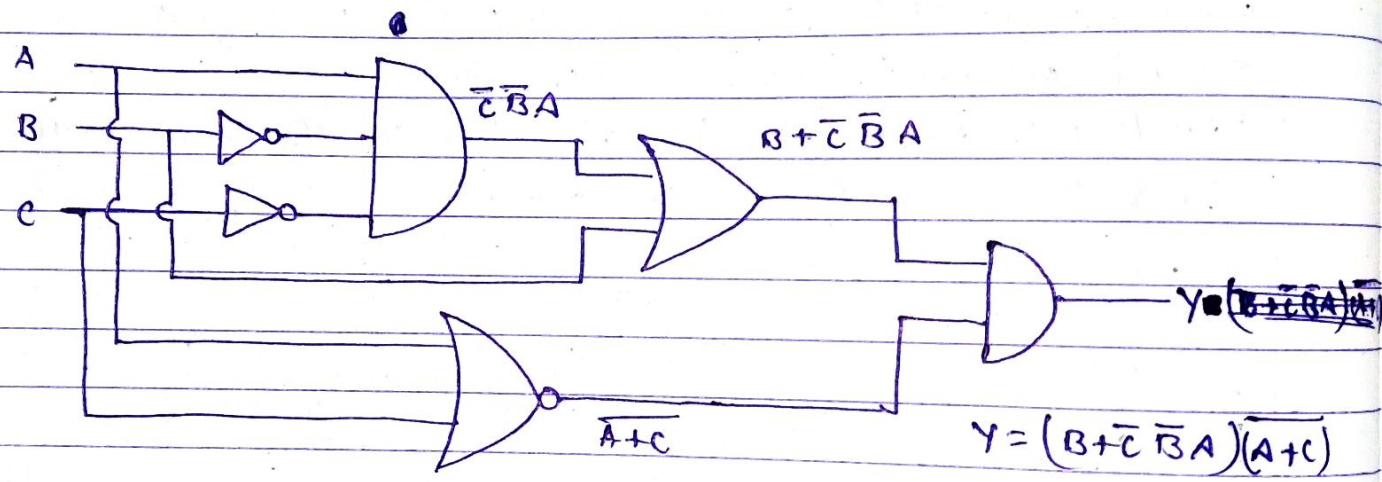


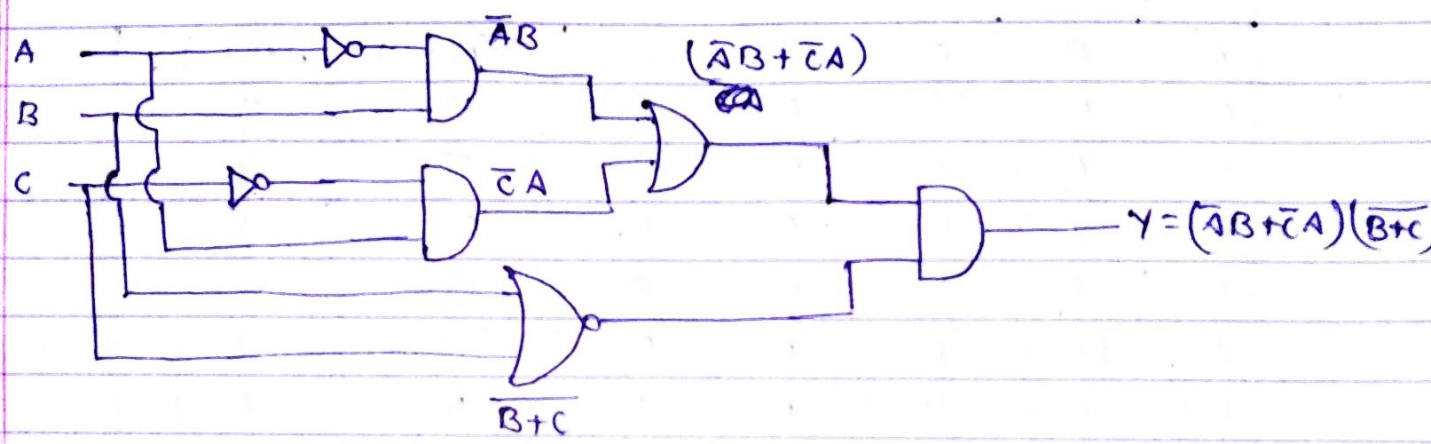
Fig: Logical circuit

Truth table:

A	B	C	$\bar{B}$	$\bar{C}$	$\bar{C}\bar{B}A$	$B+\bar{C}\bar{B}A$	$\overline{A+C}$	$Y=(B+\bar{C}\bar{B}A)(\overline{A+C})$
0	0	0	1	1	0	0	1	0
0	0	1	1	0	0	0	0	0
0	1	0	0	1	0	1	1	1
0	1	1	0	0	0	1	0	0
1	0	0	1	1	1	1	0	0
1	0	1	1	0	0	0	0	0
1	1	0	0	1	0	1	0	0
1	1	1	0	0	0	1	0	0

2. The output of a digital circuit Y is given by the expression: $Y = (\bar{A}B + \bar{C}A)(\overline{B+C})$, where A, B and C represent inputs. Draw a circuit of above equation using OR, AND and NOT gate. Find its truth table. [TU Model 2074]

⇒



Logical circuit

Truth table:

A	B	C	$\bar{A}$	$\bar{C}$	$\bar{A}B$	$\bar{C}A$	$\bar{A}B+\bar{C}A$	$\overline{B+C}$	$Y=(\bar{A}B+\bar{C}A)(\overline{B+C})$
0	0	0	1	1	0	0	0	1	0
0	0	1	1	0	0	0	0	0	0
0	1	0	1	1	1	0	1	0	0
0	1	1	1	0	1	0	1	0	0
1	0	0	0	1	0	1	1	1	1
1	0	1	0	0	0	0	0	0	0
1	1	0	0	1	0	1	1	0	0
1	1	1	0	0	0	0	0	0	0

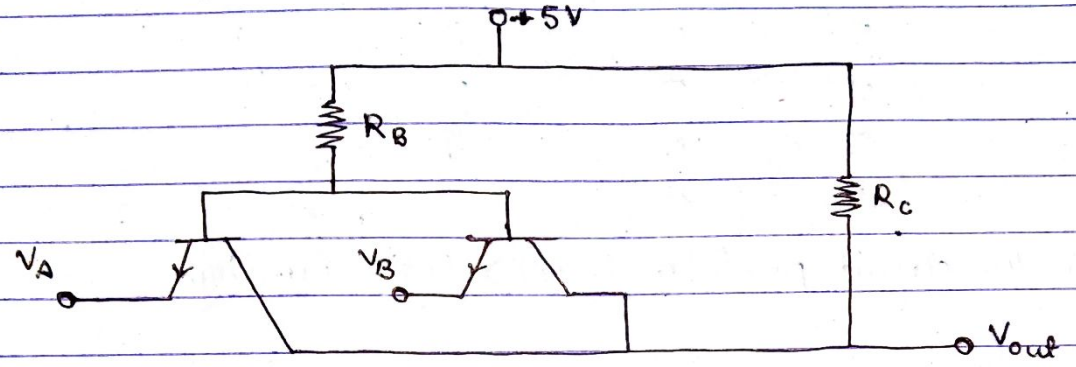
3. Make the appropriate truth tables to prove the following distributive law of Boolean Algebra:
$A(B+C) = AB + AC$ [TU Microsyllabus, P. 27-1] ... •

⇒ Truth table:

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

Hence, the distributive law of Boolean Algebra i.e. $A(B+C) = AB + AC$ is proved.

4. Analyze the circuit shown in figure. Determine the logic function performed by the circuit by making and justifying the appropriate truth table. [TU Microsyllabus, P 27.6, TU 2074]



⇒ For 1st entry, $V_A = 0$ and $V_B = 0$. It means that A and B are both grounded such that both the transistors are forward biased and supply +5V passes through R_B and goes to the ground such that the output is low (0).

For 2nd entry, $V_A = 0$ and $V_B = 5$, which means that A is grounded and +5V is supplied from B. Also +5V that comes from supply through R_B and +5V supplied from B creates reverse bias due to which transistor of V_B gets off and +5V goes through 'A' to the ground which gives low output (0). Similarly, for 3rd entry, it is same like 2nd entry but +5V goes to the ground through B.

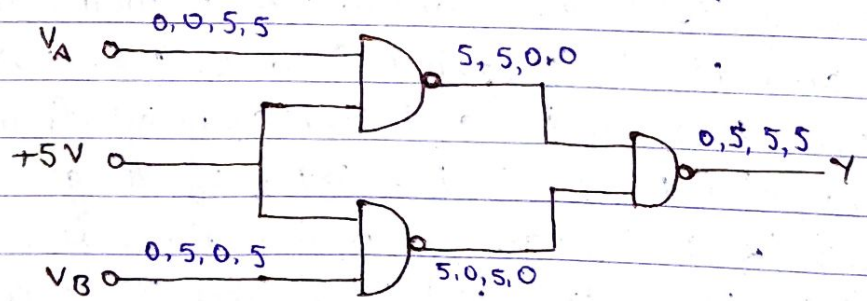
For 4th entry, $V_A = 5$ and $V_B = 5$. It means that +5V is applied from both sides in which +5V supplied from 'P' passes through R_B and makes both transistors reverse biased such that transistors get OFF and finally, +5V supplied from 'P' passes through R_C and gives high output (5).

Truth table:

Input		Output
V_A	V_B	V_{out}
0	0	0
0	5	0
5	0	0
5	5	5

Hence, the circuit performed AND logic function.

5. Find the truth table for the circuit shown in figure below. What logic function does the circuit perform? What logic function will the circuit perform if the constant +5V input to the first two gates are changed to ground potential? [TU Microsyllabus]



⇒ Truth table:

V_A	V_B	Y
0	0	0
0	5	5
5	0	5
5	5	5

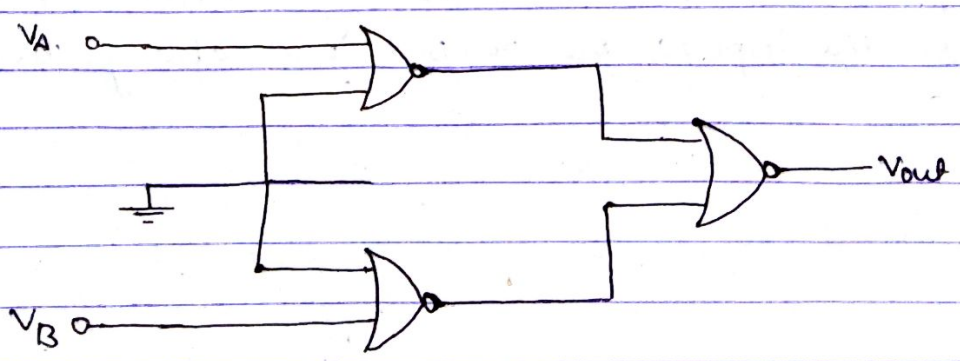
∴ The circuit performs OR logic function.

When the supply constant +5V is changed to ground ~~function~~ potential (0), then we obtain the following truth table:

V_A	V_B	$\overline{0 . V_A}$	$\overline{0 . V_B}$	Y
0	0	1	1	0
0	1	1	1	0
1	0	1	1	0
1	1	1	1	0

From the above truth table, the circuit does not perform any particular logic function. In fact, if the constant +5V input is changed to ground potential (0), then whatever the inputs in V_A and V_B, the output is always 0.

6. a) Find the truth table for the circuit of given figure. What logic function does the circuit perform?
   b) What logic function will the circuit perform if the common grounded input to the first two NOR gates are changed to +5V?
   [TU Microsyllabus]



⇒ a) Truth-table:

V_A	V_B	$\overline{0+V_A}$	$\overline{0+V_B}$	Vout
0	0	1	1	0
0	1	1	0	0
1	0	0	1	0
1	1	0	0	1

Hence, the circuit performs AND logic function.

⇒ b) If the common grounded input to the two NOR gates are changed to +5V, then we would obtain the following truth table:

Input				Output
V_A	V_B	$\overline{5+V_A}$	$\overline{5+V_B}$	V_{out}
0	0	0	0	5
0	5	0	0	5
5	0	0	0	5
5	5	0	0	5

From the above truth table, the circuit does not perform any particular logic function but whatever be the inputs, the output will always be high.