Date: _____

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ID :- 17011

Program :- BS(CS)

Subject :- Digital logic design

Instructor :-

M. Amin

Date: _____

(1)

"Question no 1"

write the following expression for Circuit. figure 01.

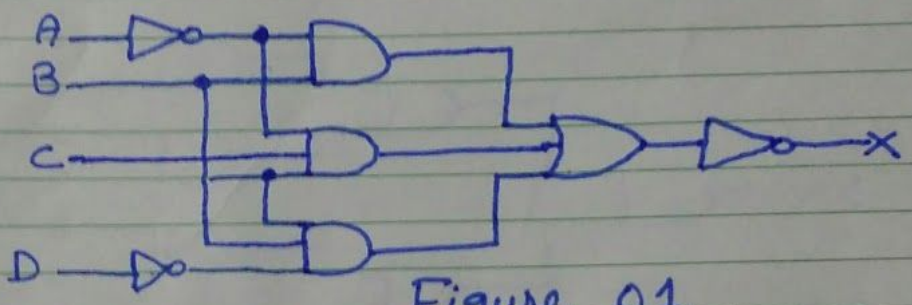


Figure 01

Solution:-

The expression for the figure 01 is

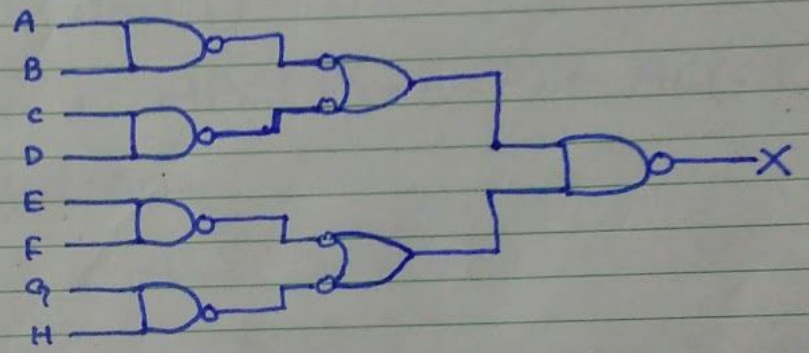
$$X = \overline{\bar{A}B + \bar{A}CD + D\bar{B}\bar{D}}$$

Answer.

Date: 2

"Question no 2"

write the output expression for Circuit as it appear in figure & equivalent to AND-OR.



Solution:-

$$X = \overline{(\overline{AB}+\overline{CD})}+\overline{(\overline{EF}+\overline{GH})}+\overline{(\overline{AB}+\overline{CD})}+\overline{(\overline{EF}+\overline{GH})}+\overline{(\overline{AB}+\overline{CD})}+\overline{(\overline{EF}+\overline{GH})}$$

$$= (\overline{AB})(\overline{CD}) + (\overline{EF})(\overline{GH}) + (\overline{AB})(\overline{CD})$$

$$+ (\overline{EF})(\overline{GH})$$

$$= \overline{ABCD} + EFGH$$

$$= \overline{ABCDEFGH}$$

Answer.

Date: 3

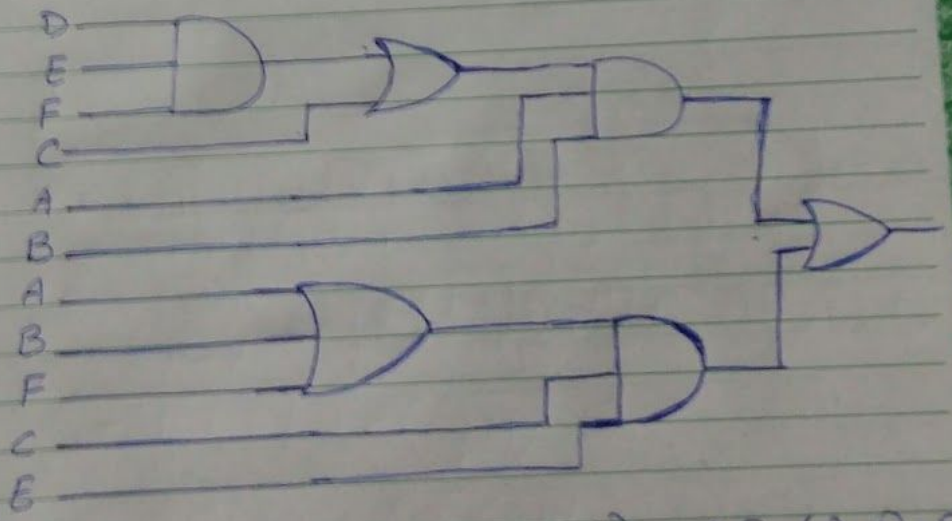
"Question no 4"

Use AND gates, OR gates, or Combination of both to implement the following logic expression as stated

$X = ABC(D+E+F) + AC(C+D+E)$

Solution:-

$X = ABC(D+E+F) + AC(C+D+E)$



output:- $X = AB(C+DEF) + CE(A+B+F)$

Answer.

Date: _____ 4

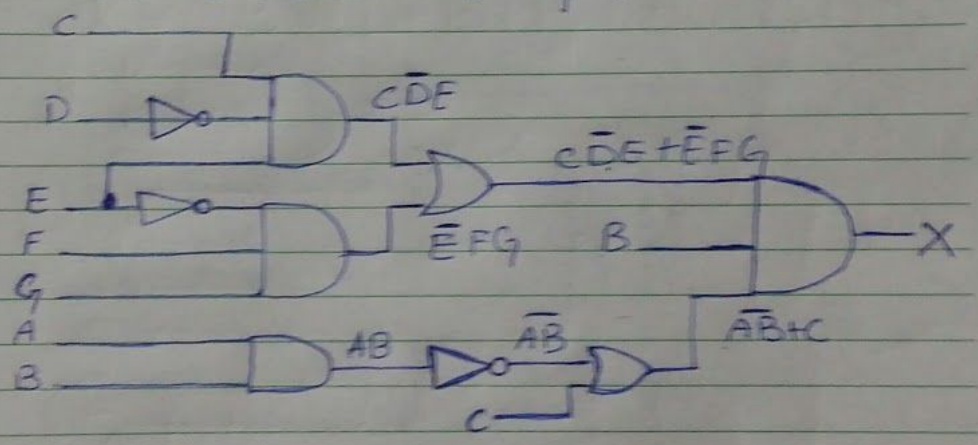
"Question no 5"

Use AND gates, OR gates and inverters as needed to implement the following logic expressions

$$X = B(C\bar{D}E + \bar{E}FG)(\overline{A\bar{B}} + C)$$

Solution:-

$$X = B(C\bar{D}E + \bar{E}FG)(\overline{A\bar{B}} + C)$$



Output:-

$$X = B(C\bar{D}E + \bar{E}FG)(\overline{A\bar{B}} + C)$$

Answer.

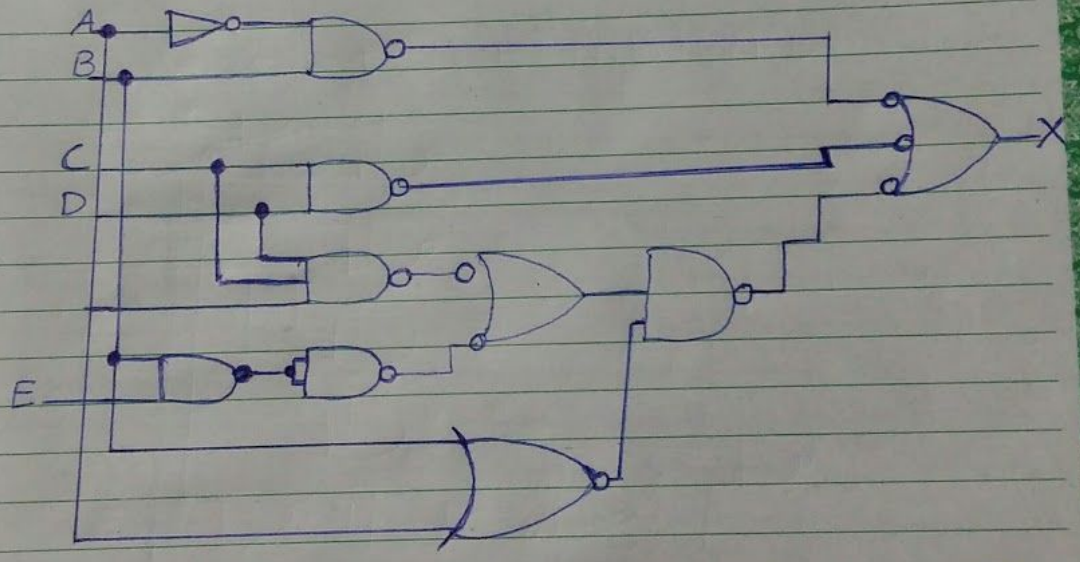
Date: _____ 5

"Question no 6"

Use NAND gates, NOR gates or Combination of both to implement the following logic expression.

$$X = \overline{A}B + CD + \overline{(A+B)}\,(ACD + \overline{B}\overline{E})$$

Solution:-



$$X = \overline{A}B + CD + \overline{(A+B)}\,(ACD + \overline{B}\overline{E})$$

Answer.

Date: 6

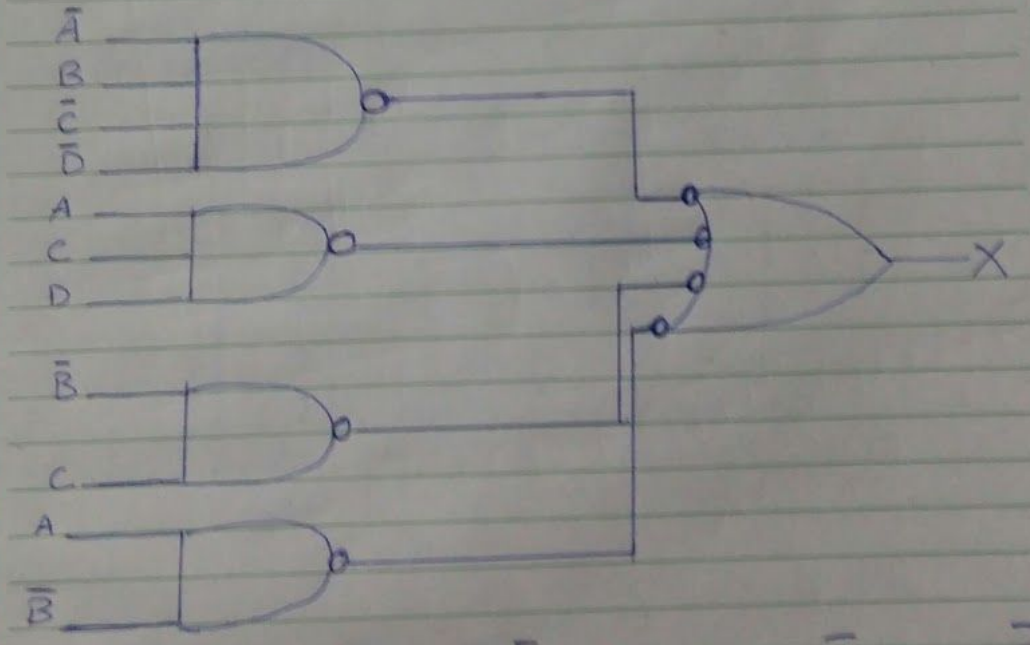
"Question no 7"

Implement the logic Circuit for the truth table in table 01

Solution:-

The expression for table no "1" is

$$X = \bar{A}B\bar{C}\bar{D} + \bar{A}BCD + \overline{\bar{A}BCD} + \bar{A}\bar{B}CD + \overline{\bar{A}BCD} + \bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}CD + ABCD$$



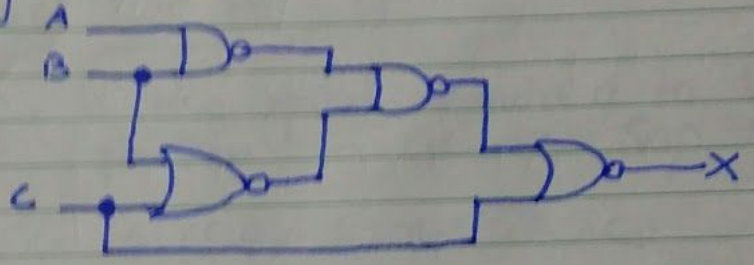
$$X = \bar{A}B\bar{C}\bar{D} + ACD + \bar{B}C + A\bar{B}$$

Answer.

Date:

"Question no 8"

Simplify the circuit in figure 03 as much as possible, and verify that the simplified circuit is equivalent to the original that the truth table are



Solution:-

$$X = AB + ABC = AB(1+C) = AB$$

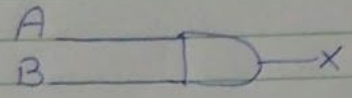
A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

→ X = 1 when AB = 1, no matter what C is

A	B	X
0	0	0
0	1	0
1	0	0
1	1	1

Since C is a don't care variable the ouput depends only on A and B as shown by the

two variables truth table above which is implemented with the AND gate



"Question no 9"

Minimize the gates required to implement the function in Q6 in SOP form.

$$X = B(C\bar{D}E + EFG)(\bar{A}\bar{B} + C)$$

Solution:-

$$X = B(C\bar{D}E + EFG)(\bar{A}\bar{B} + C)$$
$$(BC\bar{D}E + B\bar{E}FG)(\bar{A} + \bar{B} + C)$$

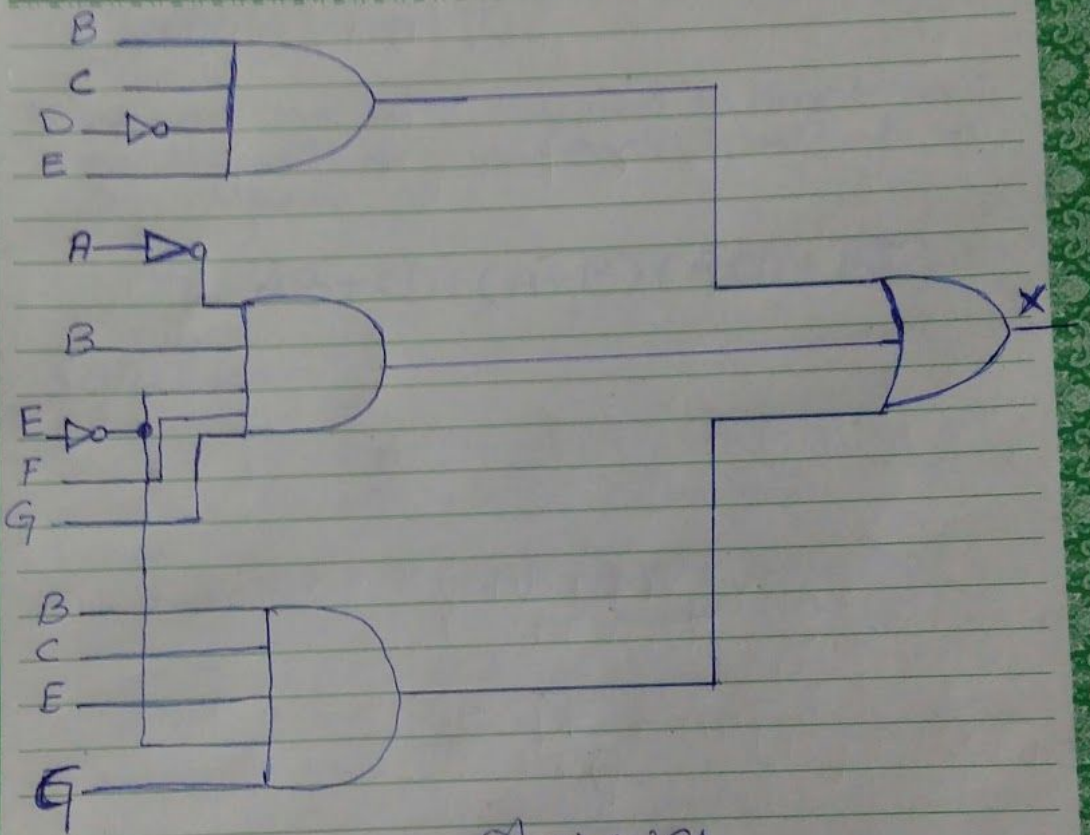
$$= \bar{A}BC\bar{D}E + \bar{A}B\bar{E}FG + BC\bar{D}E + BC\bar{E}FG$$

$$= BC\bar{D}E\bar{A} + \bar{A}B\bar{E}FG + BC\bar{E}FG$$

$$= BC\bar{D}E + \bar{A}B\bar{E}FG + BC\bar{E}FG$$

Date: _____

9



Answer.

Date:

10

"Question no 10"

Minimize the gates required to implement the functions in each part of in Sop form.

$$X = \bar{A}B + CD + (\overline{A+B})(ACD + \overline{BE})$$

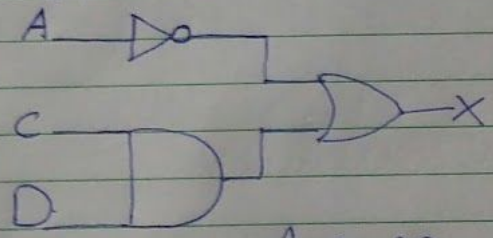
Solution:

$$X = \bar{A}B + CD + (\overline{A+B})(ACD + \overline{BE})$$

$$= \bar{A}B + CD + A\bar{B}(\overline{ACD}) + \overline{BE}$$

$$= \bar{A}B + CD + \bar{A}\bar{B} + \bar{A}\bar{B}\bar{E} + \bar{A}B + \bar{B} + \bar{C} + A\bar{B}E$$

$$= A\bar{B}E + CD$$



Answer.

Date: _____ 11

"Question no 11"

Minimize the gates required to implement the function of the Circuit in Figure 02 in Sop form.

Solution:-

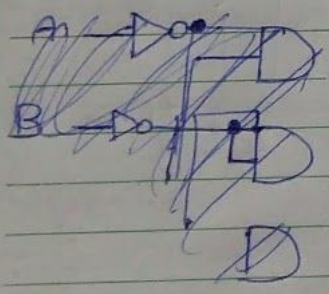
$$X = (\overline{AB} + \overline{CD})(\overline{EF} + \overline{GH})\overline{(AB + CD)(EF + GH)}$$

$$\overline{(AB + CD)} + \overline{(EF + GHG)}$$

$$= (\overline{AB})(\overline{CD}) + (\overline{EF})(GH)$$

$$= (\overline{A} + \overline{B})(\overline{C} + \overline{D})(\overline{E} + \overline{F})(\overline{G} + \overline{H})$$

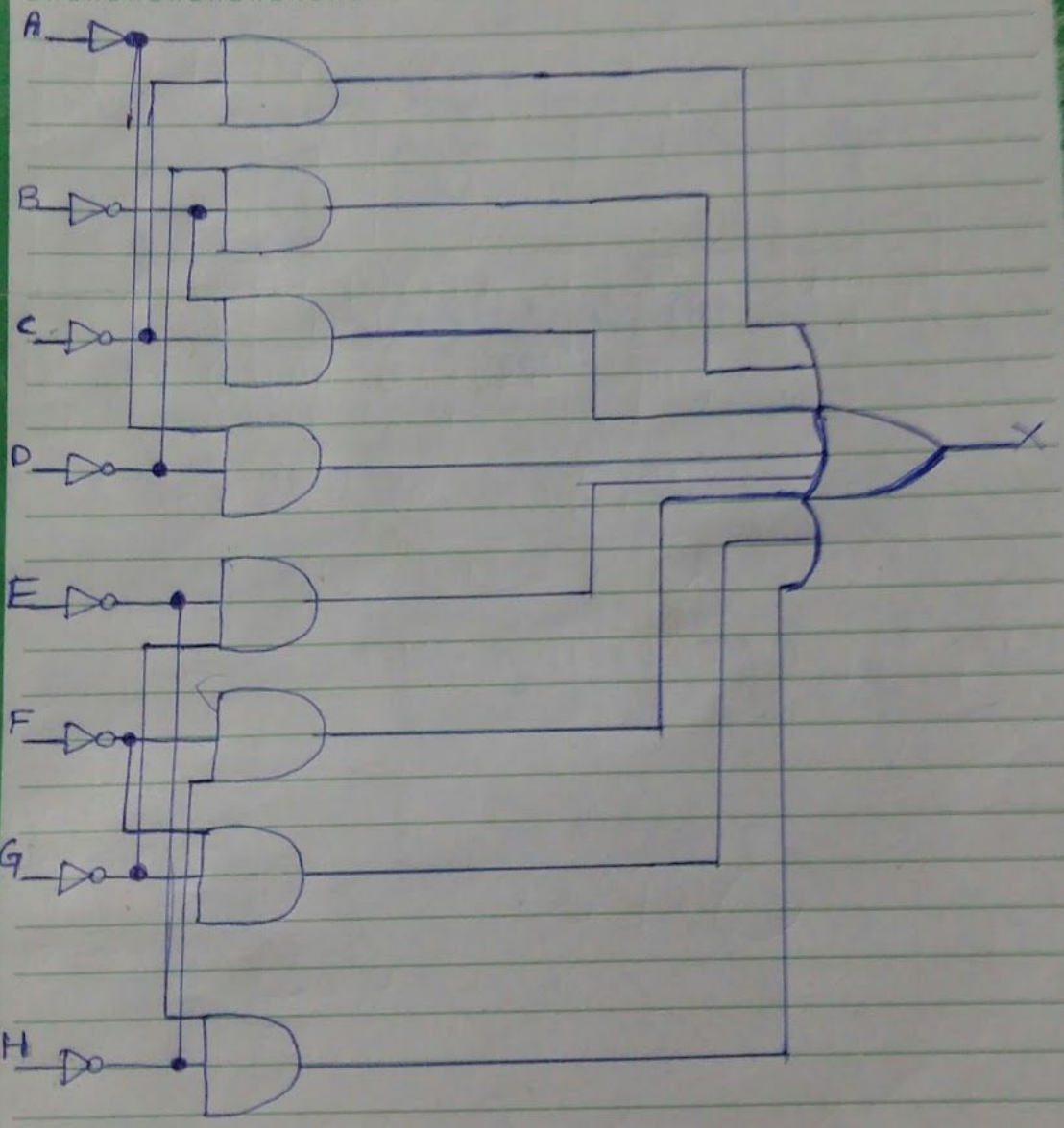
$$= \overline{AC} + \overline{BC} + \overline{AD} + \overline{BD} + \overline{EG} + \overline{FG} + \overline{EH} + \overline{FH}$$



P.T.O

Date: _____

12



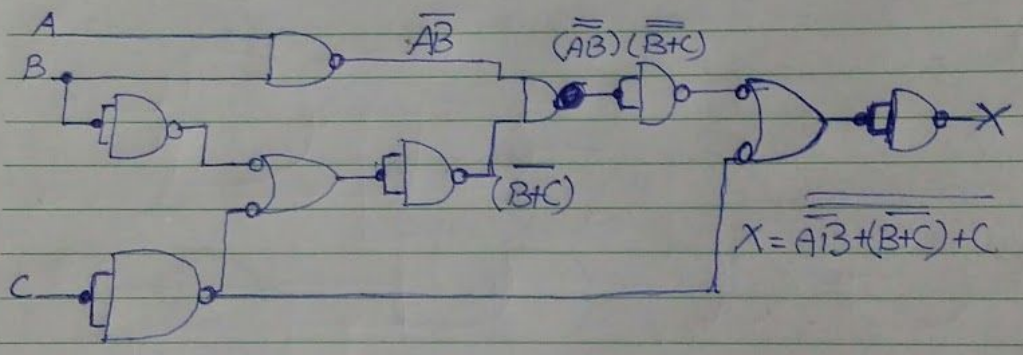
Date: _____ 14

Question no 13

Implement the logic Circuit Using only NAND gates Figure 03:-

Solution:-

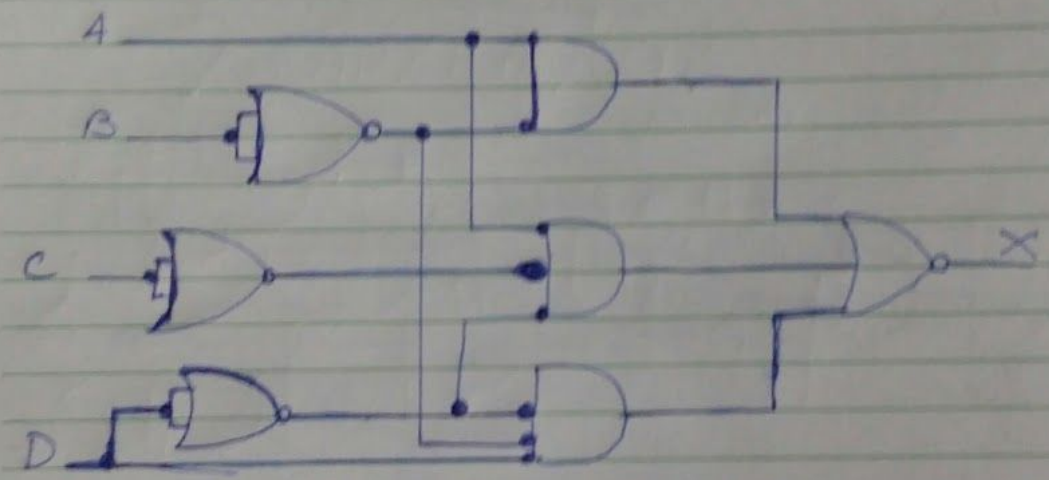
$$X = \overline{\overline{A\overline{B}}\,\overline{(\overline{B+C})}\,\overline{(C)}}$$



Question no 14

Repeat Q13 using NOR gate.

Solution:-

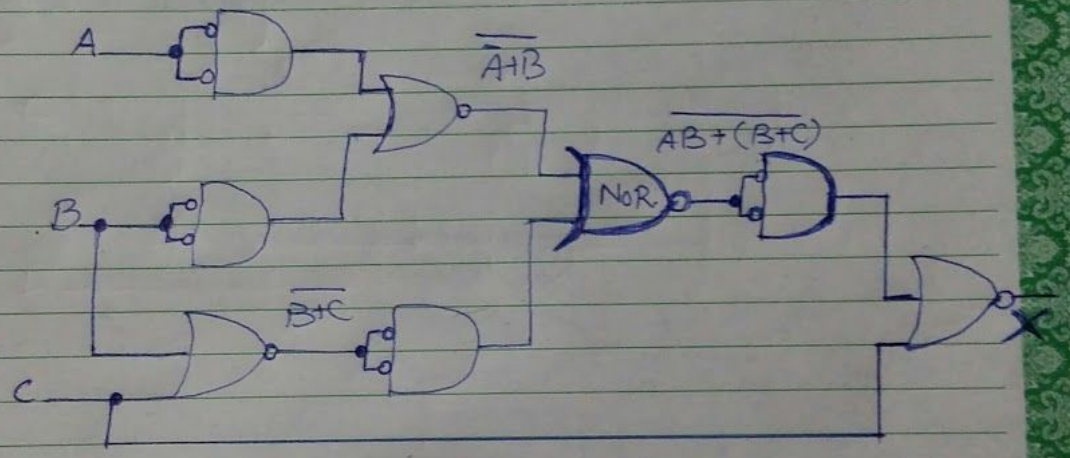


Date: _____ 16

"Question no 15"

Repeat the Q: 14 using only NOR Gate.

Solution:-



$$X = \overline{AB(\overline{B+C})+C}$$

Date: _____

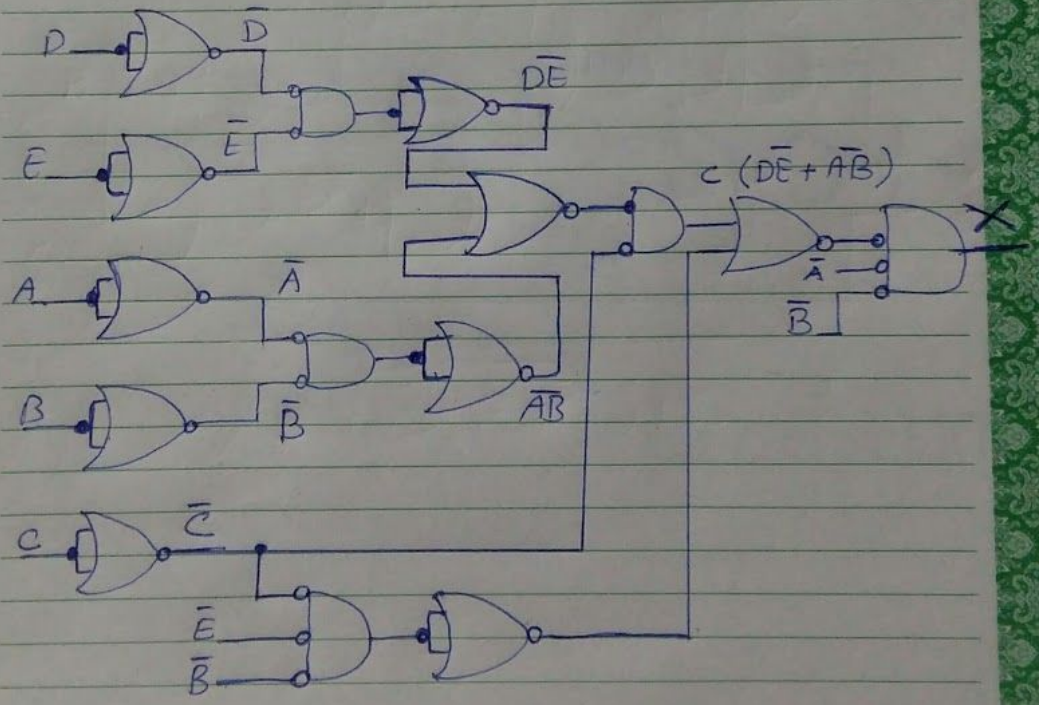
"Question no 16"

Show that the following expression as stated using only NOR gates:-

$$X = AB[C(\overline{DE} + \overline{AB}) + \overline{BC\bar{E}}]$$

Solution:-

$$X = AB[C(\overline{DE} + \overline{AB}) + \overline{BC\bar{E}}]$$



Date: 18

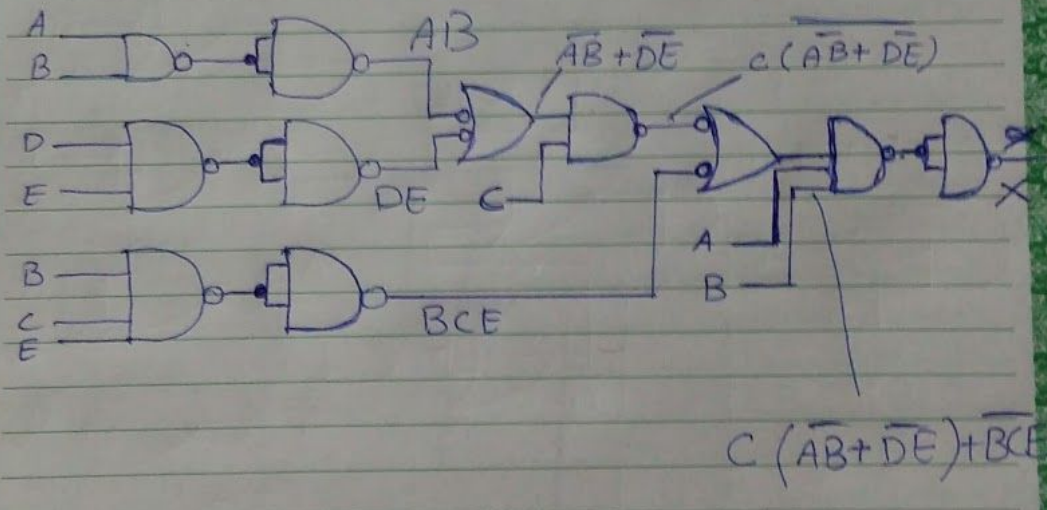
"Question no 17"

Repeat Q17 using only NAND Gates.

$$X = AB[C(\overline{DE} + \overline{AB}) + \overline{BCE}]$$

Solution:-

$$X = AB[C(\overline{DE} + \overline{AB}) + \overline{BCE}]$$



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"Question no 18"

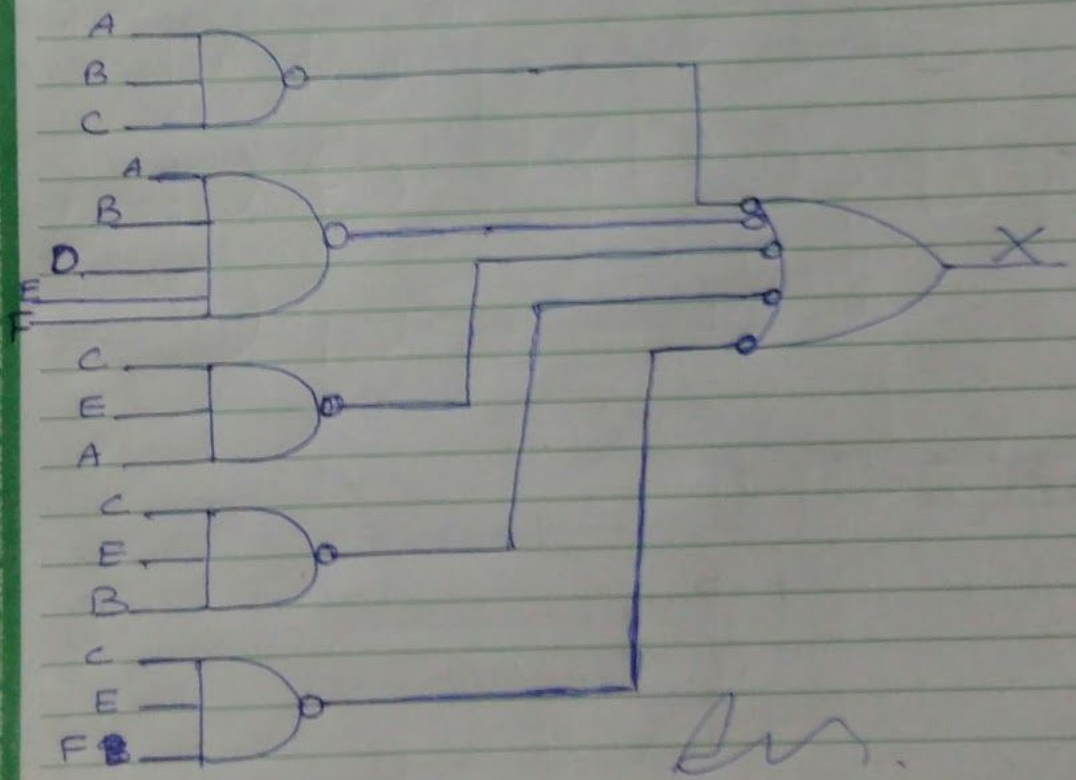
Implement the function in Q5 by using only NAND gates.

$X = ABC(D+E+F)+AC(C+D+E)$

Solution:-

$X = ABC(D+E+F)+AC(C+D+E)$

$= ABC + ABCDEF + CEA + CEB + CEF$



Date: _____ 20

"Question no 19"

Implement the function in Q6 using only NAND gates.

$X = B(C\bar{D}E + \bar{E}FG)(A\bar{B}+C)$

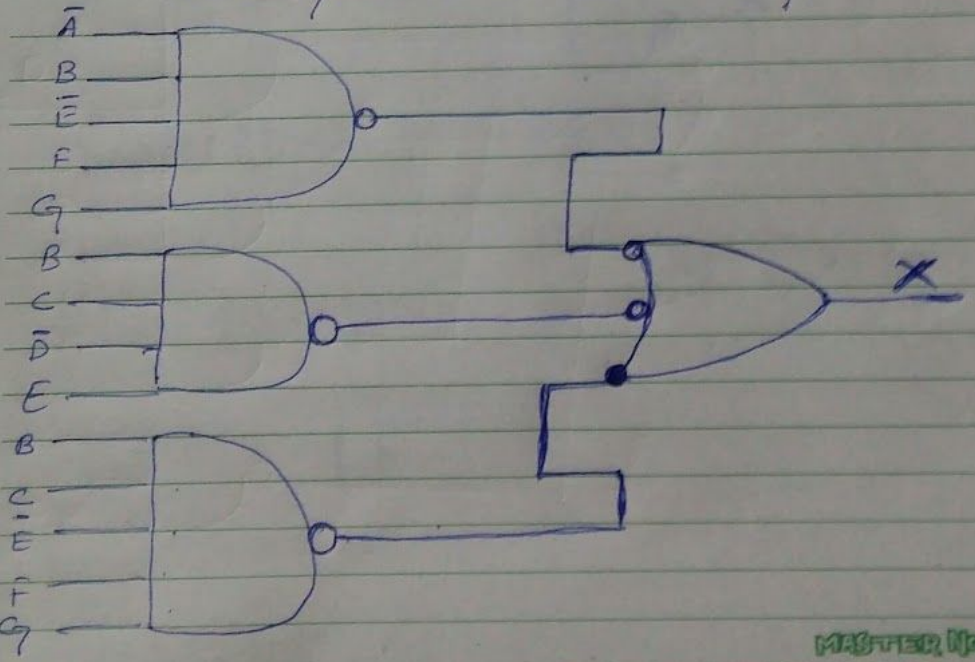
Solution:

$X = B(C\bar{D}E + \bar{E}FG)(A\bar{B}+C)\,B(\bar{C}DE+\bar{E}FG)(\bar{A}+\bar{B}+C)$

$= B(\bar{A}C\bar{D}E + \bar{A}\bar{E}FG + \bar{B}C\bar{D}E + \bar{B}\bar{E}FG + C\bar{D}E + C\bar{E}FG$

$= \bar{A}B\bar{E}FG + B\bar{B}\bar{E}FG + BC\bar{D}E + BC\bar{E}FG$

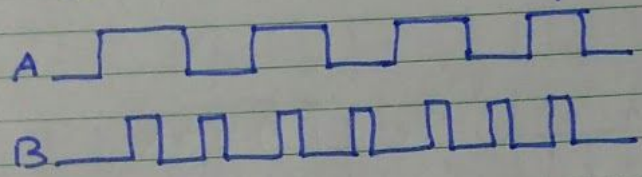
$= \bar{A}BE\bar{F}G + BC\bar{D}E + BC\bar{E}FG$

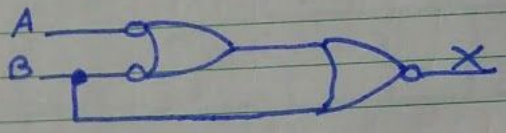


Date: 21

"Question no 20"

The output of the logic circuit in fig 04 is and Input waveform passed through an inverter Draw the output waveform.





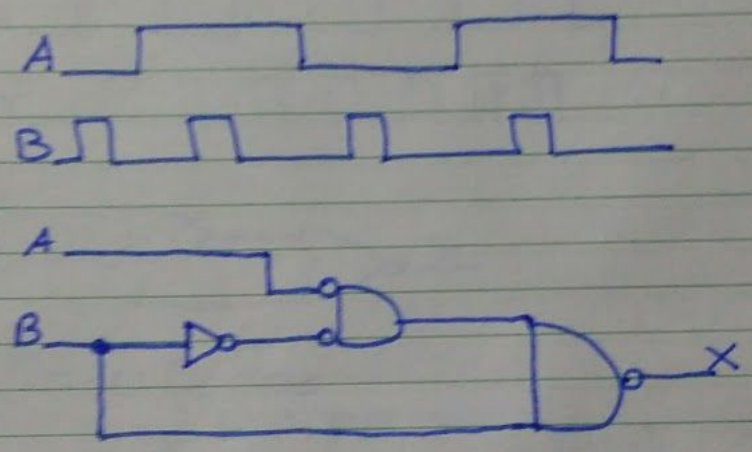
Solution:-

$$X = \bar{A} + \bar{B} + B + AB\bar{B} = 0$$

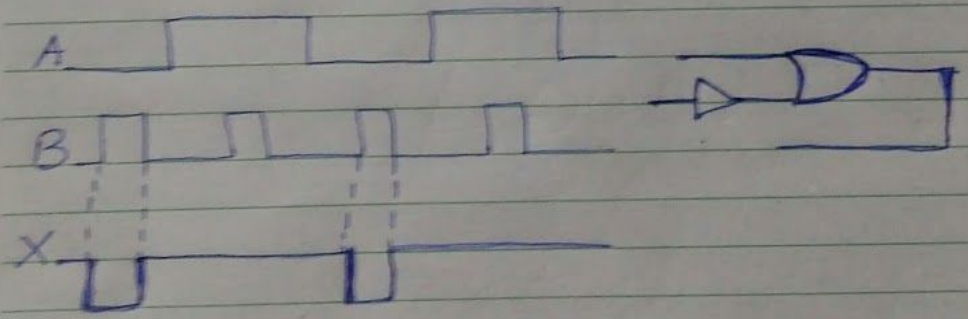
The output X is always "Low".

"Question no 21"

For the Circuit in Figure 05 draw the output waveform in proper relationship to the inputs.



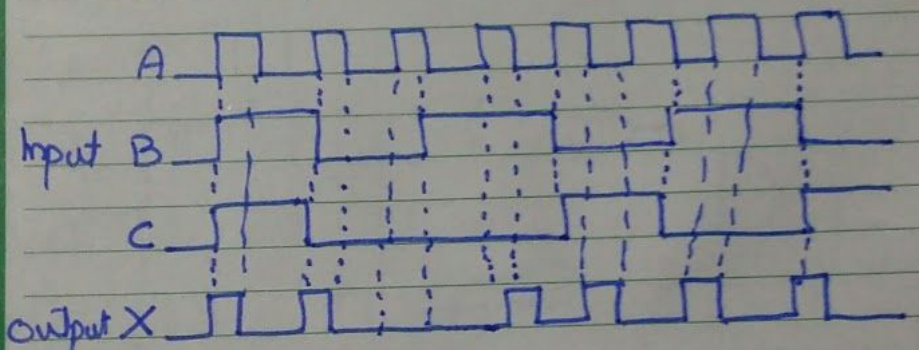
Solution:-



Date: _____ 23

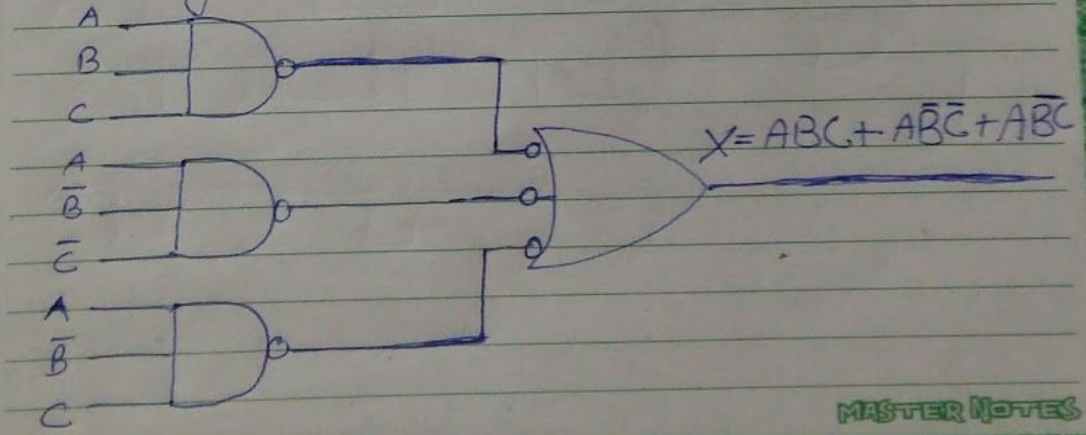
Question no 22"

For the input waveforms in figure 08, what logic circuit will generate the output waveform shown?



Solution:-

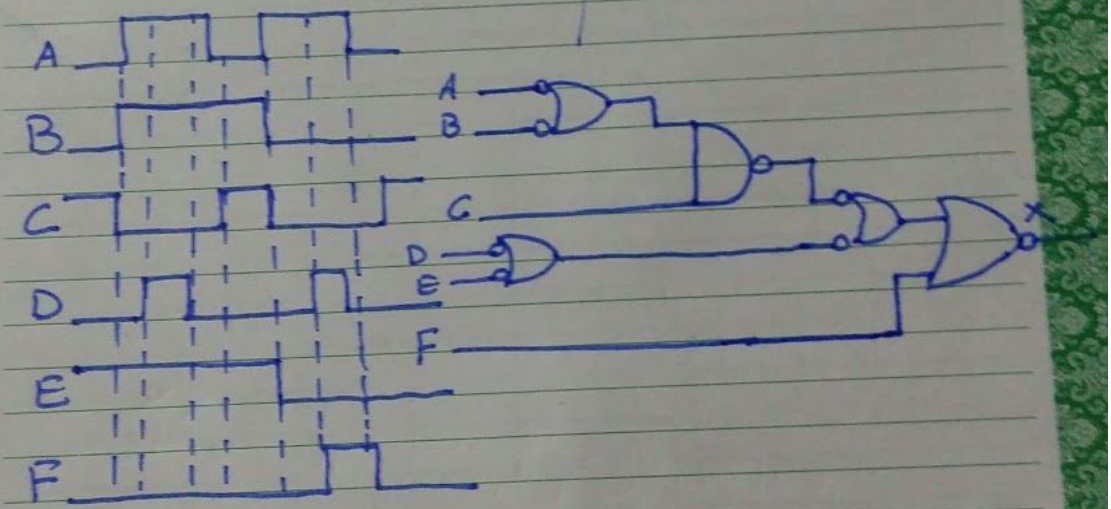
X is "High" when ABC are all High or when A is "High" and B is "Low" and C is "Low" or when A is "High" and B is Low and C is High.



Date: 24

"Question no 23"

For Circuit figure 07, draw the waveform at the numbered points in the proper releationship to each other.

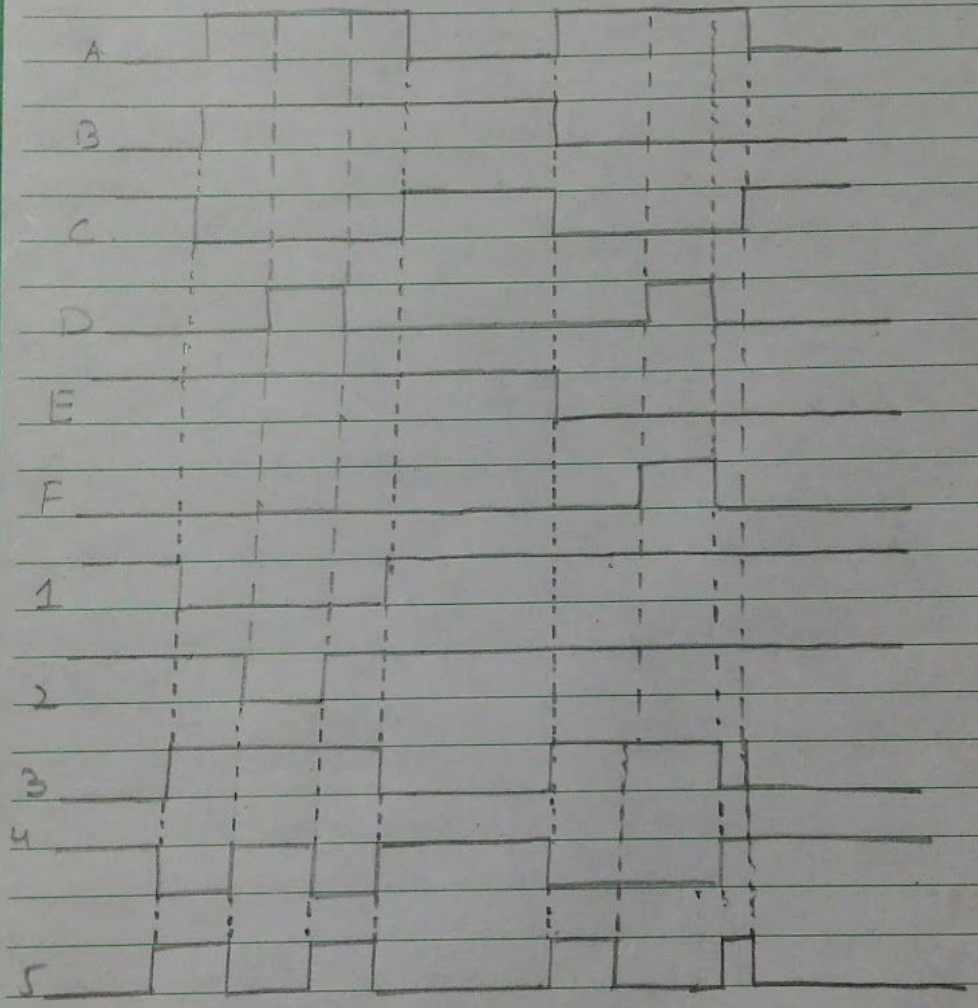


Solution:-

P.T.O

Date: _____

25



End.