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Section: DS

Question : 1 : Truth table:

A	B	C	D	X	Y
0	0	0	0	1	1
0	0	0	1	1	1
0	0	1	0	1	1
0	0	1	1	0	1
0	1	0	0	0	0
0	1	0	1	1	1
0	1	1	0	1	0
0	1	1	1	0	1
1	0	0	0	1	1
1	0	0	1	1	1
1	0	1	0	1	1
1	0	1	1	0	1
1	1	0	0	0	0
1	1	0	1	0	0
1	1	1	0	1	0
1	1	1	1	1	0

For Disease X: Kmap:

AB \ CD	00	01	11	10
00	1	1	3	2
01	4	1	5	6
11	12	13	1	14
10	1	1	9	11

Groups:

0, 1, 8, 9  $\rightarrow B'C'$

2, 6, 10, 14  $\rightarrow C'D'$

1, 5  $\rightarrow A'C'D$

14, 15  $\rightarrow ABC$

$$F_x(A, B, C, D) = B'C' + C'D' + A'C'D + ABC$$

P.T.O

for Disease Y, kmap:

AB \ CD	c'd'	c'D	CD	CD'
A'B'	1 0	1 1	1 3	1 2
A'B	4	1 5	1 7	6
AB	12	13	15	14
AB'	1 8	1 9	1 11	1 10

Groups: 0, 1, 2, 3, 8, 9, 10, 11  $\rightarrow B'$

1, 3, 5, 7  $\rightarrow A'D$

$$\therefore F_y(A, B, C, D) = B' + A'D$$

P.T.O  $\rightarrow$

Question 2:

Truth table:

A	B	C	D	R	S
0	0	0	0	1	1
0	0	0	1	1	1
0	0	1	0	1	1
0	0	1	1	0	1
0	1	0	0	0	0
0	1	0	1	1	1
0	1	1	0	1	0
0	1	1	1	0	1
<del>0</del>	0	0	0	1	1
1	0	0	1	1	1
1	0	1	0	1	1
1	0	1	1	0	1
1	1	0	0	0	0
1	1	0	1	0	0
1	1	1	0	1	0
1	1	1	1	1	0

for Red light: Kmap

	CD	c'D'	c'D	CD	CD'
AB					12
A'B'	1	0	1	3	1
A'B	4		5	7	6
AB		12	13	15	14
AB'	8	1	9	11	10

Groups:

- 0, 1, 8, 9  $\rightarrow B'C'$
- 2, 6, 10, 14  $\rightarrow CD'$
- 1, 5  $\rightarrow A'C'D$
- 14, 15  $\rightarrow ABC$

$$\therefore F_R(A, B, C, D) = B'C' + CD' + A'C'D + ABC$$

P.T.O



for green light: kmap

$\begin{matrix} cD \\ AB \end{matrix}$	$c'D'$	$c'D$	$CD$	$CD'$
$A'B'$	1	1	1	1
$A'B$	1	1	1	1
$AB$				
$AB'$	1	1	1	1

Groups:  $0, 1, 2, 3, 8, 9, 10, 11 \rightarrow B'$   
 $1, 3, 5, 7 \rightarrow A'D$

$$\therefore f_g(A, B, C, D) = B' + A'D$$

P.T.O  $\Rightarrow$

Question: 03

Q	L	D	M	A
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

∴ Minterms of A =  $\sum_m(1, 2, 3, 5, 7, 9, 10, 11, 13)$

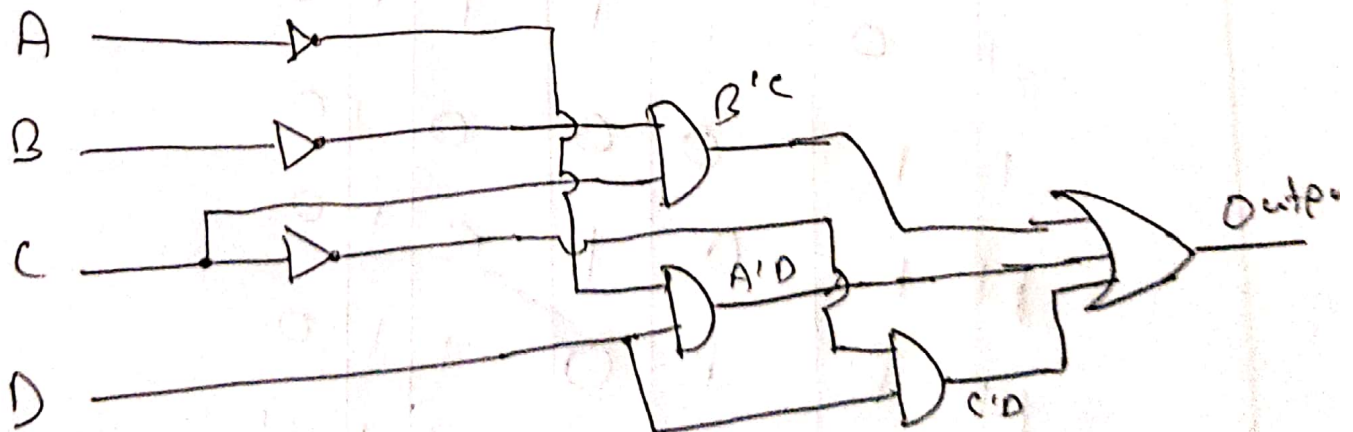
Kmap:

AB \ CD	00	01	11	10
00	0	1	1	1
01	0	1	1	1
11	0	1	1	1
10	0	1	1	1

Groups: 1, 3, 5, 7  $\rightarrow A'D$   
 1, 5, 9, 13  $\rightarrow C'D$   
 2, 3, 10, 11  $\rightarrow B'C$

$$F_A(A, B, C, D) = A'D + C'D + B'C$$

Circuit:



P.T.O  $\rightarrow$



Question 4:

F	H	M	A	Q	T	S
0	0	0	0	0	0	1
0	0	0	1	0	0	1
0	0	1	0	0	0	1
0	0	1	1	0	1	0
0	0	0	0	0	0	1
0	1	0	1	0	1	0
0	1	1	0	0	1	0
0	1	1	1	0	0	1
1	0	0	0	0	0	0
1	0	0	1	0	1	0
1	0	1	0	0	1	0
1	1	0	0	0	1	0
1	1	0	1	0	1	0
1	1	1	0	1	1	0
1	1	1	1	1	1	0

For Q: Kmap

$FH \backslash MA$	$MA'$	$MA$	$MA$	$MA'$
$F'H'$	0	1	3	2
$F'H$	4	5	7	6
$FH$	12	13	1	14
$FH'$	8	9	11	10

$\therefore$  Groups: 14, 15  $\rightarrow FHM$   
 11, 15  $\rightarrow FMA$

$\therefore F_Q(A, B, C, D) \rightarrow FHM + FMA$

P.T.O

For T: kmap.

FH \ MA	M'A' M'A		MA MA'	
	0	1	3	2
F'H'		1		
F'H	4	5	7	6
F'H'	12	13	15	14
F'H	8	9	11	10

Groups: 3, 7, 11, 15  $\rightarrow$  MA.

5, 7, 13, 15  $\rightarrow$  HA.

6, 7, 14, 15  $\rightarrow$  HM.

9, 11, 13, 15  $\rightarrow$  FA.

10, 11, 14, 15  $\rightarrow$  FM.

12, 13, 14, 15  $\rightarrow$  FH.

$$\therefore F(A, B, C, D) = MA + HA + HM + FA + FM + FH.$$

P. P. 05

For G: Kmap:

$\begin{matrix} FH \\ MA \end{matrix}$	$M'A'$	$M'A$	$MA'$	$MA$
$F'H'$	1	1	3	2
$F'H$	4	5	7	6
$FH$	12	13	15	14
$FH'$	8	9	11	10

Groups:

- $0, 1 \rightarrow F'H'M'$
- $0, 2 \rightarrow F'H'A'$
- $0, 4 \rightarrow F'M'A'$
- $0, 8 \rightarrow H'M'A'$

$$\therefore F_G(A, B, C, D) = F'H'M' + F'H'A' + F'M'A' + H'M'A$$

P.T.O.:



Question 5:

$$F(A, B, C, D) = \sum m(0, 2, 8, 10, 14) + \sum d(5, 15)$$

$\begin{matrix} A \\ B \end{matrix}$	$CD$	$\bar{C}\bar{D}$	$\bar{C}D$	$C\bar{D}$
$\bar{A}\bar{B}$	1 <sub>0</sub>	0 <sub>1</sub>	0 <sub>3</sub>	1 <sub>2</sub>
$\bar{A}B$	0 <sub>4</sub>	X <sub>5</sub>	0 <sub>7</sub>	0 <sub>6</sub>
$AB$	0 <sub>12</sub>	0 <sub>13</sub>	X <sub>15</sub>	1 <sub>14</sub>
$A\bar{B}$	1 <sub>8</sub>	0 <sub>9</sub>	0 <sub>11</sub>	1 <sub>10</sub>

Groups : 0, 2, 8, 10  $\rightarrow B'D'$

10, 14  $\rightarrow ACD'$

$\therefore \text{Output} = B'D' + ACD'$

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