

12/11/21 Friday

① Simplify the Boolean function

$$F(w, x, y, z) = \sum (1, 3, 7, 11, 15)$$

Sol:-

$\begin{matrix} yz \\ wx \end{matrix}$	00	01	11	10
00		1	1	
01			1	
11			1	
10			1	

0001-1
0011-3
0111-7
1011-11
1111-15

$$\therefore F(w, x, y, z) = w'x'z + yz$$

Rough

	w	x	yz	
	0	0	0	
	0	0	1	
Group 1 —	(1, 2), (1, 3)			
Group 2 —	(1, 3), (2, 3), (3, 3), (4, 3)			
	0	0	1	
	0	1	1	
	1	1	1	
	1	0	1	
	0	0	0	
	0	1	0	
	1	1	0	
	1	0	0	
	w	x	yz	
				$w'x'z$

Verification

$$w'x'z + yz$$

Simplify

$$w'x'(y+y')z + (w+w')yz$$

$$w'x'yz + w'x'y'z + wyz + w'y z$$

$$\begin{aligned} x \cdot 1 &= x \\ x + x' &= 1 \\ x \cdot (y + y') &= x \cdot y + x \cdot y' \end{aligned}$$

$$w'x'yz + w'x'y'z + w(x+x')yz + w'(x+x')yz$$

$$wx yz + wx' yz + w'x yz + w'x' yz$$

$$w'x'yz + w'x'y'z + wx yz + wx' yz + w'x yz$$

$$0011 + 0001 + 1111 + 1011 + 0111$$

$$\begin{array}{c} \downarrow \\ 3 \end{array} \quad \begin{array}{c} \downarrow \\ 1 \end{array} \quad \begin{array}{c} \downarrow \\ 15 \end{array} \quad \begin{array}{c} \downarrow \\ 11 \end{array} \quad \begin{array}{c} \downarrow \\ 7 \end{array}$$

$$\sum (1, 3, 7, 11, 15)$$

② Simplify $F(w, x, y, z) =$

$$\sum (0, 1, 2, 8, 10, 11, 14, 15)$$

Sol:- $F(w, x, y, z) = \sum (0, 1, 2, 8, 10, 11, 4, 15)$

~~0000~~
~~0001~~
~~0010~~
~~0011~~
~~0100~~
~~0101~~
~~0110~~
~~0111~~
~~1000~~
~~1001~~
~~1010~~
~~1011~~
~~1100~~
~~1101~~
~~1110~~
~~1111~~

$w \backslash yz$	00	01	11	10
00	1	1		1*
01				
11			1	1
10	1*		1	1*

$w'x'y' + wy + x'z'$
 $\swarrow \quad \searrow \quad \downarrow$
 $(1,1) (1,2)$ $(3,3), (4,3)$ $(1,1), (1,4)$
 $(3,4), (4,4)$ $(4,1), (4,4)$

Red $\rightarrow w'x'y'$
 Pink $\rightarrow wy$
 Green $\rightarrow x'z'$

$\therefore F(w, x, y, z) = w'x'y' + wy + x'z'$

$2^0, 2^1, 2^2, 2^3, 2^4$
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 $4 \quad 3 \quad 2 \quad 1$

③ Simplify $F(w, x, y, z) = \sum (0, 1, 4, 5, 8, 9, 12, 13)$

Sol:- $F(w, x, y, z) = \sum (0, 1, 4, 5, 8, 9, 12, 13)$

$w \backslash yz$	00	01	11	10
00	1	1		
01	1	1		
11	1	1		
10	1	1		

~~0000~~
~~0001~~
~~0010~~
~~0011~~
~~0100~~
~~0101~~
~~0110~~
~~0111~~
~~1000~~
~~1001~~
~~1010~~
~~1011~~
~~1100~~
~~1101~~
~~1110~~
~~1111~~

$F(w, x, y, z) = y'$

Rough (1,1)

Rough

$(1,1), (1,4), (4,1), (4,4)$
0 0 0 0
0 0 1 0
1 0 0 0
1 0 1 0

$(1,1) \rightarrow (1,4), (4,1)$
 $(1,4) \rightarrow (1,1), (4,4)$
 $(4,1) \rightarrow (1,1), (4,4)$
 $(4,4) \rightarrow (1,4), (4,1)$