2.16 **(a)** Logical product of all the 3 variable maxterms can be written as,

$$F(a, b, c) = M_7.M_6.M_5.M_4.M_3.M_2.M_1.M_0$$

$$= m_7'.m_6'.m_5'.m_4'.m_3'.m_2'.m_1'.m_0' \qquad \text{because; } mi' = Mi$$

$$= (m_7 + m_6 + m_4 + m_3 + m_2 + m_1 + m_0)'$$

$$= ((a' + a)\, (b'c' + b'c + bc' + bc))'$$

$$= ((b' + b)\, (c' + c))' \qquad \text{because; } a + a' = 1$$

$$= (1)'$$

$$= 0$$

OR

$$= M_7.M_6.M_5.M_4.M_3.M_2.M_1.M_0$$

$$= (a + b + cc')\, (a + b' + cc')\, (a' + b + cc')\, (a' + b' + cc')$$

$$= (a + bb')\, (a' + bb') \qquad \text{because; } cc' = 0 \,\&\, (a + b)\,(a +$$

$$b') = a + bb'$$

$$= aa'$$

$$= 0$$

(b) Logical product of all n variable maxterms can be written as,

$$= \Sigma(Mi\, Mi') \qquad \text{for,} \qquad i = 0, 1, \ldots, (2^n - 1)$$

$$= M_0\, M_0' + M_1\, M_1' + M_2\, M_2' + \ldots\ldots + M_2^{n-1}\, M_2^{n-1'}$$

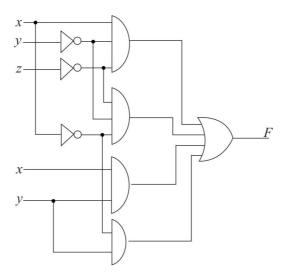$$= 0 + 0 + \ldots + 0 \qquad \text{because,} \qquad X.X' = 0$$

$$= 0$$

2.17 **(c)** $(b + d)(b + d')(a+c) = (aa' + b + cc' + d)(aa' + b + cc' + d')(a + bb' + c + dd')$

$$= \Sigma(6, 7, 12, 13, 14, 15) = \pi(0, 1, 3, 4, 5, 8, 9, 11, 10, 2)$$

2.18 $F = xy'z' + x'y'z' + xy + x'y = xy'z' + x'y'z' + xyz + xyz' + x'yz + x'yz' = \Sigma(0, 2, 3, 4, 6, 7)$

(a)

x	y	z	F
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

(b)

(c) $F = xy'z' + x'y'z' + xy + x'y = y'z' + y = y + z'$

(d)

x	y	z	(a)	(d)
0	0	0	1	1
0	0	1	0	0
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	0	0
1	1	0	1	1
1	1	1	1	1

Hence, (a) = (d).

(e)

Total number of gates is = 2(1 – NOT and 1 – OR)

Total number of gates as per (b) are = 8(3 – NOT, 4 – AND and 1 – OR)

2.22   **(a)** $(u + x'w)(x + u'v) = ux + x'wu'v$

$\rightarrow$ (SOP form)

$= (u + x'wu'v)(x + x'wu'v)$

$= (u + x')(u + w)(u + v)(x + w)(x + u')(x + v) \rightarrow$ (POS form)

(b) $x' + z(x + y')(y + z') = x' + (xz + zy')(y + z') = x' + xyz$

$= x' + yz$ $\rightarrow$ SOP form

$= (x' + y)(x' + z)$ $\rightarrow$ POS form

2.28   **(a)** $y = a(bcd)'e = a(b' + c' + d')e$

$$y = a(b' + c' + d')e = ab \quad + ac \quad + ad$$
$$= \Sigma(\,17,\ 19,\ 21,\ 23,\ 25,\ 27,\ 29)$$

a bcde	y	a bcde	y
0 0000	0	1 0000	0
0 0001	0	**1 0001**	1
0 0010	0	1 0010	0
0 0011	0	**1 0011**	1
0 0100	0	1 0100	0
0 0101	0	**1 0101**	1
0 0110	0	1 0110	0
0 0111	0	**1 0111**	1
	0		0
0 1000	0	1 1000	0
0 1001	0	**1 1001**	1
0 1010	0	1 1010	0
0 1011	0	**1 1011**	1
0 1100	0	1 1100	0
0 1101	0	**1 1101**	1
0 1110	0	1 1110	0
0 1111	0	1 1111	0