

1. a) $F(A, B, C, D) = \sum m(0, 2, 3, 6, 7, 8, 10, 11, 12, 15)$

$F \begin{matrix} \backslash \\ ab \end{matrix} \begin{matrix} cd \end{matrix}$	00	01	11	10
00	1 ⁰	0 ¹	1 ⁵	1 ²
01	0 ⁴	0 ⁵	1 ⁷	1 ⁶
11	1 ¹²	0 ¹³	1 ¹⁵	0 ¹⁴
10	1 ⁸	0 ⁹	1 ¹¹	1 ¹⁰

$\Rightarrow F(A, B, C, D) = ac'd' + a'b'cd' + a'c + cd + ab'c$

b) $F(A, B, C, D) = \sum m(0, 2, 3, 5, 7, 8, 13) + \sum d(1, 6, 12)$

$F \begin{matrix} \backslash \\ ab \end{matrix} \begin{matrix} cd \end{matrix}$	00	01	11	10
00	1 ⁰	d ¹	1 ³	1 ²
01	0 ⁴	1 ⁵	1 ⁷	d ⁶
11	0 ¹²	1 ¹³	0 ¹⁵	0 ¹⁴
10	1 ⁸	0 ⁹	0 ¹¹	0 ¹⁰

coi $d_1 = 1$

$d_6 = 0$

$d_{12} = 1$

$\Rightarrow F(A, B, C, D) = a'b' + a'd + abc' + b'c'd'$



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$$c) F(A, B, C, D) = \sum m(1, 7, 9, 10, 12, 13, 14, 15) + \sum d(4, 5, 8)$$

F ab \ cd	cd			
	00	01	11	10
00	0 ⁰	1 ¹	0 ³	0 ²
01	d ⁴	d ⁵	1 ⁷	0 ⁶
11	1 ¹²	1 ¹³	1 ¹⁵	1 ¹⁴
10	d ⁸	1 ⁹	0 ¹¹	1 ¹⁰

$$\Rightarrow F(A, B, C, D) = c'd + ab + a'bd + acd'$$

$$d) F(A, B, C, D) = \pi M(2, 8, 11, 15) \cdot \pi D(3, 12, 14)$$

F ab \ cd	cd			
	00	01	11	10
00	1 ⁰	1 ¹	d ³	0 ²
01	1 ⁴	1 ⁵	1 ⁷	1 ⁶
11	d ¹²	1 ¹³	0 ¹⁵	d ¹⁴
10	0 ⁸	1 ⁹	0 ¹¹	1 ¹⁰

$$\Rightarrow F(A, B, C, D) = (a+b+c')(a'+c+d)(a'+c'+d')$$

$$e) F(A, B, C, D) = \pi M(0, 2, 6, 11, 13, 15) \cdot \pi D(1, 9, 10, 14)$$

F ab \ cd	cd			
	00	01	11	10
00	0 ⁰	d ¹	1 ³	0 ²
01	1 ⁴	1 ⁵	1 ⁷	0 ⁶
11	1 ¹²	0 ¹³	0 ¹⁵	d ¹⁴
10	1 ⁸	d ⁹	0 ¹¹	d ¹⁰

$$\Rightarrow F(A, B, C, D) = (a+b+d)(c'+d)(a'+d')$$

2.

$$a) F(A, B, C, D, E) = \sum m(0, 5, 7, 9, 11, 13, 15, 18, 19, 22, 24, 25, 27, 28, 29, 31)$$

F		cde							
ab	00	000	001	011	010	110	111	101	100
	00	1 ⁰	0 ¹	0 ³	0 ²	0 ⁶	1 ⁷	1 ⁵	0 ⁴
	01	0 ⁸	1 ⁹	1 ¹¹	0 ¹⁰	0 ¹⁴	1 ¹⁵	1 ¹³	0 ¹²
	11	1 ²⁴	1 ²⁵	1 ²⁷	0 ²⁶	0 ³⁰	1 ³¹	1 ²⁹	1 ²⁸
	10	0 ¹⁶	0 ¹⁷	1 ¹⁹	1 ¹⁸	1 ²²	0 ²³	0 ²¹	0 ²⁰

$$\Rightarrow F(A, B, C, D, E) = ab'c'd'e' + \cancel{abcd} + bc'e + ac'de + ab'de' + a'ce + bce + abd'$$

$$b) F(A, B, C, D, E) = \sum m(1, 3, 10, 14, 21, 27, 28, 30) + \sum d(5, 12, 17, 18)$$

F		cde							
ab	00	000	001	011	010	110	111	101	100
	00	0 ⁰	1 ¹	1 ³	0 ²	0 ⁶	0 ⁷	d ⁵	0 ⁴
	01	0 ⁸	0 ⁹	0 ¹¹	1 ¹⁰	1 ¹⁴	0 ¹⁵	0 ¹³	d ¹²
	11	0 ²⁴	0 ²⁵	1 ²⁷	0 ²⁶	1 ³⁰	0 ³¹	0 ²⁹	1 ²⁸
	10	0 ¹⁶	d ¹⁷	d ¹⁹	0 ¹⁸	0 ²²	0 ²³	1 ²¹	0 ²⁰

$$\Rightarrow F(A, B, C, D, E) = b'c'e + ac'de + a'bde' + bcd'e' + b'cd'e + bcd'e'$$