Q-M for multi-output fns:-

(1) Identify the PI for individual outputs and for their products.

eg: 2 fns: $f_1, f_2 \Rightarrow$ PI for $f_1, f_2, f_1 \cdot f_2$

3 fns: $f_1, f_2, f_3 \Rightarrow$ PI for $f_1, f_2, f_3, f_1 \cdot f_2, f_1 \cdot f_3, f_2 \cdot f_3$ and $f_1 \cdot f_2 \cdot f_3$.

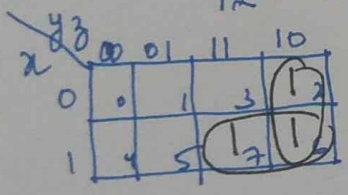
(2) Obtain Augmented PI chart & identify Essential PI for individual fns. Then use dominated/dominating rows/cols or branching method to reduce the table if needed (If objective is to minimize the no. of gates in multi-outputs ckt implementation).

(3) If secondary objective is to minimize the interconnections, then removing dominated rows is not allowed as it may eliminate sol^n which has fewer interconnections.

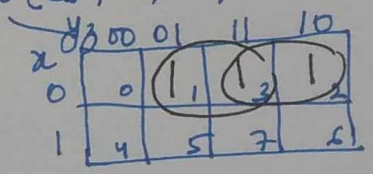
Consider 2 fns f_1 & f_2. Use QM method to implement ckt.

$f_1 = \Sigma m(2,6,7)$

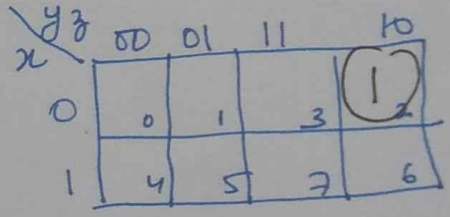
$f_2 = \Sigma m(1,2,3)$



$f_1 = xy + y\bar{z}$



$f_2 = \bar{x}y + \bar{x}z$



$f_1 \cdot f_2 = \bar{x}y\bar{z}$

Augmented PI chart:

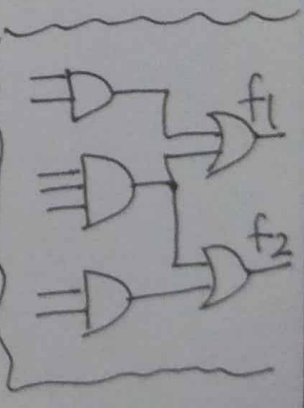
Fn	PI	f_1: 2	6	7	f_2: 1	2	3
f_1	A = xy		X	(X)			
	B = $y\bar{z}$	X	X				
f_2	C = $\bar{x}y$					X	X
	D = $\bar{x}z$				(X)		X
$f_1 \cdot f_2$	E = $\bar{x}y\bar{z}$	X				X	

A & D are Essential PI.

Reduced PI chart:

Fn	PI	f_1 (2)	f_2 (2)
f_1	B = $y\bar{z}$	X	
f_2	C = $\bar{x}y$		X
$f_1 \cdot f_2$	E = $\bar{x}y\bar{z}$	X	X

$\therefore$ ckt will have 3 terms xy, $\bar{x}z$ and $\bar{x}y\bar{z}$



Multiple switching fn minimization criterion:

① Each minimized fn should have as many terms in common with those in other minimized fns as possible.

② Each fn should have min. no. of product terms (SOP) or sum terms (for POS).

→ use single PI table (Augmented PI chart) by considering all fns together, using a term Tag.

$f_1(x_1, x_2, x_3, x_4) = \Sigma m(1, 2, 3, 5, 7, 8, 9, 12, 14)$

$f_2(x_1, x_2, x_3, x_4) = \Sigma m(0, 1, 2, 3, 4, 6, 8, 9, 10, 11)$

$f_3(x_1, x_2, x_3, x_4) = \Sigma m(1, 3, 5, 7, 8, 9, 12, 13, 14, 15)$

Index	Decimal no.	Binary	f_1	f_2	f_3
	0	0000		1	✓
0			0		
	1	0001	1	1	✓
1					
	2	0010	1	1	✓
	4	0100	0	1	✓
	8	1000	1	1	✓
	3	0011	1	1	✓
2					
	5	0101	1	0	✓
	6	0110	0	1	✓
	9	1001	1	1	✓
	10	1010	0	1	✓
	12	1100	1	0	✓
	7	0111	1	0	✓
3					
	11	1011	0	1	✓
	13	1101	0	0	✓
	14	1110	1	0	✓
4	15	1111	0	0	✓

Tag

Decimal nos	Pairset Reduction (8 4 2 1)	f1 f2 f3	
0,1 (1)	0 0 0 _	0 1 0	✓
0,2 (2)	0 0 _ 0	0 1 0	✓
0,4 (4)	0 _ 0 0	0 1 0	
0,8 (8)	_ 0 0 0	0 1 0	✓
1,3 (2)	0 0 _ 1	1 1 1	A
1,5 (4)	0 _ 0 1	1 0 1	✓
1,9 (8)	_ 0 0 1	1 1 1	B ⇒
2,3 (1)	0 0 1 _	1 1 0	C
2,6 (4)	0 _ 1 0	0 1 0	✓
2,10 (8)	_ 0 1 0	1 0 0	✓
4,5 (1)	0 1 0 _	0 0 0	
4,6 (2)	0 1 _ 0	0 1 0	✓
4,12 (8)	_ 1 0 0	0 0 0	
8,9 (1)	1 0 0 _	1 1 1	D
8,10 (2)	1 0 _ 0	0 1 0	✓
8,12 (4)	1 _ 0 0	1 0 1	E
3,7 (4)	0 _ 1 1	1 0 1	✓
3,11 (8)	_ 0 1 1	0 1 0	✓
5,7 (2)	0 1 _ 1	1 0 1	✓
~~6,7 (1)~~	~~0 1 1 _~~		
5,13 (8)	_ 1 0 1	0 0 1	✓
6,7 (1)	0 1 1 _	0 0 0	
6,14 (8)	_ 1 1 0	0 0 0	
9,11 (2)	1 0 _ 1	0 1 0	✓
9,13 (4)	1 _ 0 1	0 0 1	✓
10,11 (1)	1 0 1 _	0 1 0	✓
10,14 (4)	1 _ 1 0	0 0 0	
12,13 (1)	1 1 0 _	0 0 1	✓
12,14 (2)	1 1 _ 0	1 0 1	F
7,15 (8)	_ 1 1 1	0 0 1	✓
11,15 (4)	1 _ 1 1	0 0 0	
13,15 (2)	1 1 _ 1	0 0 1	✓
14,15 (1)	1 1 1 _	0 0 1	✓

Tag

Red groups doesn't exist for any fn. are so that they are not considered for next reduction.

Quads

	f1 f2 f3	
0,1,2,3 (1,2)	0 1 0	✓
0,1,8,9 (1,8)	0 1 0	✓
0,2,4,6 (2,4)	0 1 0	G
0,2,8,10 (2,8)	0 1 0	✓
1,3,5,7 (2,4)	1 0 1	H
1,3,9,11 (2,8)	0 1 0	✓
1,5,9,13 (4,8)	0 0 1	I
2,3,10,11 (1,8)	0 1 0	✓
8,9,10,11 (1,2)	0 1 0	✓
8,9,12,13 (1,4)	0 0 1	J
5,7,13,15 (2,8)	0 0 1	K
12,13,14,15 (1,2)	0 0 1	L

Tag

Octet

0,1,2,3,8,9,10,11 (1,2,8)	M

Tag

f1	f2	f3
0	1	0

PI are

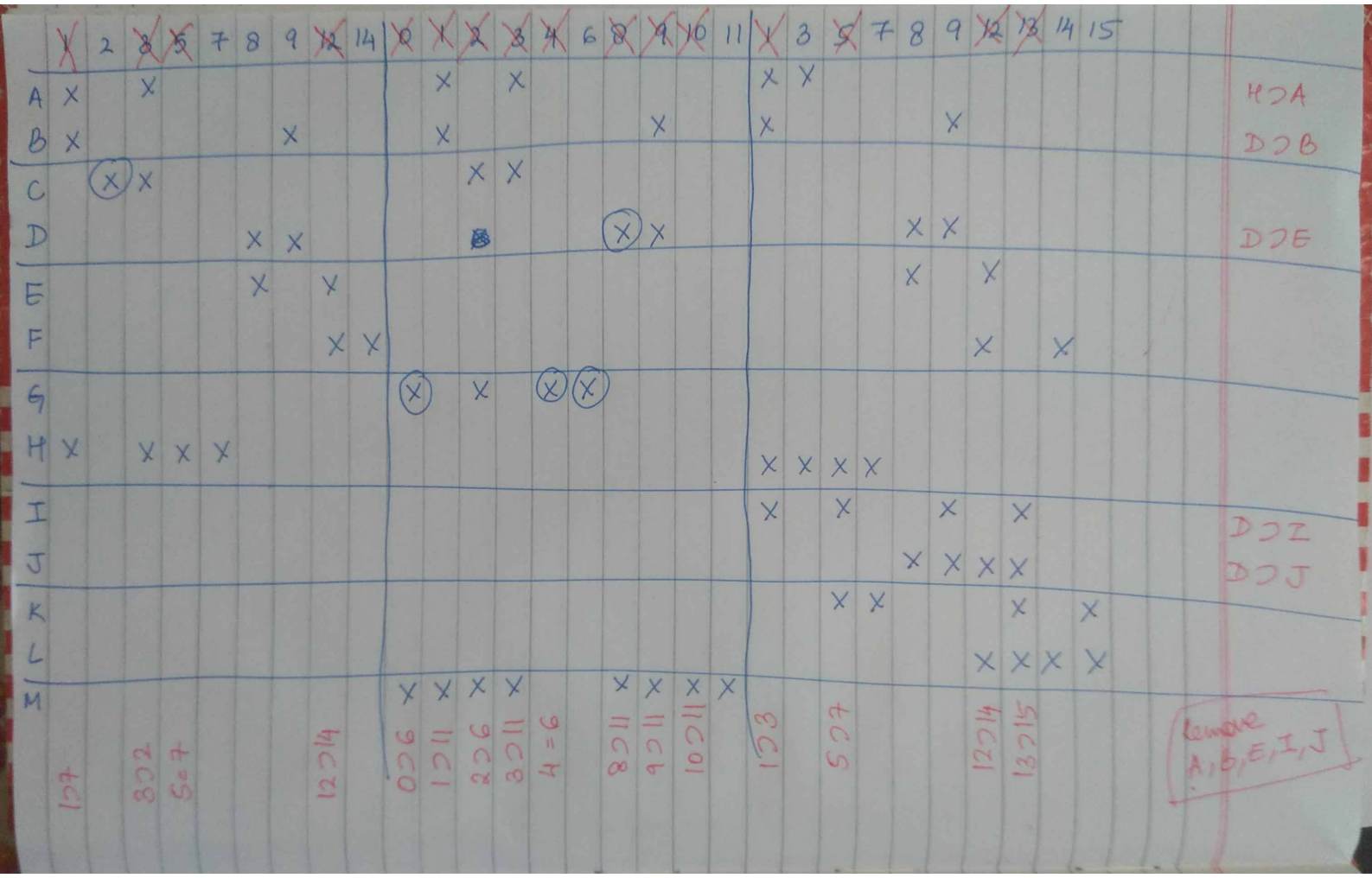
A, B, C, D, E, F, G, H, I, J, K, L, M.

		f_3	
		14	15
LOF	F	X	
LOK	K		X
	L	X	X

$f_1 = C + D + F + H$

$f_2 = G + M$

$f_3 = D + H + L$.


H ⊃ A
D ⊃ B
D ⊃ E
D ⊃ I
D ⊃ J
Remove A, B, E, I, J