QM method:
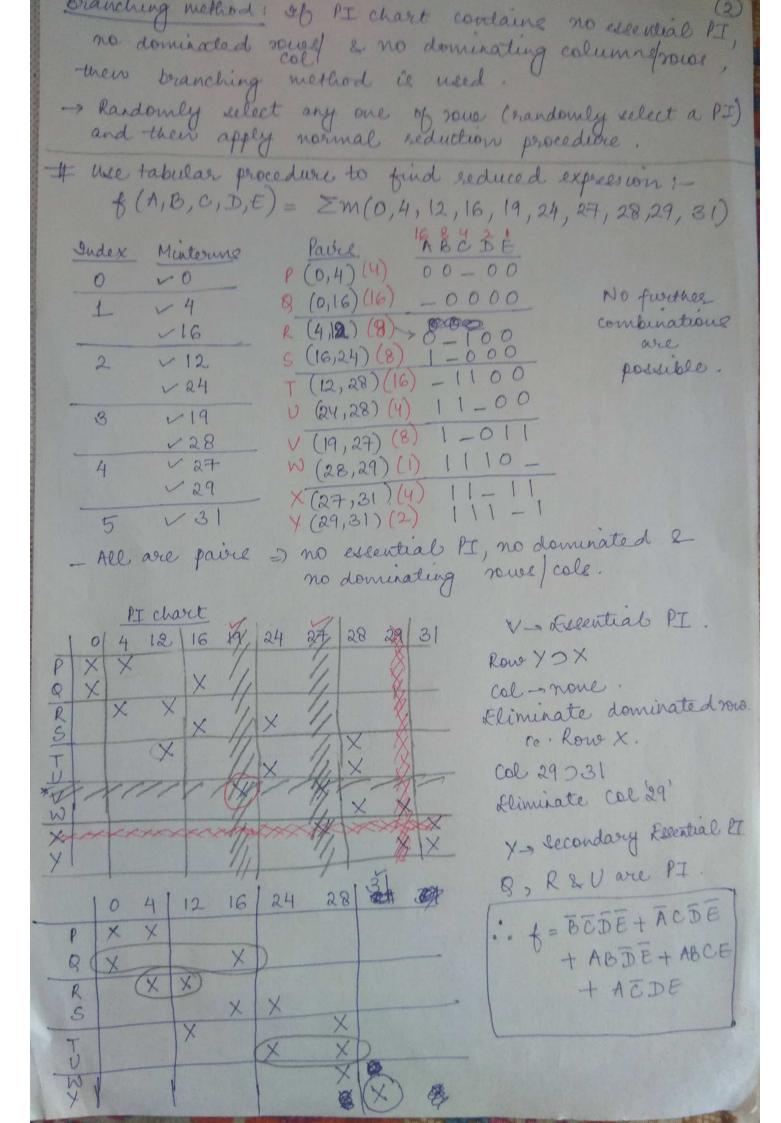
PI chart → for simple fns but for complex fns, it has to be reduced further to get the reduced PI chart & reduced exp.

① Two rows/col are said to be equal if them have exactly X's in same cols/rows. $(I = J)$

⊛ A **col** 'I' in a PI chart is said to **dominate** another col 'J' if col 'I' has every 'X' in every row in which col 'J' has a X.

✱ If col 'I' dominates col 'J', then col 'I' can be deleted from chart without affecting search for minimal expression (remove dominating columns)

✱ If row 'I' is said to dominate another row 'J' if row 'I' has a X in every col in which row 'J' has a X.

✱ If row 'I' dominates row 'J', then row 'J' can be deleted from chart, without affecting the search for minimal expression (remove dominated rows).

Procedure:
① Determine Essential PI from PI chart.
② Form Reduced PI chart by removing EPI, and columns covered by them.
③ Remove dominated rows & dominating columns.
④ Identify secondary EPI from reduced chart and continue process until ane is obtained.

eg: <u>Dominated & dominating rows & columns</u>

	3	4	9	11	12	13
A	X					
B		X	X		X	X
C	X			X		
D					X	X
E		X		X		

col'12' = col'13'
↗ equal columns

Row 'A' is dominated by row 'C' (Dominating Row)
Dominated Row

col '9' is dominated by col '4' & '12' & '13' (Dominating columns)
Dominated column

Branching method: If PI chart contains no essential PI, no dominated row/col & no dominating column/row, then branching method is used.

→ Randomly select any one of rows (randomly select a PI) and then apply normal reduction procedure.

Use tabular procedure to find reduced expression :-

$$f(A,B,C,D,E) = \Sigma m(0,4,12,16,19,24,27,28,29,31)$$

Index	Minterms	Pairs	A B C D E
0	✓ 0	P (0,4) (4)	0 0 – 0 0
1	✓ 4	Q (0,16) (16)	– 0 0 0 0
	✓ 16	R (4,12) (8) →	0 – 1 0 0
2	✓ 12	S (16,24) (8)	1 – 0 0 0
	✓ 24	T (12,28) (16)	– 1 1 0 0
3	✓ 19	U (24,28) (4)	1 1 – 0 0
	✓ 28	V (19,27) (8)	1 – 0 1 1
4	✓ 27	W (28,29) (1)	1 1 1 0 –
	✓ 29	X (27,31) (4)	1 1 – 1 1
5	✓ 31	Y (29,31) (2)	1 1 1 – 1

(header weights above ABCDE: 16 8 4 2 1)

No further combinations are possible.

– All are pairs ⇒ no essential PI, no dominated & no dominating rows/cols.

PI chart

V → Essential PI.

Row Y ⊃ X

Col → none.

Eliminate dominated row
i.e. Row X.

Col 29 ⊃ 31
Eliminate col '29'

X → Secondary Essential PI.

Q, R & U are PI.

$$\therefore f = \bar{B}\bar{C}\bar{D}\bar{E} + \bar{A}C\bar{D}\bar{E} + AB\bar{D}\bar{E} + ABCE + A\bar{C}DE$$

Branching method

$f = f(A,B,C,D) = \Sigma m(2,3,4,6,9,11,12,13)$

Index	Minterms
1	~~2~~ 4 ~~1~~
2	~~8~~ 3
	6
	9
	12
3	11
	13

Pairs		A B C D
P	2,3 (1)	0 0 1 —
Q	2,6 (4)	0 — 1 0
R	4,6 (2)	0 1 — 0
S	4,12 (8)	— 1 0 0
T	3,11 (8)	— 0 1 1
U	9,11 (2)	1 0 — 1
V	9,13 (4)	1 — 0 1
W	12,13 (1)	1 1 0 —

PI chart

	2	3	4	6	9	11	12	13
P	X	X						
Q	X			X				
R			X	X				
S			X				X	
T		X				X		
U					X	X		
V					X			X
W							X	X

No essential PI

No dominating rows/col

No dominated rows/col

So, Branching method is used.

Select any minterms, randomly, say '2'.
'2' is covered by row 'P' & 'Q'. Randomly select 'P'.
Remove row 'P' & minterms covered by it (ie. 2 & 3)
UJT& Row 'R' dominates row 'Q'. → Remove dominated row (Q)&T
col 'A' dominates col '6'. → Remove dominating col (4)&9

Reduced PI chart

	3	4 ✓	6 ✓	9	12 ✓	13	11 ✓
*R		X	Ⓧ				
S		X			X		
*U				X			Ⓧ
W				X	X	X	

$$f = P + R + \cancel{} \; U + W$$

$$= \overline{A}\,\overline{B}C + \overline{A}B\overline{D} +$$

$$\overline{A}\overline{B}D + AB\overline{C} +$$

Secondary Essential PI

are R & U.

Minterms '12', & '13'
can be covered by W