

K-Maps (6-Var reduction)

①

$F = \sum m(6, 9, 13, 18, 19, 25, 27, 29, 31) + d(2, 3, 11, 15, 17, 24, 28)$

BC \ DE	00	01	11	10
00	0	1	X ₃	X ₂
01	4	5		1
11	12	13	X ₁₅	14
10	8	9	X ₁₁	10

A=0

BC \ DE	00	01	11	10
00	16	X ₁₇	1 ₁₉	1 ₁₈
01	20	21	23	22
11	X ₂₈	1 ₂₉	1 ₃₁	30
10	X ₂₄	1 ₂₅	1 ₂₇	26

A=1

① Grouping of Octet (9, 11, 13, 15, 25, 27, 29, 31)

	A	B	C	D	E
9 →	0	0	0	1	1
11 →	0	0	1	1	1
13 →	0	1	0	1	1
15 →	0	1	1	1	1
25 →	1	1	0	0	1
27 →	1	1	0	1	1
29 →	1	1	1	0	1
31 →	1	1	1	1	1

→ BE (3 vars are reduced)
as $8 = 2^3$

16, 8, 4, 2, 1

② Quad (2, 3, 18, 19) →

	A	B	C	D	E
2 →	0	0	0	1	0
3 →	0	0	0	1	1
18 →	1	0	0	1	0
19 →	1	0	0	1	1

→ $\overline{B}\overline{C}D$ (2 vars are reduced)
as $4 = 2^2$

③ Pair (2, 6) →

	A	B	C	D	E
2 →	0	0	0	1	0
6 →	0	0	1	1	0

→ $\overline{A}\overline{B}D\overline{E}$ (1 var is reduced)
as $2 = 2^1$

∴ Answer is :

$F = BE + \overline{B}\overline{C}D + \overline{A}\overline{B}D\overline{E}$

Multi-Output Fns :

In addition to multi-outputs, we draw an additional K-map (Shared K-map):

$$\# f_1 = \sum m(1, 2, 3, 6, 8, 12, 14, 15)$$

$$f_2 = \prod M(0, 4, 9, 10, 11, 14, 15) = \sum m(1, 2, 3, 5, 6, 7, 8, 12, 13)$$

→ Need to keep multi-outputs in same form (both minterms or both maxterms).

AB \ CD	00	01	11	10
00	0	1 ₁	1 ₃	1 ₂
01	4	5	7	6
11	1 ₁₂	1 ₁₃	1 ₁₅	1 ₁₄
10	8	9	11	10

f_1

Pair of (8,12) = $\begin{matrix} 1000 \\ 1100 \end{matrix} \rightarrow A\bar{C}\bar{D}$

(1,3) $\Rightarrow \bar{A}\bar{B}D$

(2,6) $\Rightarrow \bar{A}C\bar{D}$

(14,15) $\Rightarrow ABC$

$$f_1 = A\bar{C}\bar{D} + \bar{A}C\bar{D} + \bar{A}\bar{B}D + ABC$$

AB \ CD	00	01	11	10
00	0	1 ₁	1 ₃	1 ₂
01	4	5	7	6
11	1 ₁₂	1 ₁₃	1 ₁₅	1 ₁₄
10	8	9	11	10

$f_2 \leftarrow 2 \text{ ways} \rightarrow f_2$

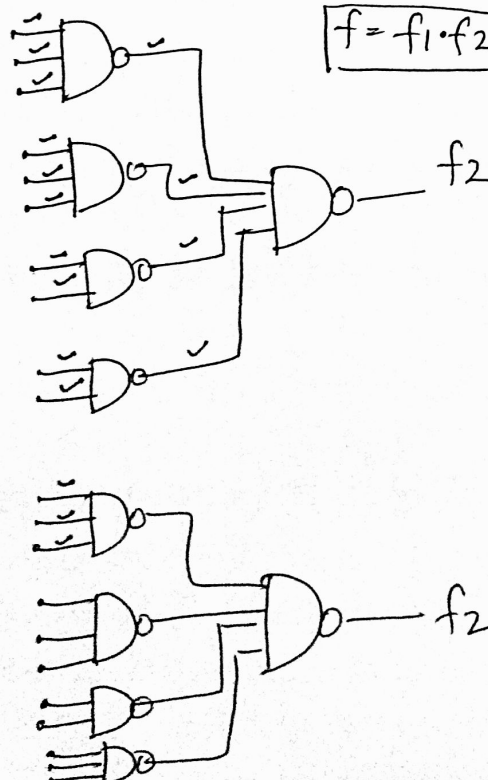
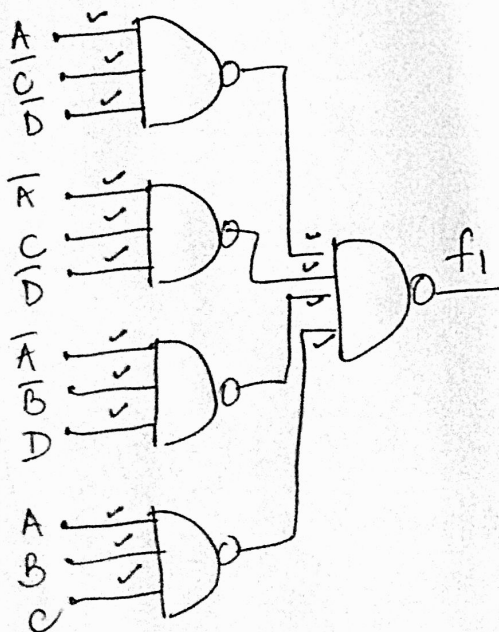
$$f_2 = A\bar{C}\bar{D} + B\bar{C}D + \bar{A}D + \bar{A}C$$

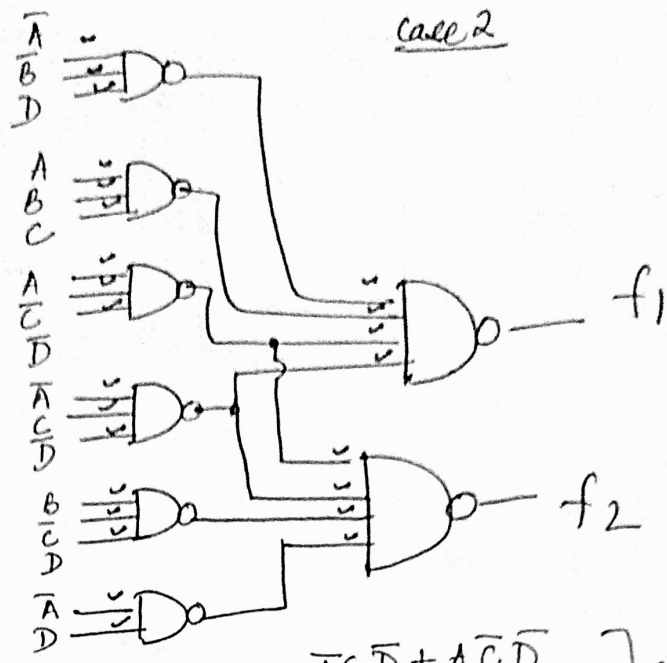
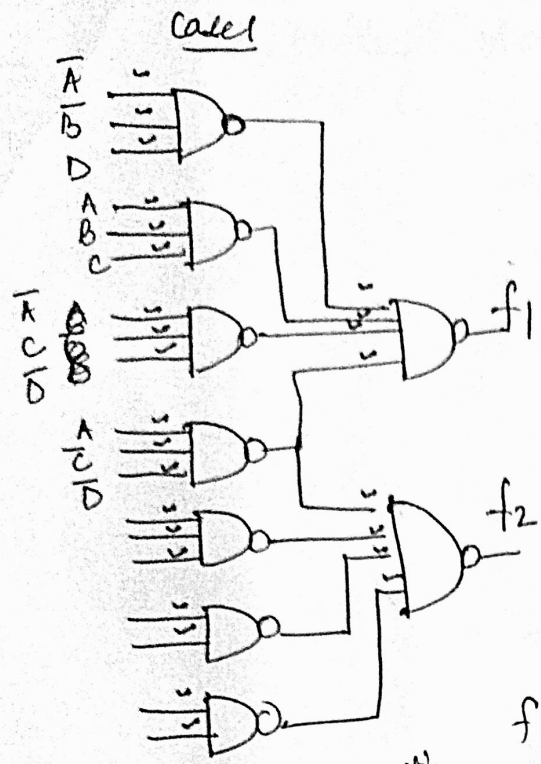
or

$$f_2 = A\bar{C}\bar{D} + B\bar{C}D + \bar{A}D + \bar{A}C\bar{D}$$

AB \ CD	00	01	11	10
00	0	1 ₁	1 ₃	1 ₂
01	4	5	7	6
11	1 ₁₂	1 ₁₃	1 ₁₅	1 ₁₄
10	8	9	11	10

$f = f_1 \cdot f_2$ Shared K-map





$$f_1 = \bar{A}\bar{B}D + ABC + \bar{A}\bar{C}\bar{D} + \bar{A}\bar{C}\bar{D} \quad \text{I/P's} \quad \text{Case 2.}$$

Minimised ckt

$$f_2 = \bar{A}\bar{C}\bar{D} + \bar{A}\bar{C}\bar{D} + \bar{B}\bar{C}\bar{D} + \bar{A}D$$

Minterms/Maxterms + don't cases

Incompletely specified fns:

f_1	f_2	$f = f_1 \cdot f_2$
0	0	0
0	1	0
1	0	0
0	X	0
X	0	0
1	X	1
X	1	1
1	1	1
X	X	X

$f_1 = \sum m(0, 2, 6, 10, 11, 12, 13) + d(3, 4, 5, 14, 15)$

$f_2 = \sum m(1, 2, 6, 7, 8, 13, 14, 15) + d(3, 5, 12)$

$f = f_1 \cdot f_2$

$= \sum m(2, 6, 12, 13, 14, 15) + d(3, 5)$

=

AB \ CD	00	01	11	10
00	1 ₀	1	X ₃	1 ₂
01	X ₄	X ₅	1	1 ₆
11	1 ₇	1 ₈	X ₁₅	X ₁₄
10	1	1	1	1

f_1

AB \ CD	00	01	11	10
00		1	X	1
01		X	1	1
11	X	1	1	1
10	1			

f_2

AB \ CD	00	01	11	10
00			X	1
01		X		1
11	1	1	1	1
10				

f

$$f_1 = \bar{A}\bar{D} + \bar{B}C + AB \quad (\bar{A}C\bar{D} \text{ is not considered as it can be formed into bigger gp})$$

$$f_2 = A\bar{C}\bar{D} + \bar{A}D + \bar{A}C + AB$$

$$f = AB + \bar{A}C\bar{D}$$

Draw ckt for fns f_1 & f_2 .