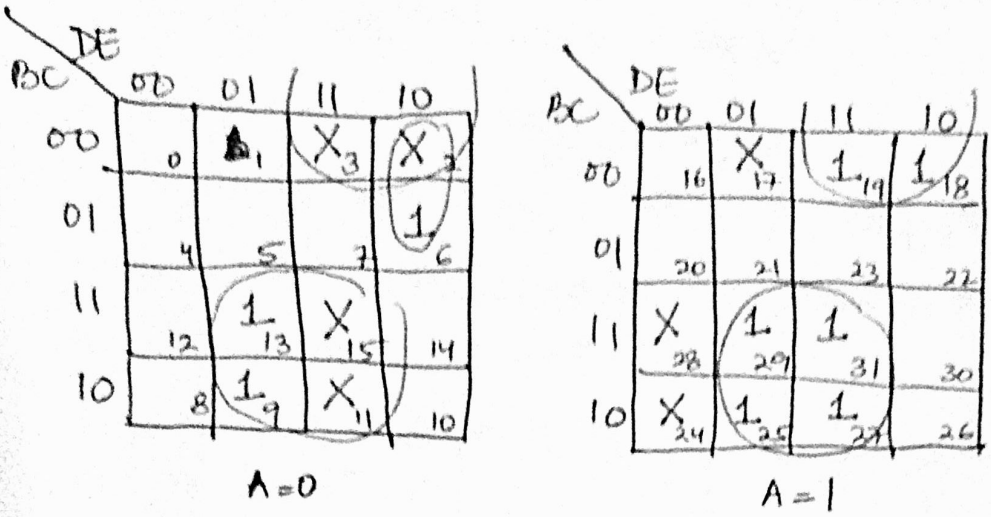
K-Maps (6-var reduction)

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



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

16 8 4 2 1

	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 var's are reduced as $8 = 2^{3}$)

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

→ $\bar{B}\bar{C}D$ (2 var's 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

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

∴ Answer is:

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

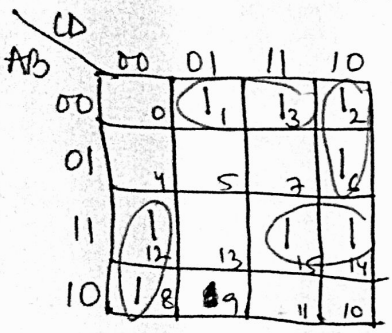
Multi-Output fns:

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

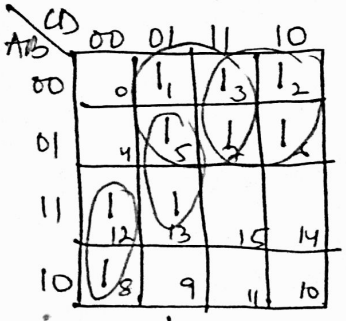
$f_1 = \Sigma m(1,2,3,6,8,12,14,15)$

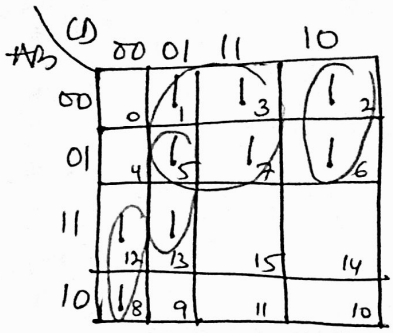
$f_2 = \Pi M(0,4,9,10,11,14,15) = \Sigma m(1,2,3,5,6,7,8,12,13)$

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



f_1





f_2 ← 2 ways → f_2

Pairs of (8,12) = $\overline{1}000$, $11\overline{00}$ → $A\bar{C}\bar{D}$

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

or

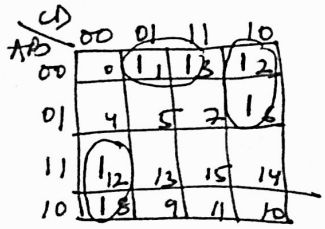
$f_2 = A\bar{C}\bar{D} + B\bar{C}D + \bar{A}D + \bar{A}C\bar{D}$

(1,3) ⇒ $\bar{A}\bar{B}D$

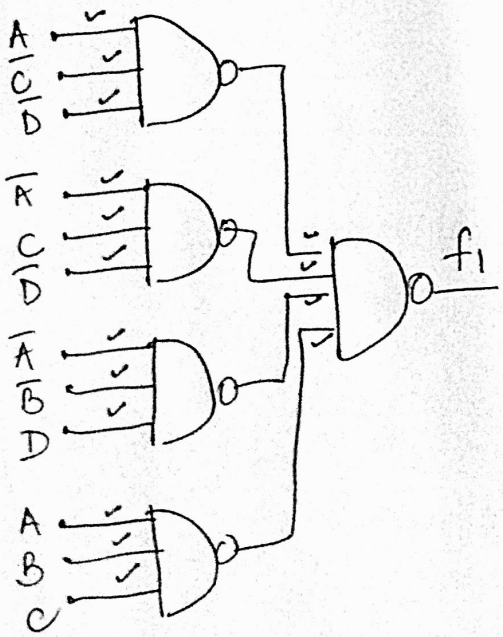
(2,6) ⇒ $\bar{A}C\bar{D}$

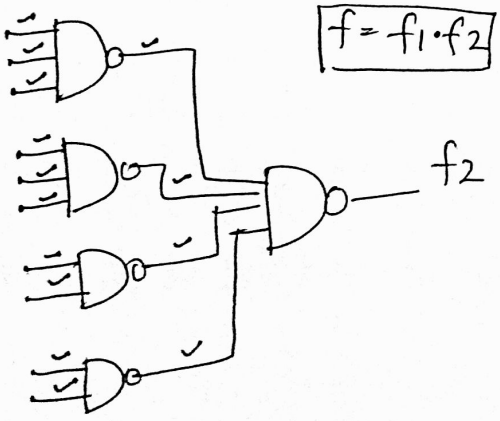
(14,15) ⇒ ABC

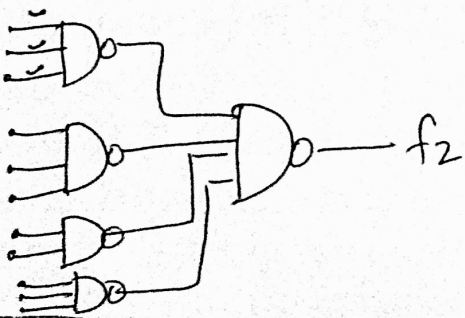
$f_1 = A\bar{C}\bar{D} + \bar{A}C\bar{D} + \bar{A}\bar{B}D + ABC$



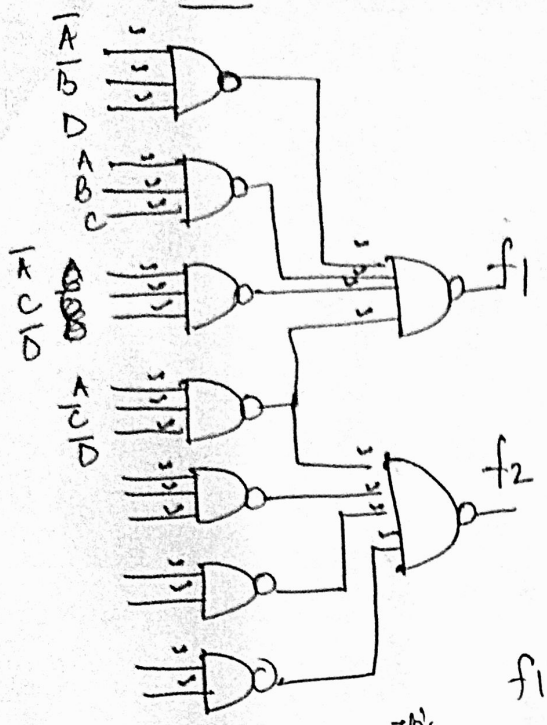
$f = f_1 \cdot f_2$ Shared K-map





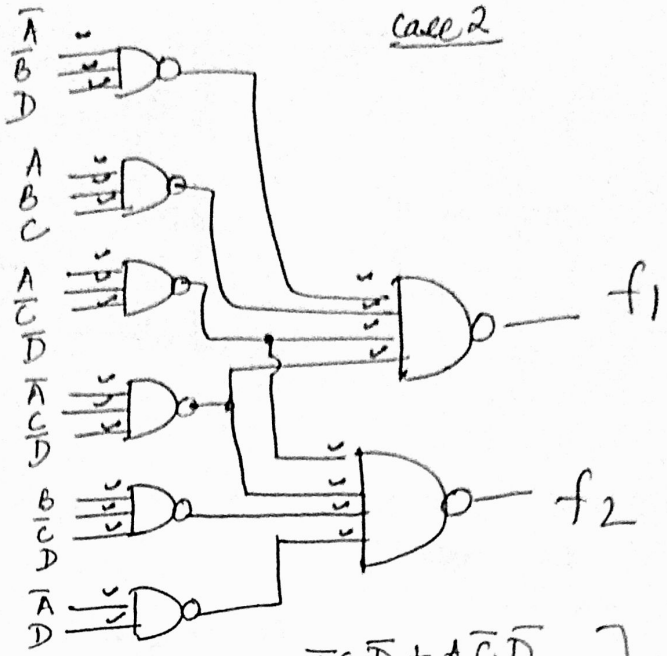


Case 1



(27) I/P's

Case 2



$f_1 = \bar{A}\bar{B}D + AB\bar{C} + \bar{A}C\bar{D} + A\bar{C}\bar{D}$ (25) I/P's — case 2.

Minimised ckt

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

Incompletely specified fns : Minterms / Maxterms + don't cares

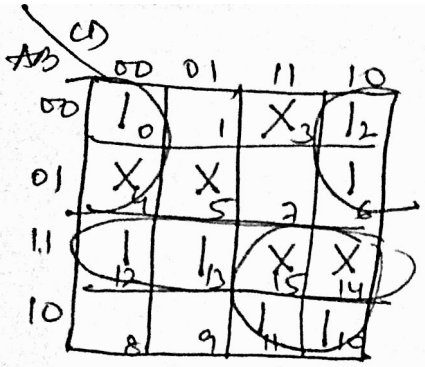
f_1	f_2	$f = f_1 \cdot f_2$
0	0	0
0	1	0
1	0	0
0	X	0
X	0	0
1	X	1
X	1	1
1	1	1
X	X	X

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

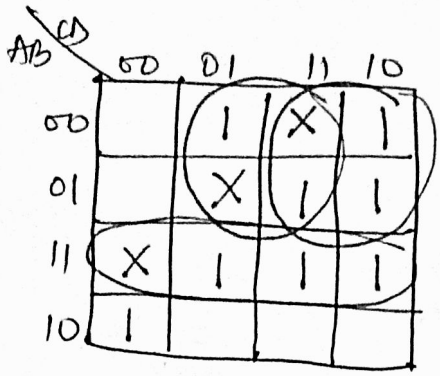
$f_2 = \Sigma m(1, (2), (6), 7, 8, (13), (14), (15) + d(3)(5), (12))$

$f = f_1 \cdot f_2$

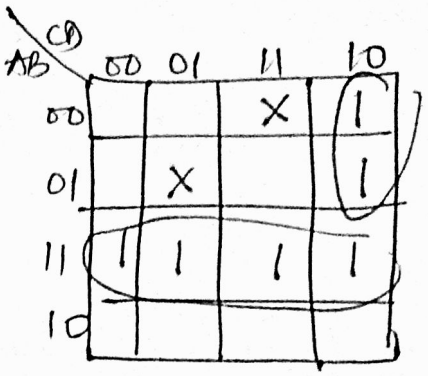
$= \Sigma m(2, 6, 12, 13, 14, 15) + d(3, 5)$



f_1



f_2



f

$f_1 = \bar{A}\bar{D} + \overset{AC}{\cancel{\bar{A}C\bar{D}}} + AB$ ($\bar{A}C\bar{D}$ is not considered as it can be formed into bigger grp)

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

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

Draw ckt for fns f_1 & f_2.