UNIT 1 : LOGIC SIMPLIFICATION AND COMBINATIONAL LOGIC DESIGN

Today's Target

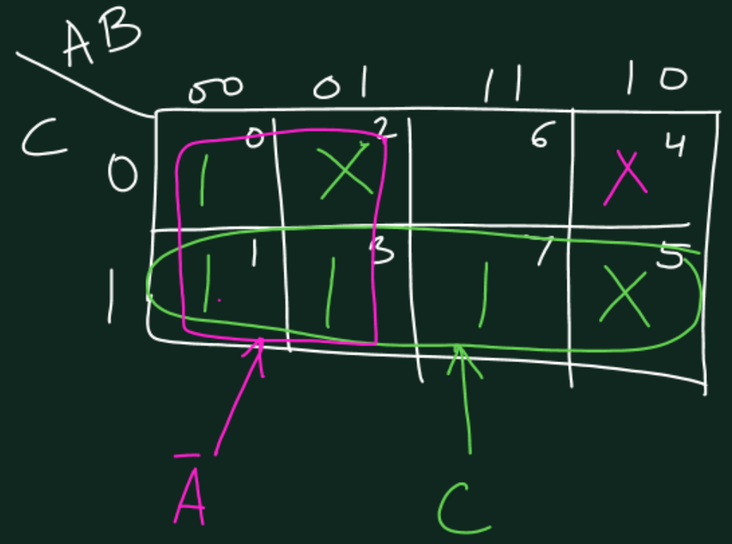
- Don't Care Conditions
- 5,6 Variable K-Map
- Numerical Practice
- DPP
- University Questions

Don't Care (Incompletely Specified) Conditions

- Some times, not all values of a function are defined
- Some input conditions will never occur
- We don't care what the output is for that input condition
- In these cases, we can choose the output to be either 0 or 1, whichever simplifies the circuit.

$$F = \Sigma m(0,1,3,7) + d(2,5)$$

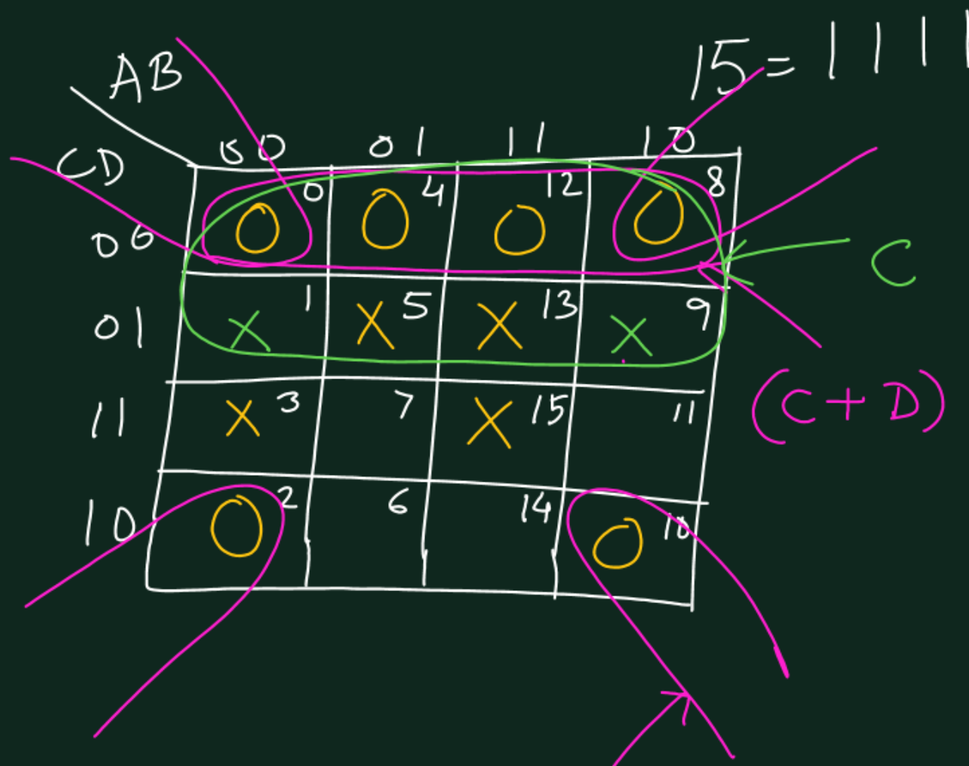
$7 = 1\,1\,1$



$$F = \bar{A} + C$$

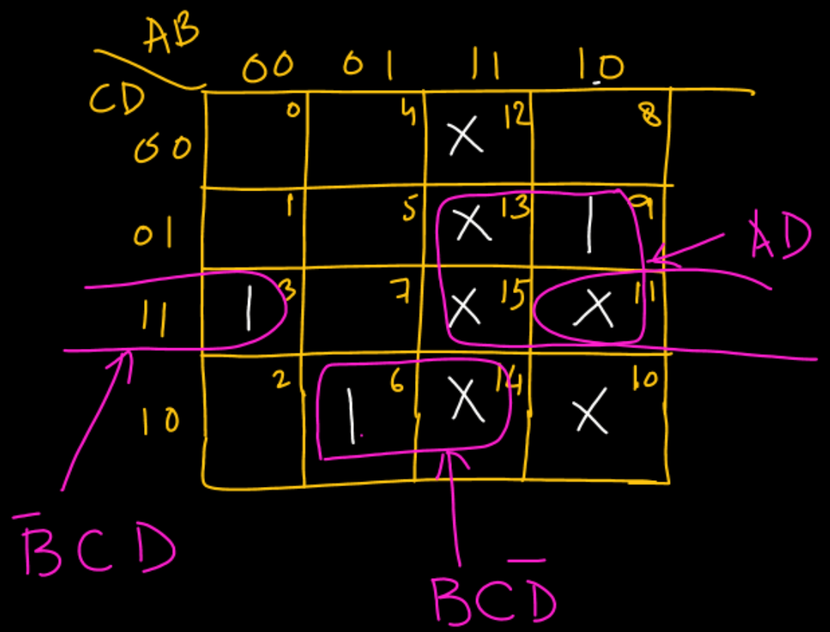
$$F = \Pi M(0,2,4,8,10,12) + d(3,5,13,15)$$

$15 = 1\,1\,1\,1$



$$F = (B+D)(C+D)(B+D)$$

Example: A circuit is to have an output of 1 if a binary coded decimal (BCD) digit is a multiple of 3



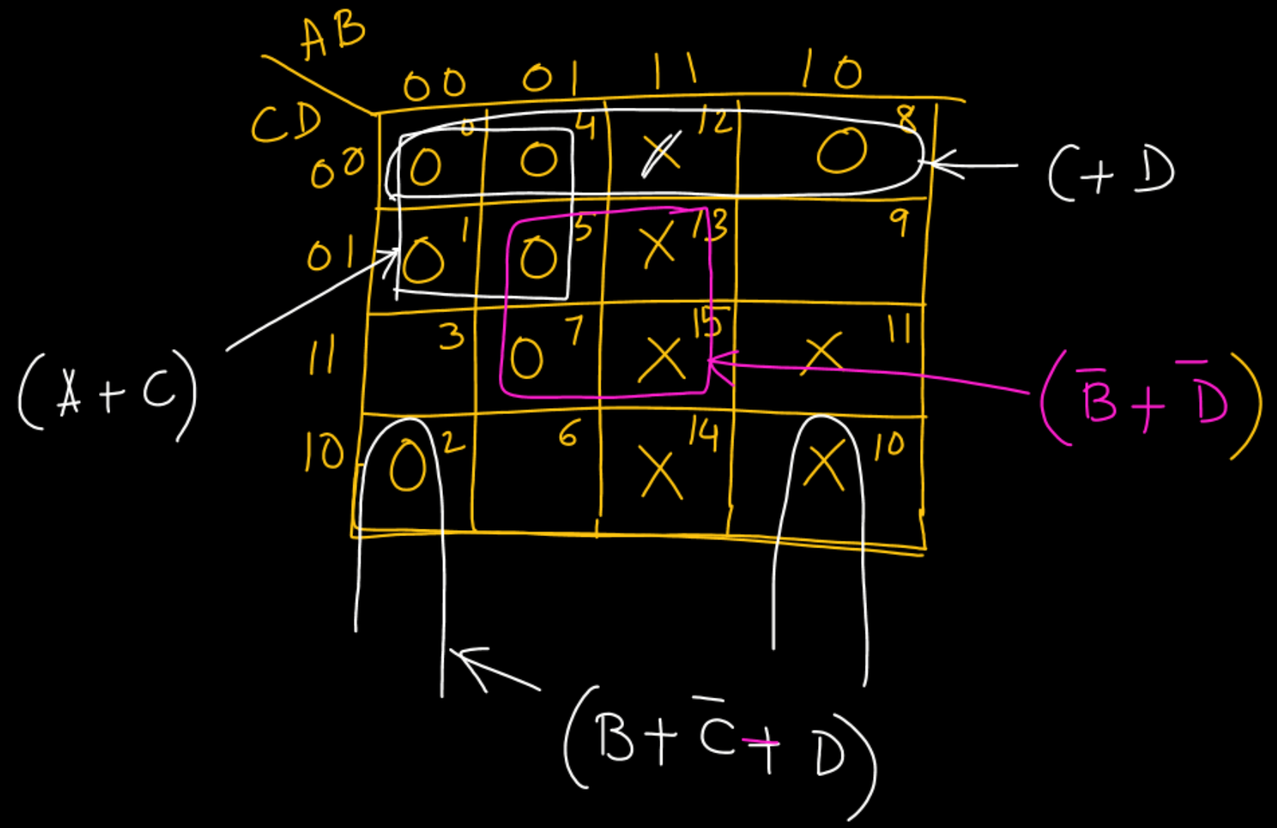
$$F = \Pi M(0, 1, 2, 4, 5, 7, 8) + d(10, 11, 12, 13, 14, 15)$$

A	B	C	D	Y
0	0	0	0	0 ✓
0	0	0	1	0 ✓
0	0	1	0	0 ✓
0	0	1	1	1
0	1	0	0	0 ✓
0	1	0	1	0 ✓
0	1	1	0	1
0	1	1	1	0 ✓
1	0	0	0	0 ✓
1	0	0	1	1 ✓
1	0	1	0	X
1	0	1	1	X
1	1	0	0	X
1	1	0	1	X
1	1	1	0	X
1	1	1	1	X

$$F = AD + B\bar{C}\bar{D} + \bar{B}CD$$
$$= AD + C(B\bar{D} + \bar{B}D)$$
$$= AD + C(B \oplus D)$$

Product of sums:

$F = \Pi M(0, 1, 2, 4, 5, 7, 8) + d(10, 11, 12, 13, 14, 15)$

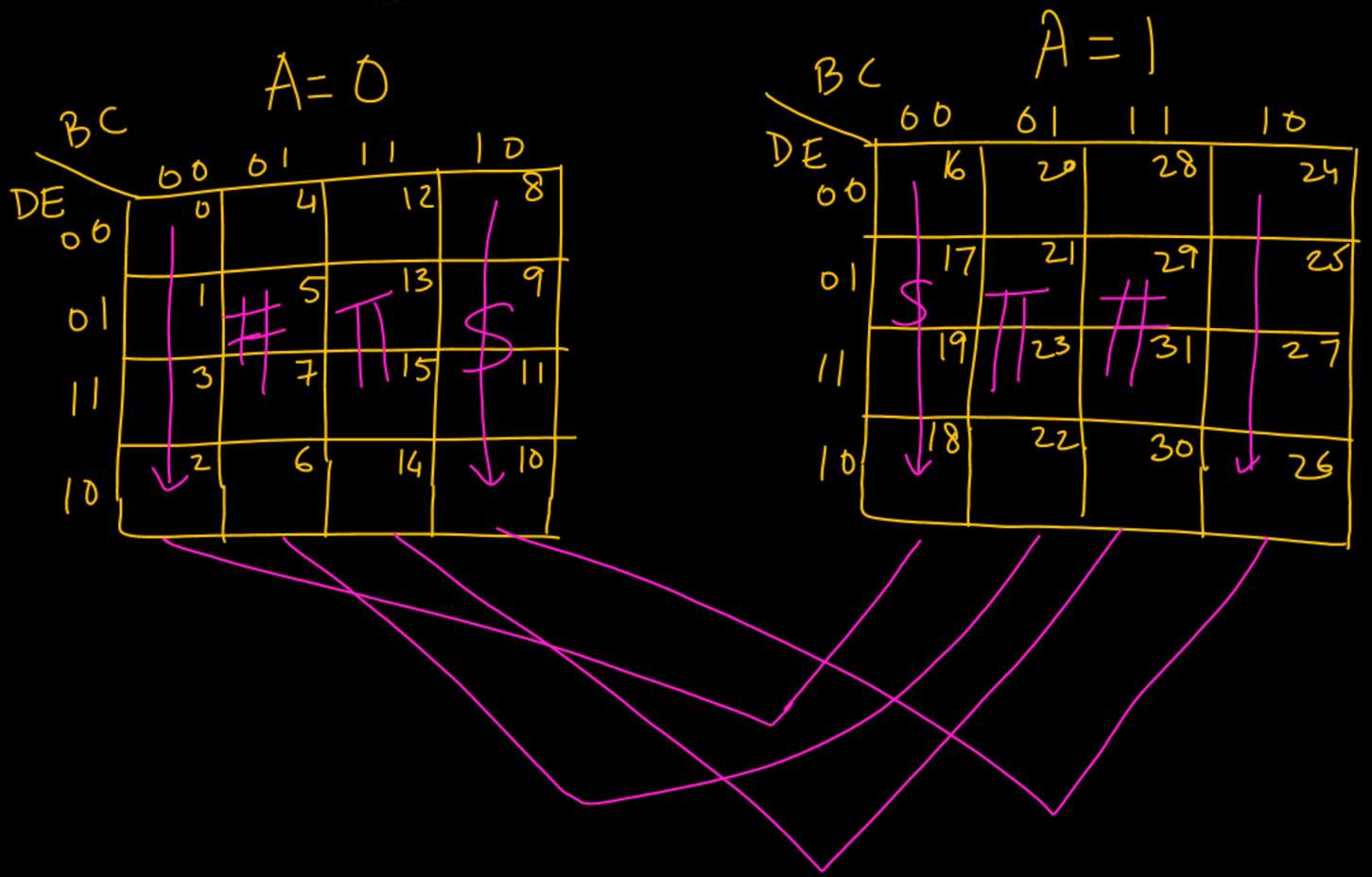


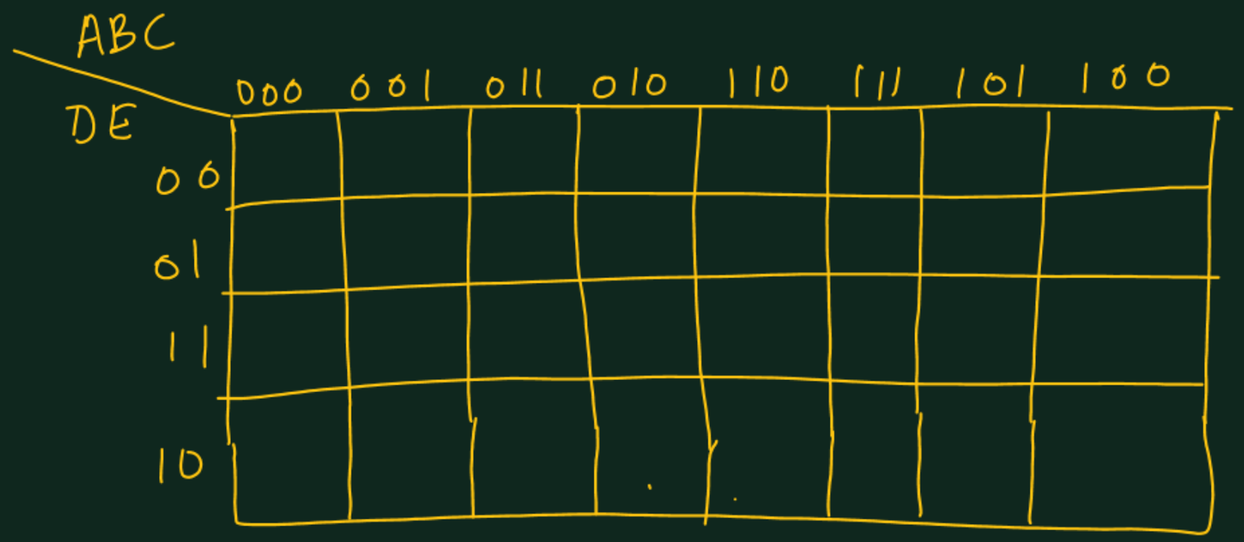
$F = (C + D)(\bar{B} + \bar{D})(B + \bar{C} + D)$

$(A + C)$

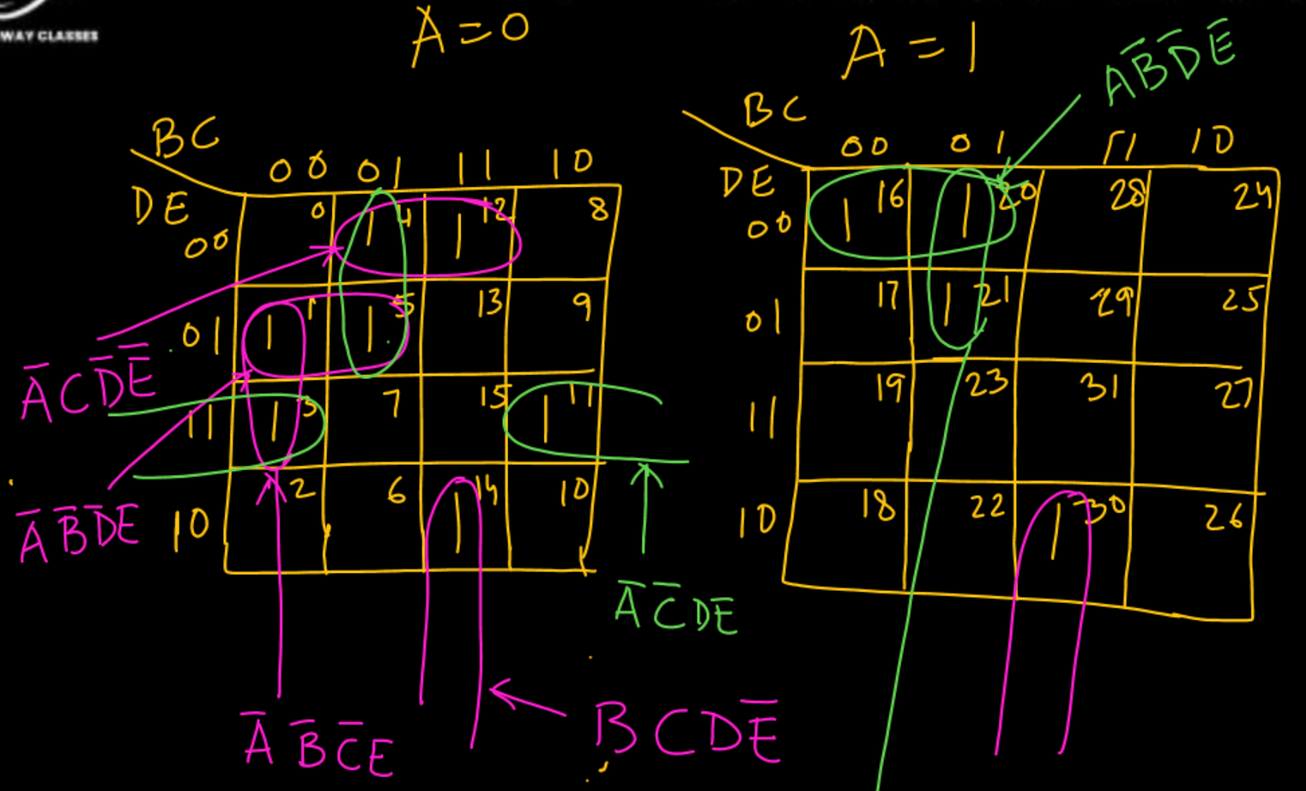
5 Variable K-Map

- The number of cells in 5 variable K-map is thirty-two $2^5 = 32$
- **5 variable K-Map**.




ABC
DE
000
001
011
010
110
111
101
100
00
01
11
10

Example: $Y(A,B,C,D,E) = \sum m(1,3,4,5,11,12,14,16,20,21,30)$



$$F = \underset{①}{\bar{A}C\bar{D}\bar{E}} + \underset{②}{\bar{A}\bar{B}\bar{D}\bar{E}} + \underset{③}{\bar{A}\bar{B}\bar{C}E} + \underset{④}{B\bar{C}D\bar{E}} + \underset{⑤}{\bar{B}C\bar{D}} + \underset{⑥}{\bar{A}\bar{C}DE} + A\bar{B}\bar{D}\bar{E}$$



$$F = \underset{⑤}{\bar{B}C\bar{D}} + \underset{②}{A\bar{B}\bar{D}\bar{E}} + \underset{①}{\bar{A}C\bar{D}\bar{E}} + \underset{③}{\bar{A}\bar{B}\bar{C}E} + \underset{⑥}{\bar{A}\bar{C}DE} + \underset{④}{BC\bar{D}\bar{E}}$$

6 Variable K-Map

$2^6 = 64$

AB = 00

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

AB = 01

CD \ EF	00	01	11	10
00	16	20	28	24
01	17	21	29	25
11	19	23	31	27
10	18	22	30	26

AB = 11

CD \ EF	00	01	11	10
00	48	52	60	56
01	49	53	61	57
11	51	54	63	59
10	50	55	62	58

AB = 10

CD \ EF	00	01	11	10
00	32	36	44	40
01	33	37	45	41
11	35	39	47	43
10	34	38	46	42

DEF \ ABC	000	001	011	010	110	111	101	100
000	0	8	24	16	48	56	40	32
001	1	9	25	17	49	57	41	33
011	3	11	27	19	51	59	43	35
010	2	10	26	18	50	58	42	34
110	6	14	30	22	54	62	46	38
111	7	15	31	23	55	63	47	39
101	5	13	29	21	53	61	45	37
100	4	12	28	20	52	60	44	36

DPP

a) Minimize: $y = \Sigma m(0,1,2,3,5,6,7,8,14,15) + d(4,11,13)$

b) Minimize the logic function: $F(A,B,C,D,E) = \Sigma m(8,9,10,11,13,15, 16,18,21, 24,25,26, 27,30,31)$

UNIVERSITY QUESTIONS

YEAR	QUESTION	MARKS	ANSWER
22-23	Simplify the logic function using K-map $Y = \Sigma m (0, 2, 3, 4, 6, 7, 9, 11,16,18,19,20,22,23,25,27)$	10 marks	
19-20	Simplify the logic expression using K map $F(A,B,C,D,E,F) = \Sigma m(0,5,7,8,9,12,13,23,24,25, 28,29, 37, 40,42,44,46,55,56,57,60,61)$	10 marks	

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