Digital Logic Design

PI
E PI

CSE 131Digital Logic Design

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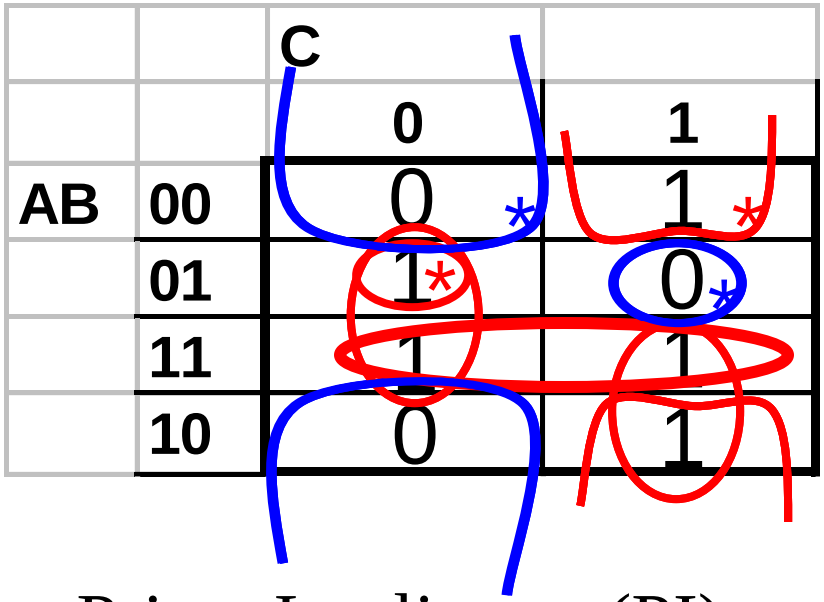
K Maps

- Defn: Implicant - Any selected Boolean cube with the same value on all vertices.
- Defn: Prime Implicant - Any implicant that cannot be <u>completely</u> enclosed by another implicant.



- Essential Prime Implicants: Prime Implicants (PI) covering a square covered by no other PI.

- EX: Find the Min SOP for the following 3-variable function:

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

		C	
		0	1
AB	00	0	1
	01	0	1
	11	1	1
	10	1	1

F=A +C

- Construct the Karnaugh Map
- Fill in the K-Map
- Identify the adjacency groupings

- Using Karnaugh Maps to minimize functions by grouping 1’s gave a Min SOP Form:
- Using Karnaugh Maps to minimize functions by grouping 0’s gives a Min POS Form:

- The dual of the Uniting theorem is the basis upon which POS is derived from K-Maps. Starting with a Canonical POS form.

A	B	F
0	0	1
0	1	0
1	0	1
1	1	0

$$F = (\overline{B} + A)(\overline{B} + \overline{A})$$

$$F = (\overline{B} + A\overline{A}) \quad \text{Distr.}$$

$$F = (\overline{B} + 0) \quad \text{Compl.}$$

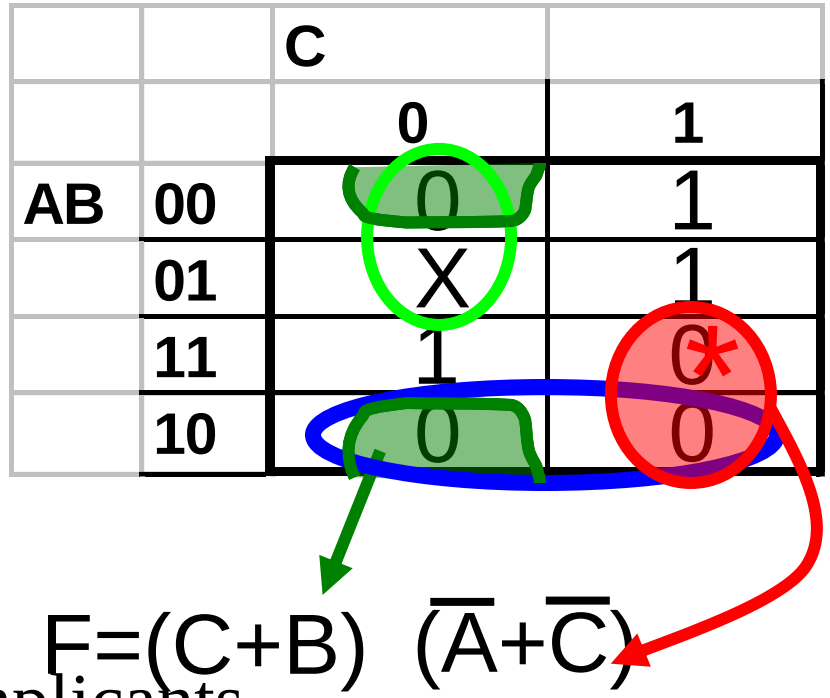
$$F = \overline{B} \quad \text{Ident.}$$

- Eliminate the varying variable.
- Write Canonical POS form using remaining variables.

- Following the dual of the development for SOP we could show that the Karnaugh Map Method is valid for POS forms.

- EX: Find the Min POS for the following 3-variable function:

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	X
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0



  - Identify all Prime Implicants
  - Identify Essential Prime Implicants

- TEAMS: Find the Min POS for the following 4-variable function:

CD / AB	00	01	11	10
00	X	1	0	1
01	0	1	1	1
11	0	X	X	0
10	0	1	0	1

$B+\bar{C}+D$

$\bar{A}+\bar{B}$

$(C+D)$

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

- First find all PI's then identify all EPI's.

- TEAMS: Find the Min POS for the following 4-variable function:

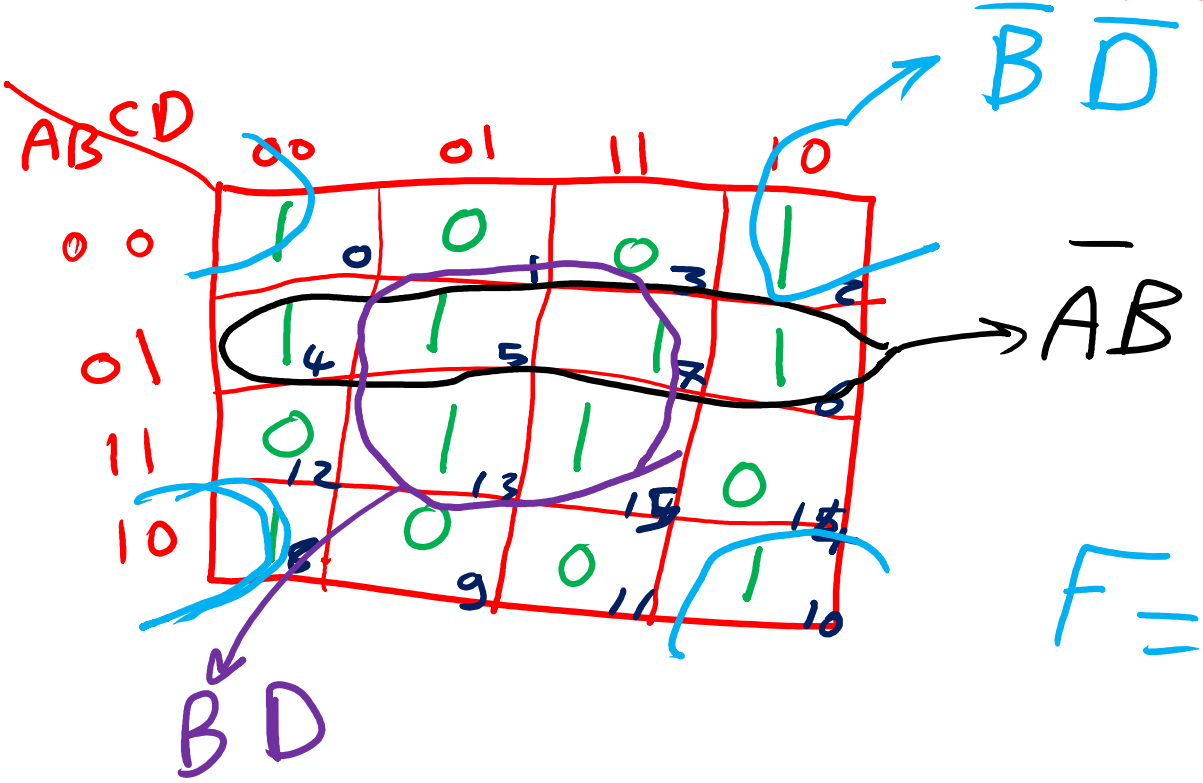
CD				
AB	00	01	11	10
00	1	0	0	X 1
01	0	1	X 1	0
11	1	X 1	X 1	1
10	1	X 0	X 0	1

$A+\overline{B}+D$

$(B+\overline{D})(A+\overline{B}+D)$

SoP

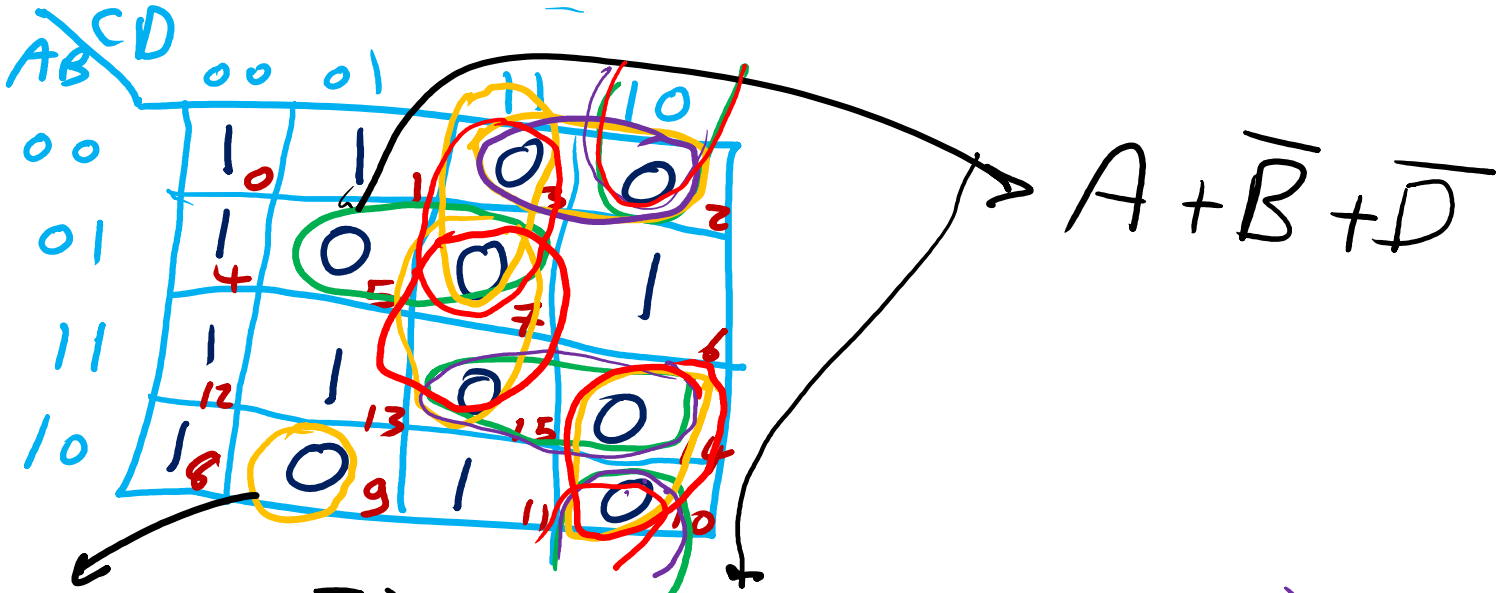
$$F = \sum m(0, 2, 4, 5, 6, 7, 8, 10, 13, 15)$$



$$F = BD + \bar{A}B + \bar{B}\bar{D}$$

POS

$F = \Pi M(2,3,5,7,9,10,14,15)$



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

EPI