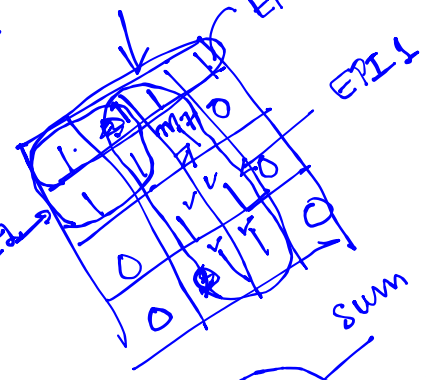
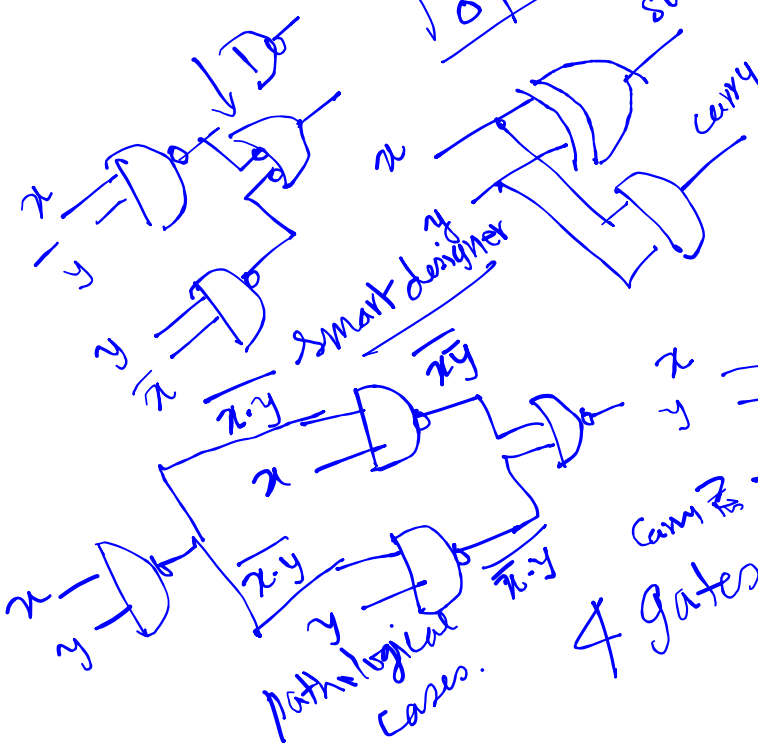
K-Map

$x\bar{x} = 0$

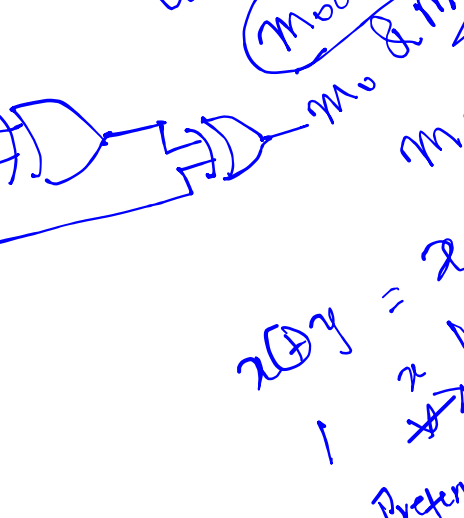
Minimum basic gates





Minimize

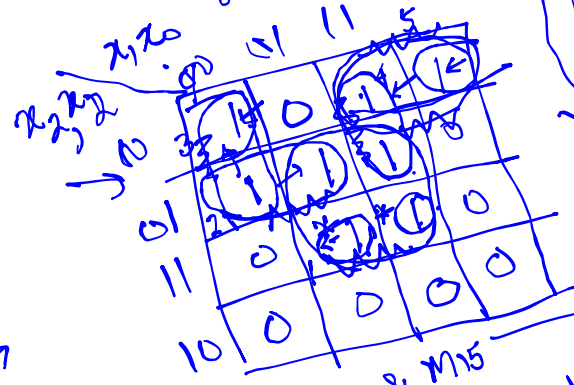
Min. nr. of basic gates



3 AND
2 OR

$ab + \bar{b}c + ca$

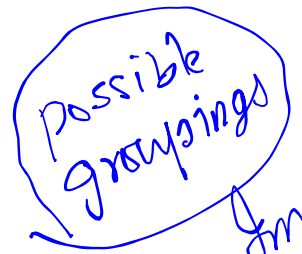
↑ 2 input gate



→ m_{13} & m_{15}

Prime Implicants

Possible groupings



Prime Implicants

EPI

x_2x_0

$+\bar{x}_3\bar{x}_2x_1 + \bar{x}_2x_1x_0 + \bar{x}_3x_1x_0$

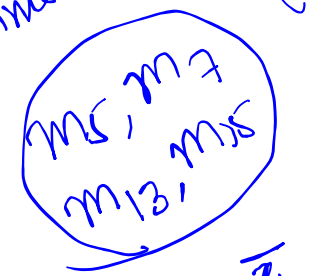
min OR gates

min. nr. of sum term

min. nr. literals

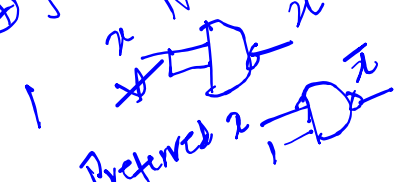
$+\bar{x}_3\bar{x}_2x_1 + \bar{x}_2x_1x_0 + \bar{x}_3x_2x_1$

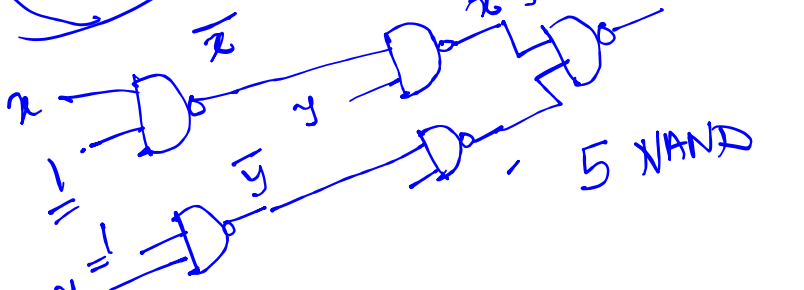
1st → Max. Member Group



$x \oplus y = x\bar{y} + \bar{x}y$

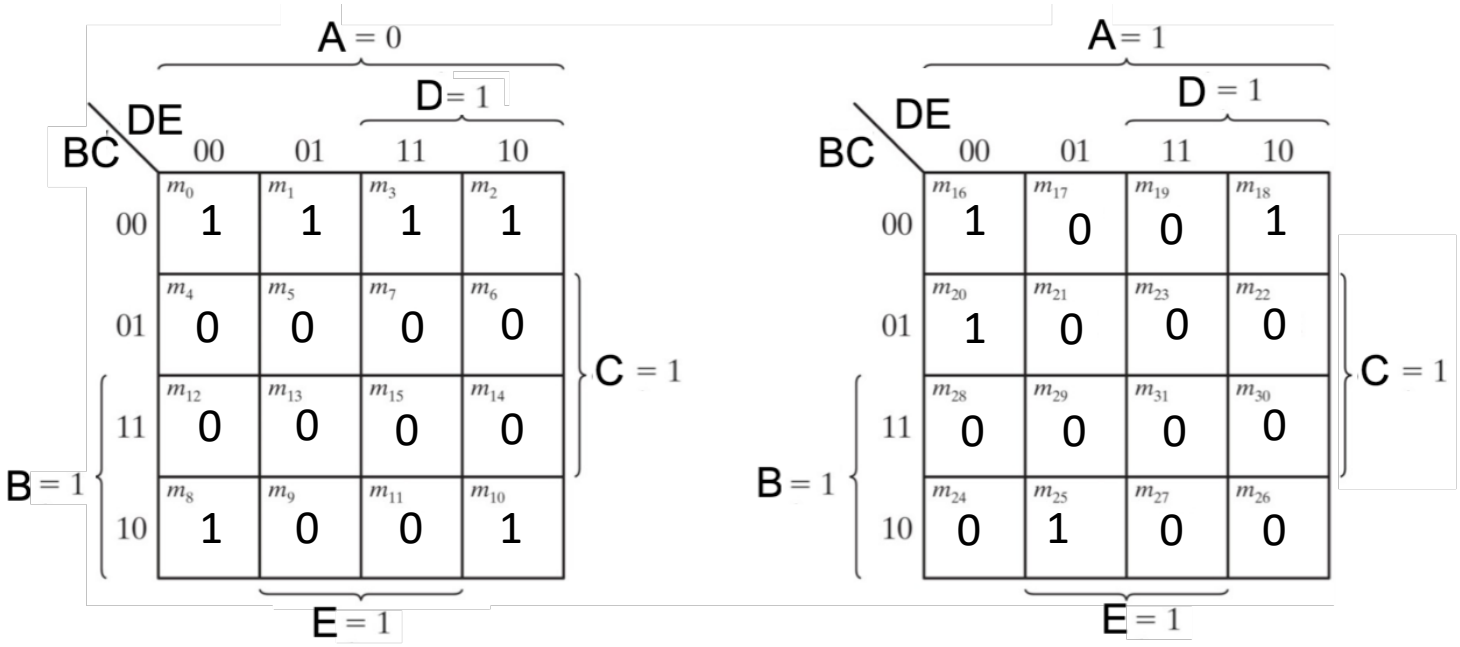
2 NAND gates.

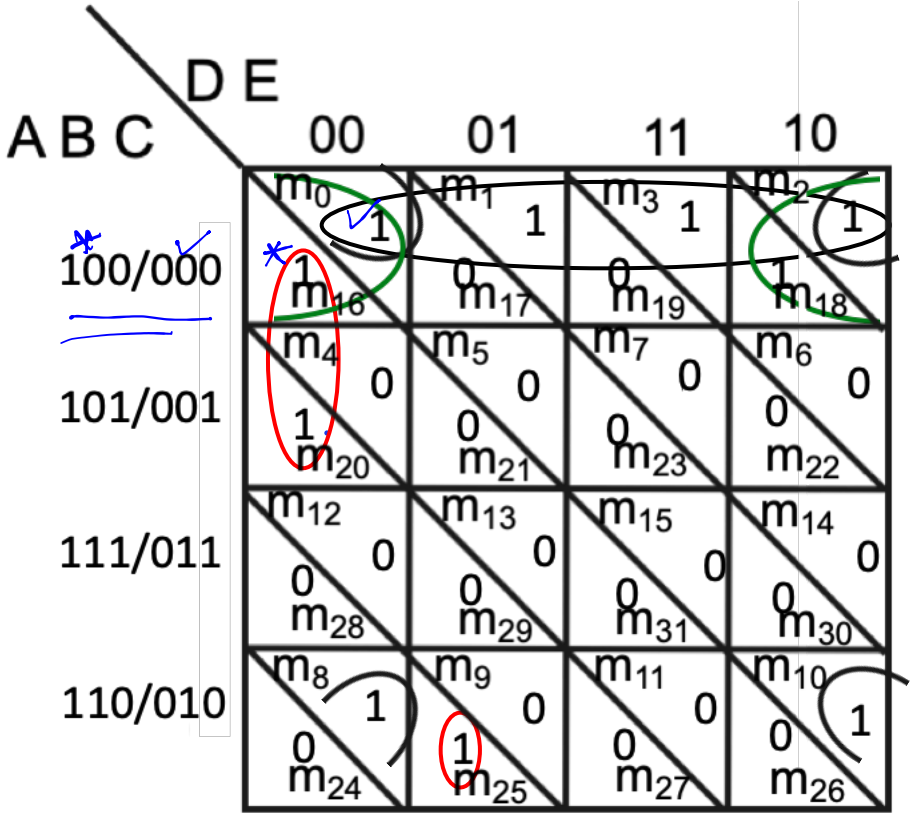




K-Map (5-Variable) --- An Alternate Style

$$f(A,B,C,D,E) = \sum m(0,1,2,3,8,10,16,18,20,25)$$





Green: Complete Square grouping

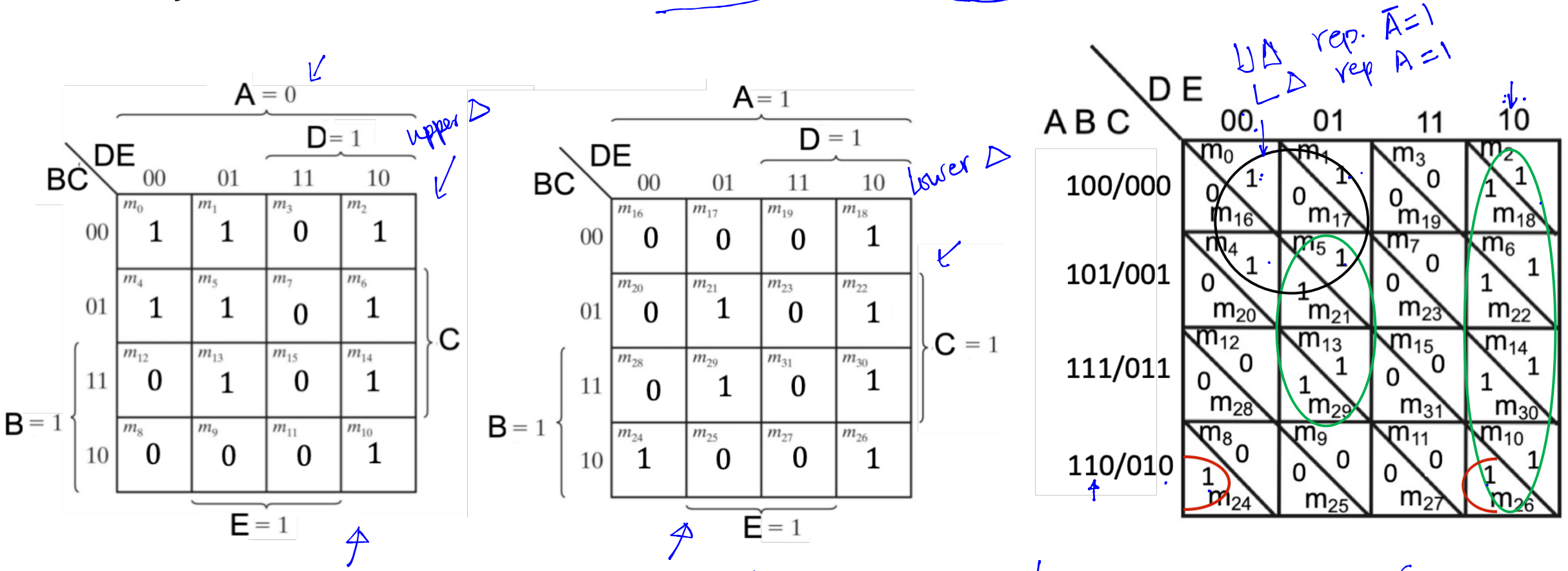
Black: Upper Triangle grouping

Red: Lower Triangle Grouping

$$f(A,B,C,D,E) = \bar{B}\cdot\bar{C}\cdot\bar{E} + \bar{A}\cdot\bar{B}\cdot\bar{C} + \bar{A}\cdot\bar{C}\cdot\bar{E} + A\cdot\bar{B}\cdot\bar{D}\cdot\bar{E} + A\cdot B\cdot\bar{C}\cdot\bar{D}\cdot E$$

K-Map (5-Variable) --- An Alternate Style

- $f(A,B,C,D,E) = \sum m(0,1,2,4,5,6,10,13,14,18,21,22,24,26,29,30)$

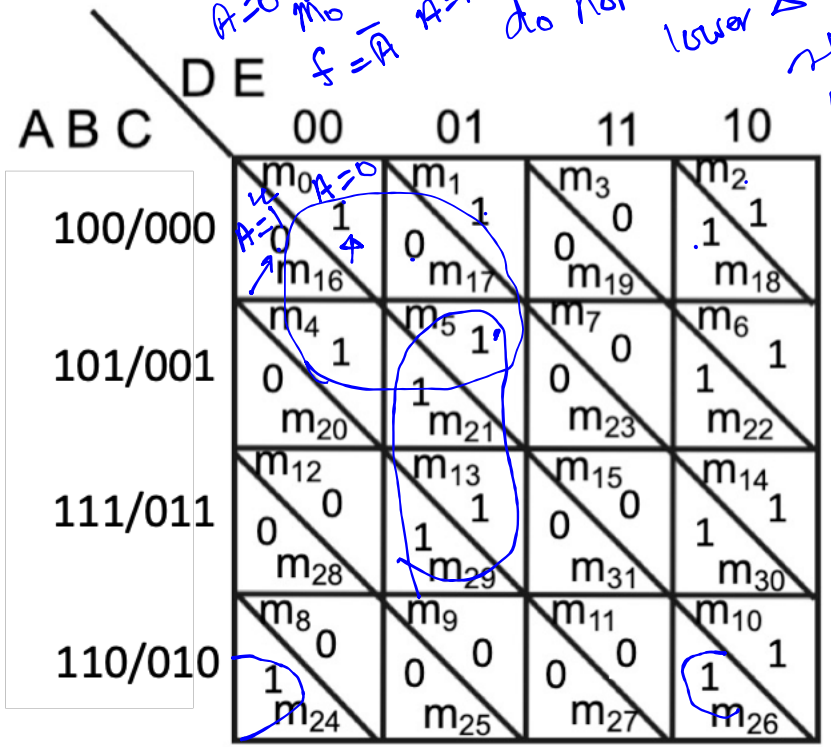


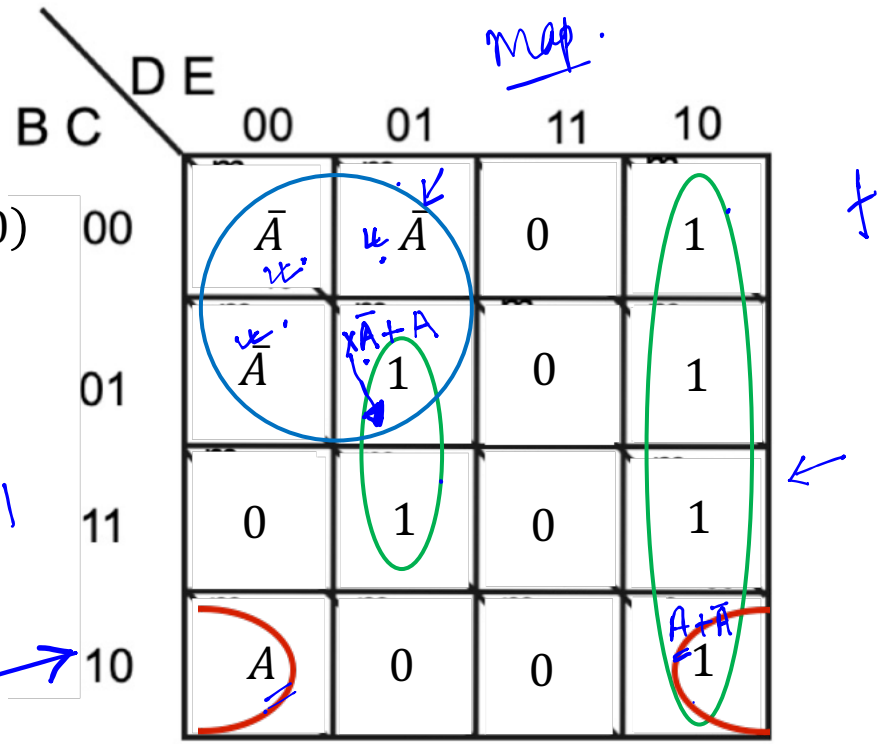
$$f(A,B,C,D,E) = D \cdot \overline{E} + C \cdot \overline{D} \cdot E + \overline{A} \cdot \overline{B} \cdot \overline{D} + A \cdot B \cdot \overline{C} \cdot \overline{E}$$

K-Map (5-Variable) --- An Alternate Style

Variable included map:

$$f(A,B,C,D,E) = \sum m(0,1,2,4,5,6,10,13,14,18,21,22,24,26,29,30)$$





Green: Groups neighbouring 1s

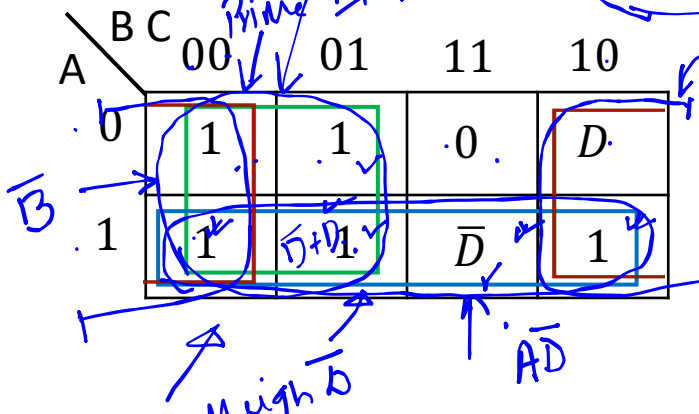
Blue: Groups neighbouring $\bar{A}$s (including 1s in the neighbourhood).

Red: Groups neighbouring As (including 1s in the neighbourhood).

$$f(A,B,C,D,E) = D \cdot \bar{E} + C \cdot \bar{D} \cdot E + \bar{A} \cdot \bar{B} \cdot \bar{D} + A \cdot B \cdot \bar{C} \cdot \bar{E}$$

Example for variable included map (from Truth Table) :

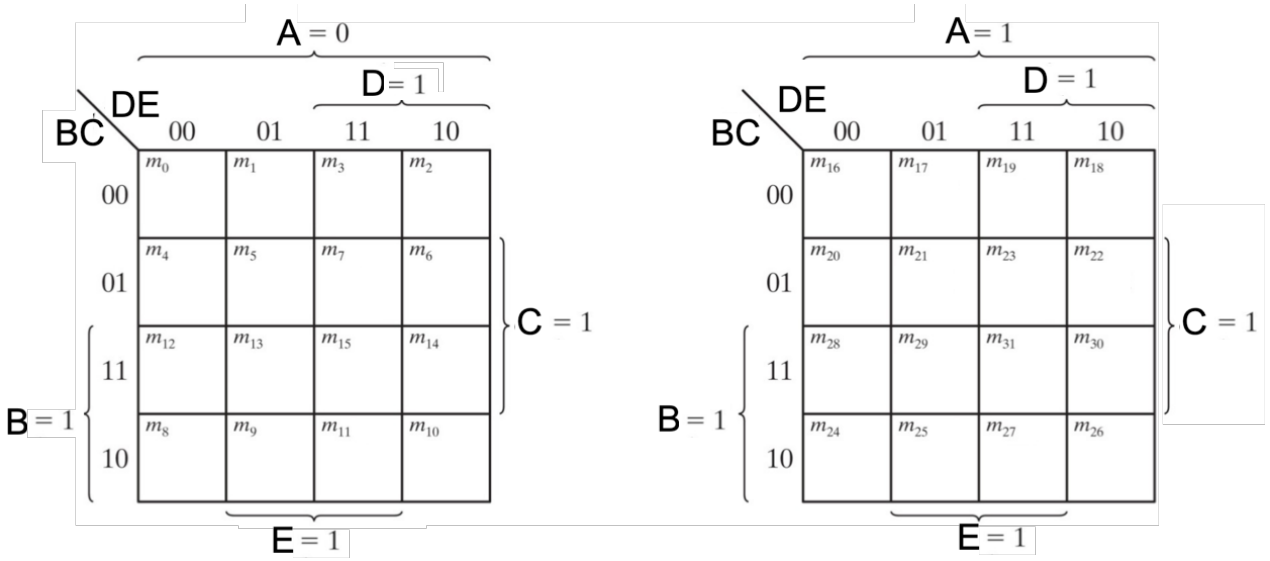
A	B	C	D	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

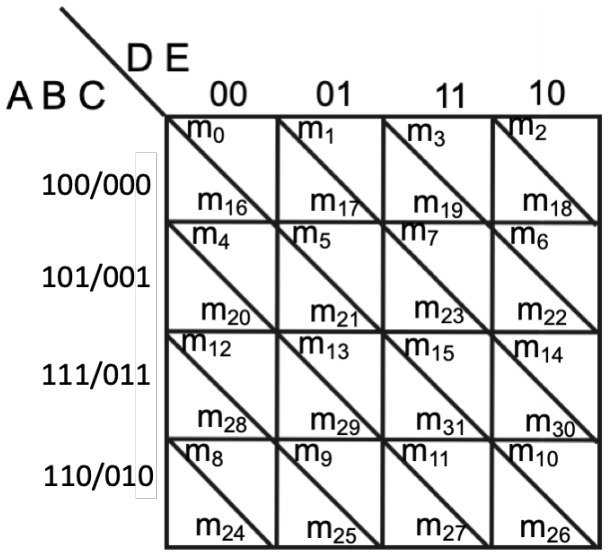


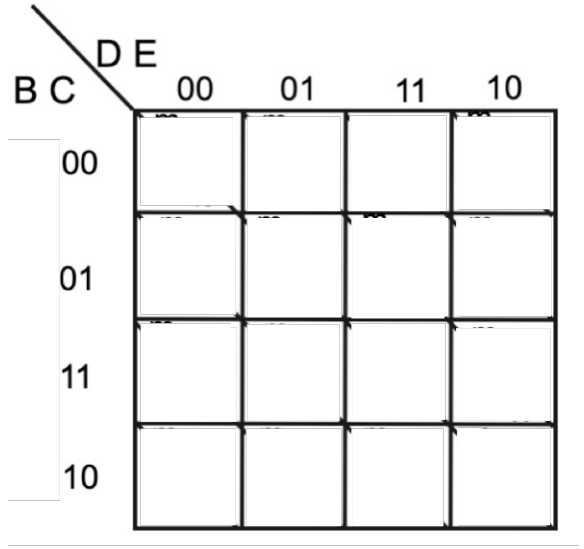
$$F(A,B,C,D) = \bar{B} + A\cdot\bar{D} + \bar{C}\cdot D$$

K-Map (5-Variable) --- Home Work

- $f(A,B,C,D,E) = \sum m(0,4,6,8,12,13,14,15,16,17,18,21,24,25,26,28,29,31)$







K-Map (HW):

- Find minimized SOP
- $f(v,w,x,y,z) = \sum m(0,4,8,10,11,12,13,15,17,19,26,27,28,29)$
- $f(v,w,x,y,z) = \sum m(1,3,5,7,8,10,12,13,14,19,22,24,28)$
- $f(v,w,x,y,z) = \sum m(0,1,2,7,8,9,11,12,14,15,16,17,24,27,30,31)$
- Consider a circuit which has 4-bit input and 1-bit output. The output of the circuit is high when input has odd number of 1's. Draw the k-map and implement the circuit using only XOR gates.

If you do not have enough question → New Topic, MUX

Tomorrow we discuss all problems faced in class + all problems faced in HW

K-Map (Homework)

Design the following with (i) only two input NAND gates, (ii) two input NOR gates

- 4-bit to seven segment display converter.
- Binary to Gray code converter and vice-versa.
- BCD to excess-3 converter and vice-versa.
- 1's complement adder and subtractor.
- 2's complement adder and subtractor.
- Prime number detector for 4-bit input and 5-bit input for unsigned numbers.