

ECE213: Digital Electronics



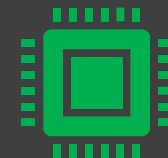
Ajmer Singh



9988921373



ajmer.17381@lpu.co.in





The Course Contents

Unit II

Combinational Logic System : Truth table, Basic logic operation, Boolean Algebra, Basic postulates, Standard representation of logic functions - SOP forms, Simplification of switching functions - K-map, Synthesis of combinational logic circuits, Logic gates, Fundamental theorems of Boolean algebra, Standard representation of logic functions POS forms

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

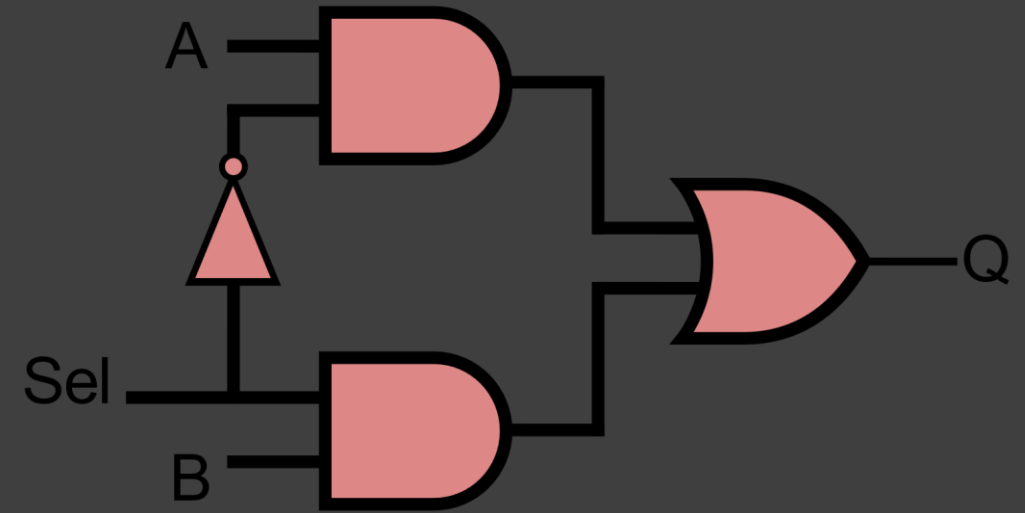


The Course Contents

Unit III

Introduction to Combinational Logic Circuits : Adders, Subtractors, Comparators, Multiplexers and Demultiplexers, Decoders, Encoders, Parity circuits

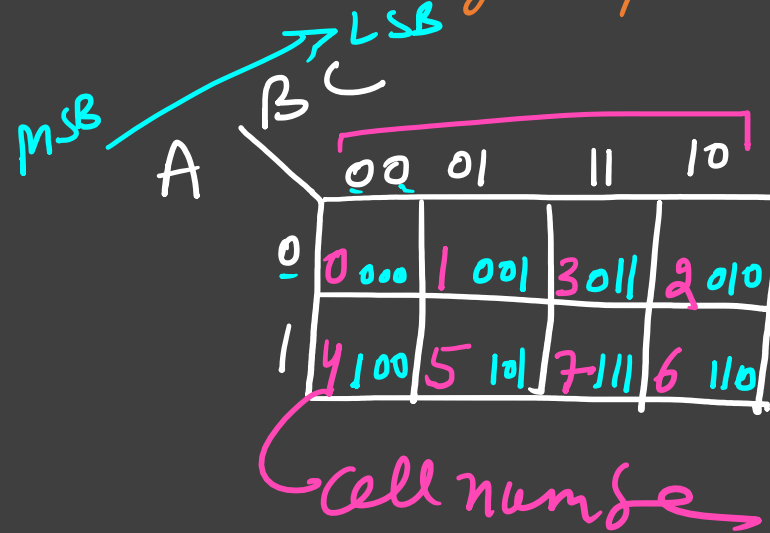
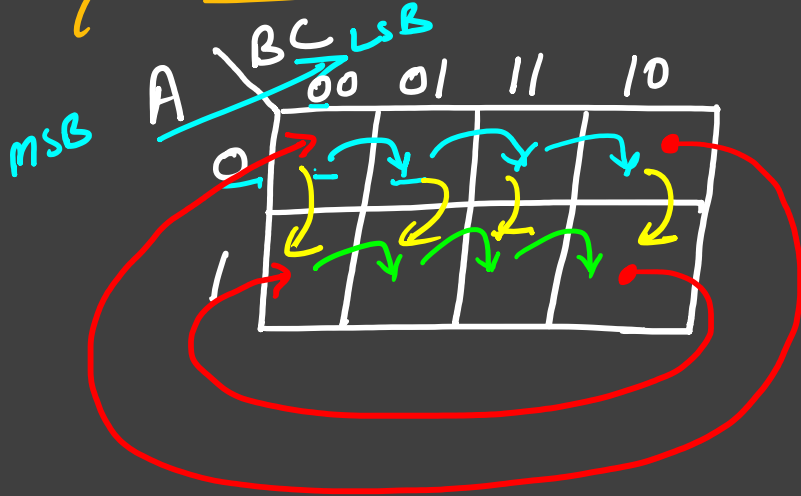
Introduction to Logic Families : Introduction to different logic families, Structure and operations of TTL, MOS and CMOS logic families



Combinational Logic System

Simplification of switching functions - Karnaugh-map

★ 3-Var K-map

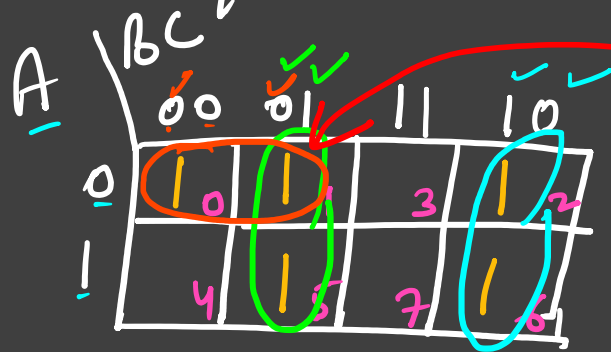


Combinational Logic System

Simplification of switching functions - K-map

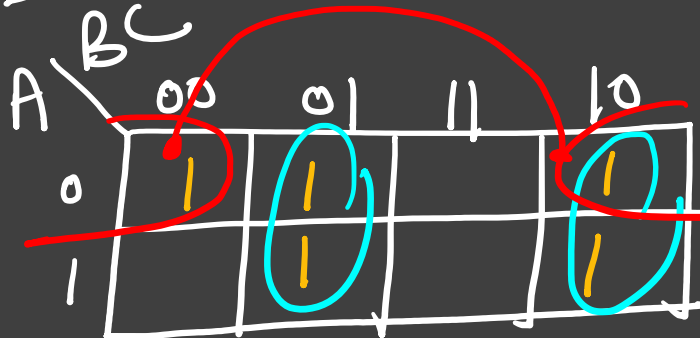
Ex Reduce the following Boolean fun. using K-map

$$Y = \sum m(\underline{0}, \underline{1}, \underline{2}, \underline{5}, \underline{6})$$



$$Y = \underline{B\bar{C}} + \underline{\bar{B}C} + \underline{\bar{A}\bar{B}}$$

$$Y = (B \oplus C) + \bar{A}\bar{B}$$



$$Y = B\bar{C} + \bar{B}C + \bar{A}\bar{C}$$

$$Y = (B \oplus C) + \bar{A}\bar{C}$$

2-Var 0-3
3-Var 0-7
4-Var 0-15
5-Var 0-31
6-Var 0-63

wrap around

Combinational Logic System

Simplification of switching functions - K-map

y_1

A \ BC	00	01	11	10
0	1	1	0	0
1	1	1	0	0

$$y_1 = \underline{\underline{\overline{B}}}$$

y_3

A \ BC	00	01	11	10
0	0	0	1	1
1	0	0	1	1

$$y_3 = \underline{\underline{B}}$$

y_5

A \ BC	00	01	11	10
0	1	0	0	1
1	1	0	0	1

$$y_5 = \underline{\underline{\overline{C}}}$$

y_2

A \ BC	00	01	11	10
0	0	1	1	0
1	0	1	1	0

$$y_2 = \underline{\underline{C}}$$

y_4

A \ BC	00	01	11	10
0	1	1	1	1
1	0	0	0	0

$$y_4 = \underline{\underline{\overline{A} + \overline{B}\overline{C}}}$$

Q: How many variable can be eliminate using 2^n group size is K-map

A:

$n=0$	$2^0 = 1$	$n \text{ max} =$
$n=1$	$2^1 = 2$	
$n=2$	$2^2 = 4$	
$n=3$	$2^3 = 8$	

Combinational Logic System

Simplification of switching functions - K-map

y_6

		BC	00	01	11	10
A	0		0	1	1	1
	1		0	1	1	1

$$y_6 = C + B$$

y_8

		BC	00	01	11	10
A	0		0	1	0	1
	1		0	1	1	1

$$y_8 = \bar{B}C + B\bar{C} + AC$$

y_{10}

		BC	00	01	11	10
A	0			1	1	
	1				1	1

$$y_{10} = \bar{A}C + AB$$

y_7

		BC	00	01	11	10
A	0		1	0	0	1
	1		1	1	1	1

$$y_7 = A + \bar{C}$$

y_9

		BC	00	01	11	10
A	0		1	1	1	0
	1		0	1	1	1

$$y_9 = C + \bar{A}\bar{B} + AB$$

y_{11}

		BC	00	01	11	10
A	0		1	0	1	1
	1		0	0	1	1

$$y_{11} = B + \bar{A}\bar{C}$$

Combinational Logic System

Simplification of switching functions - K-map

EX

A \ BC	00	01	11	10
0	0	1	0	1
1	1	0	1	0

$$\begin{aligned}
 Y &= \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + ABC \\
 &= \bar{A}(\bar{B}C + B\bar{C}) + A(\bar{B}\bar{C} + BC) \\
 &= \bar{A}(B \oplus C) + A(\overline{B \oplus C}) \\
 &= A \oplus B \oplus C
 \end{aligned}$$

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

$$X = A \oplus B$$

Z \ AB	00	01	11	10
0	0	1	0	1
1	1	0	1	0

$$Z = \overline{A \oplus B}$$

Y \ BC	00	01	11	10
0	0	1	0	1
1	1	0	1	0

$$\begin{aligned}
 Y &= \bar{B}(A \oplus C) + B(\overline{A \oplus C}) \\
 &= A \oplus B \oplus C
 \end{aligned}$$

Combinational Logic System

Simplification of switching functions - K-map

Σx

A	B			
	00	01	11	10
0	1	0	1	0
1	0	1	0	1

$$y =$$