SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB204 – LINEAR AND DIGITAL CIRCUITS

II YEAR/ III SEMESTER

UNIT 4 – COMBINATIONAL and SEQUENTIAL CIRCUITS

TOPIC 1 - HALF ADDER and FULL ADDER

WHAT IS COMBINATIONAL CIRCUIT?

- Output is function of input only

  i.e. no feedback

Combinational Logic Circuits are memoryless digital logic circuits whose output at any instant in time depends only on the combination of its inputs.

HALF ADDER

Half Adder

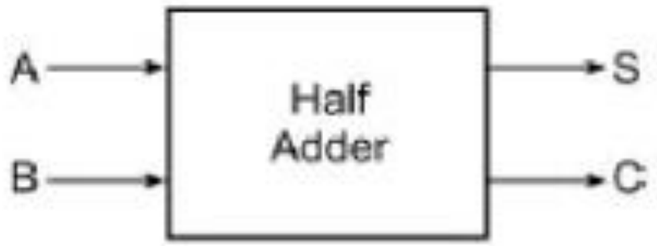
Adds 1-bit plus 1-bit

Produces Sum and Carry

$$\text{SUM } S = A.\overline{B} + \overline{A}.B$$

$$\text{CARRY } C = A.B$$

A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1



HALF ADDER

For Carry

A \ B	0	1
0	0	0
1	0	1

Carry = AB

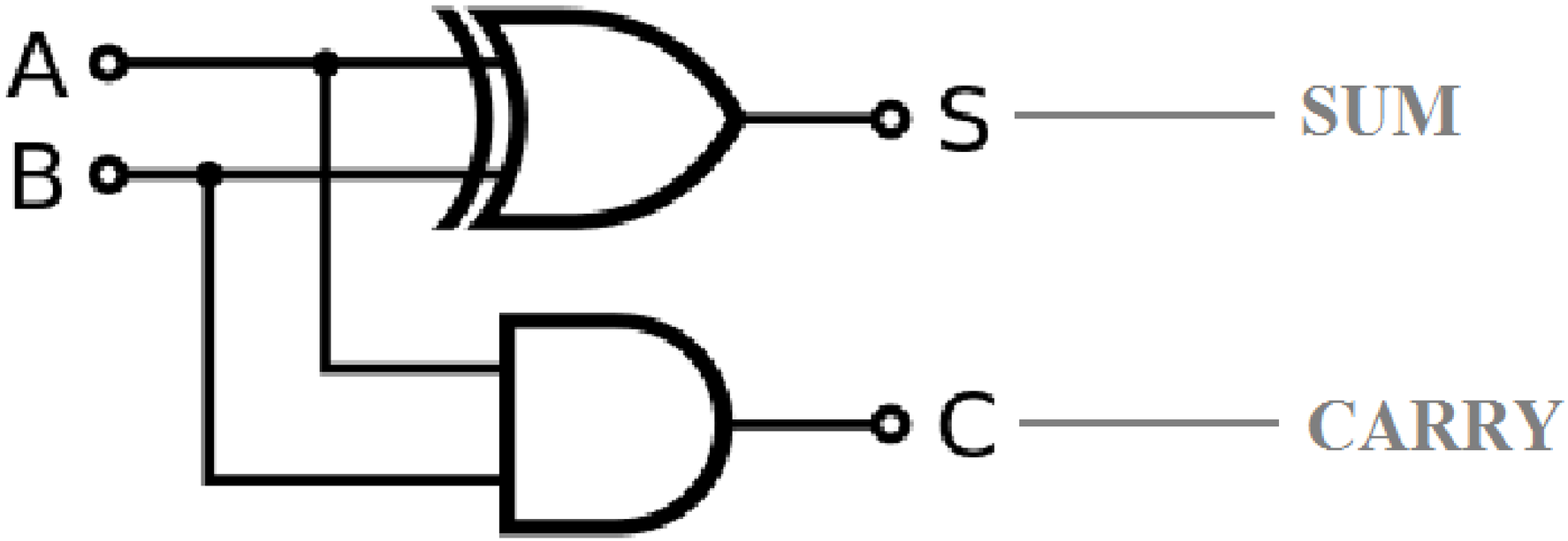
For Sum

A \ B	0	1
0	0	1
1	1	0

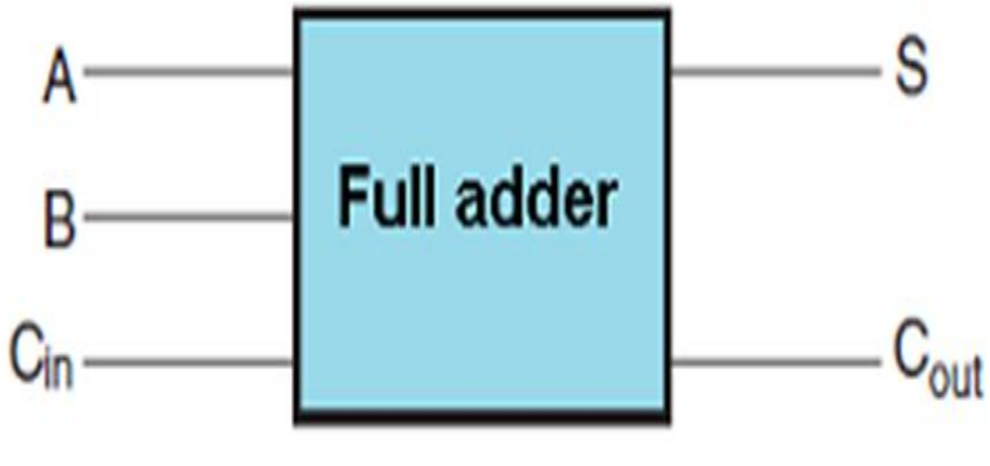
Sum = $A\overline{B} + \overline{A}B$

= $A \oplus B$

HALF ADDER



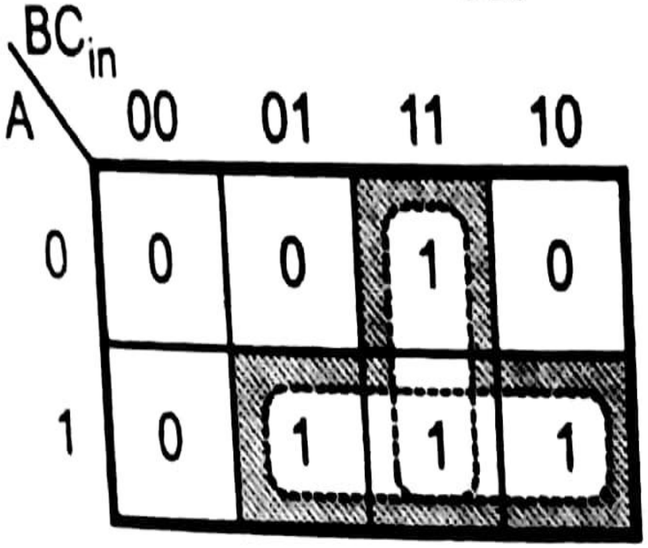
FULL ADDER



A	B	C_{in}	SUM (S)	C_{out}
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

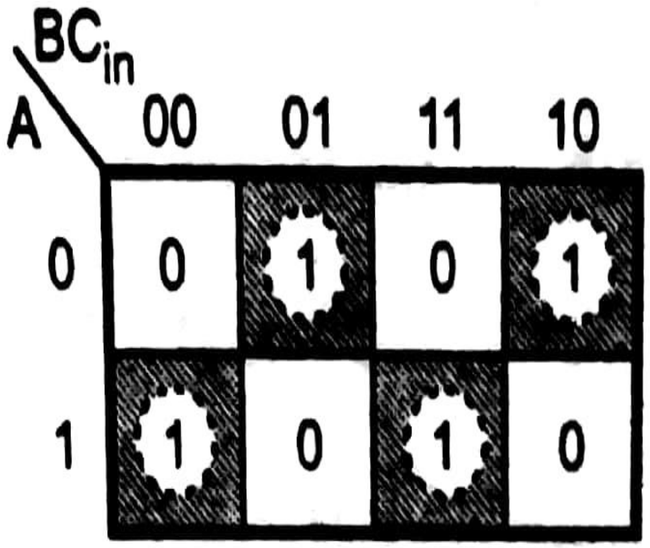
FULL ADDER

For Carry (C_{out})



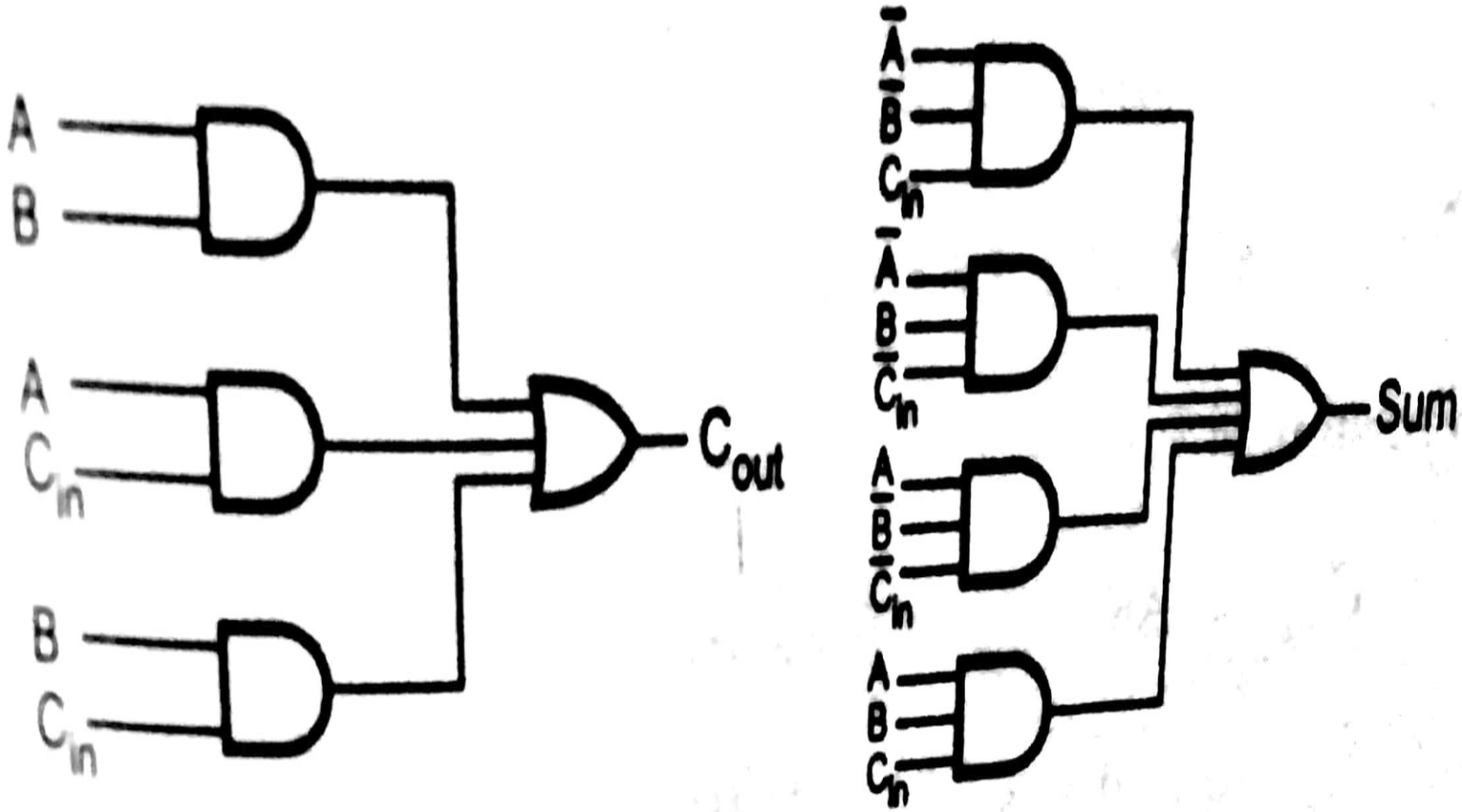
$$C_{out} = AB + A\,C_{in} + B\,C_{in}$$

For Sum



$$Sum = \bar{A}\,\bar{B}C_{in} + \bar{A}B\bar{C}_{in} + A\bar{B}\,\bar{C}_{in} + ABC_{in}$$

LOGICAL DIAGRAM



FULL ADDER

$$\text{Sum} = \bar{A}\,\bar{B}\,C_{in} + \bar{A}\,B\,\bar{C}_{in} + A\,\bar{B}\,\bar{C}_{in} + A\,B\,C_{in}$$

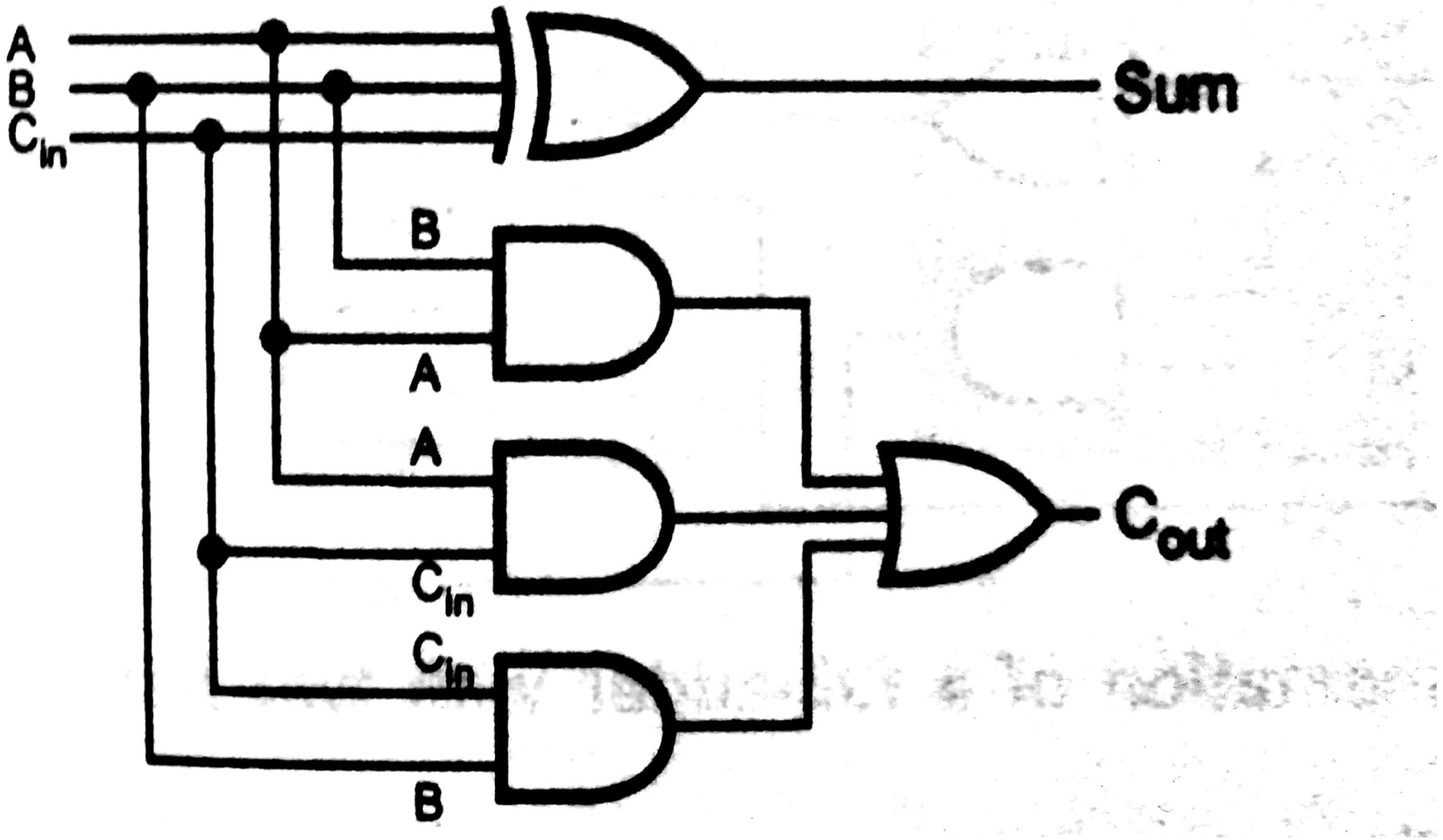
$$= C_{in}\,(\bar{A}\,\bar{B} + AB) + \bar{C}_{in}\,(\bar{A}\,B + A\,\bar{B})$$

$$= C_{in}\,(A \cdot B) + \bar{C}_{in}\,(A \oplus B)$$

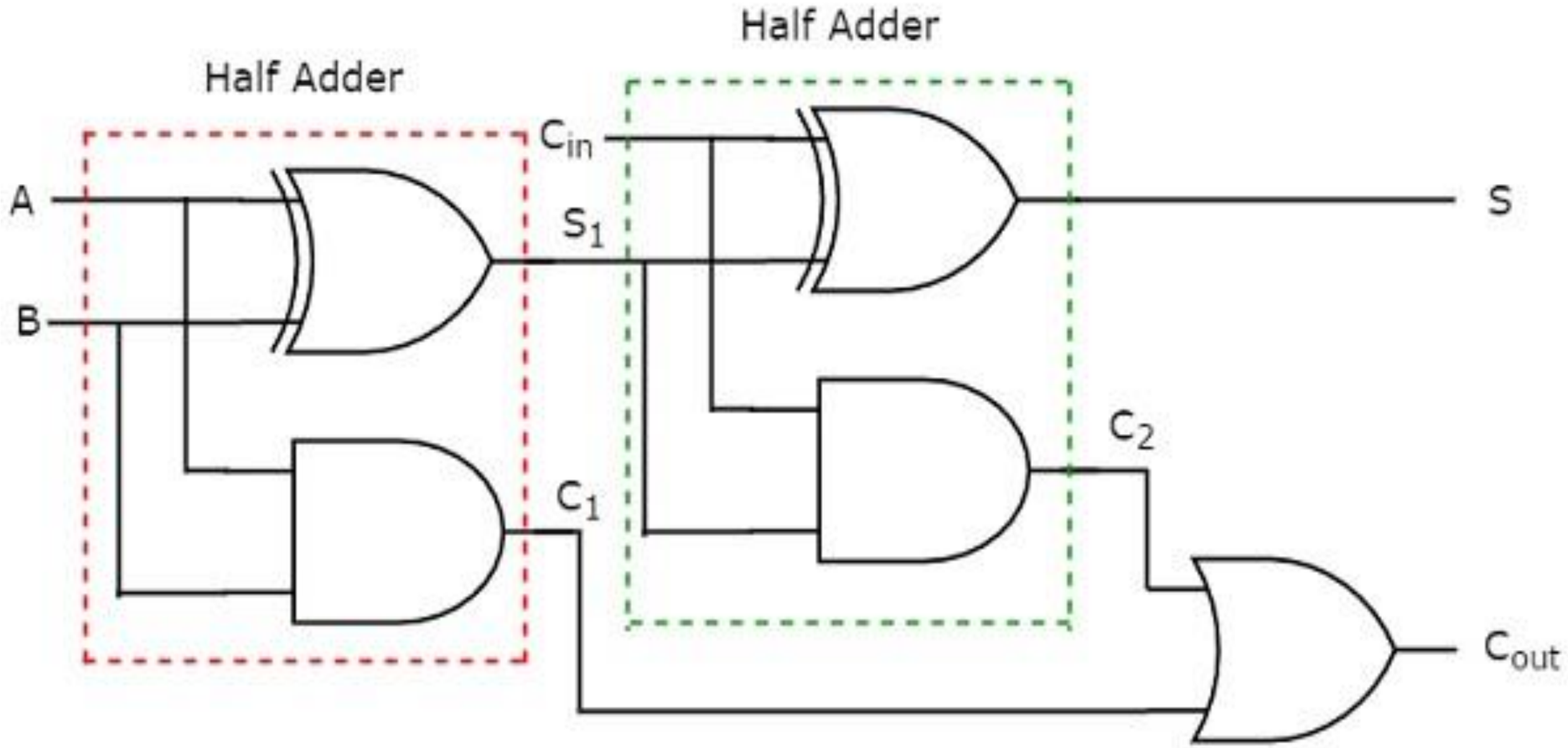
$$= C_{in}\,(\overline{A \oplus B}) + \bar{C}_{in}\,(A \oplus B)$$

$$= C_{in} \oplus (A \oplus B)$$

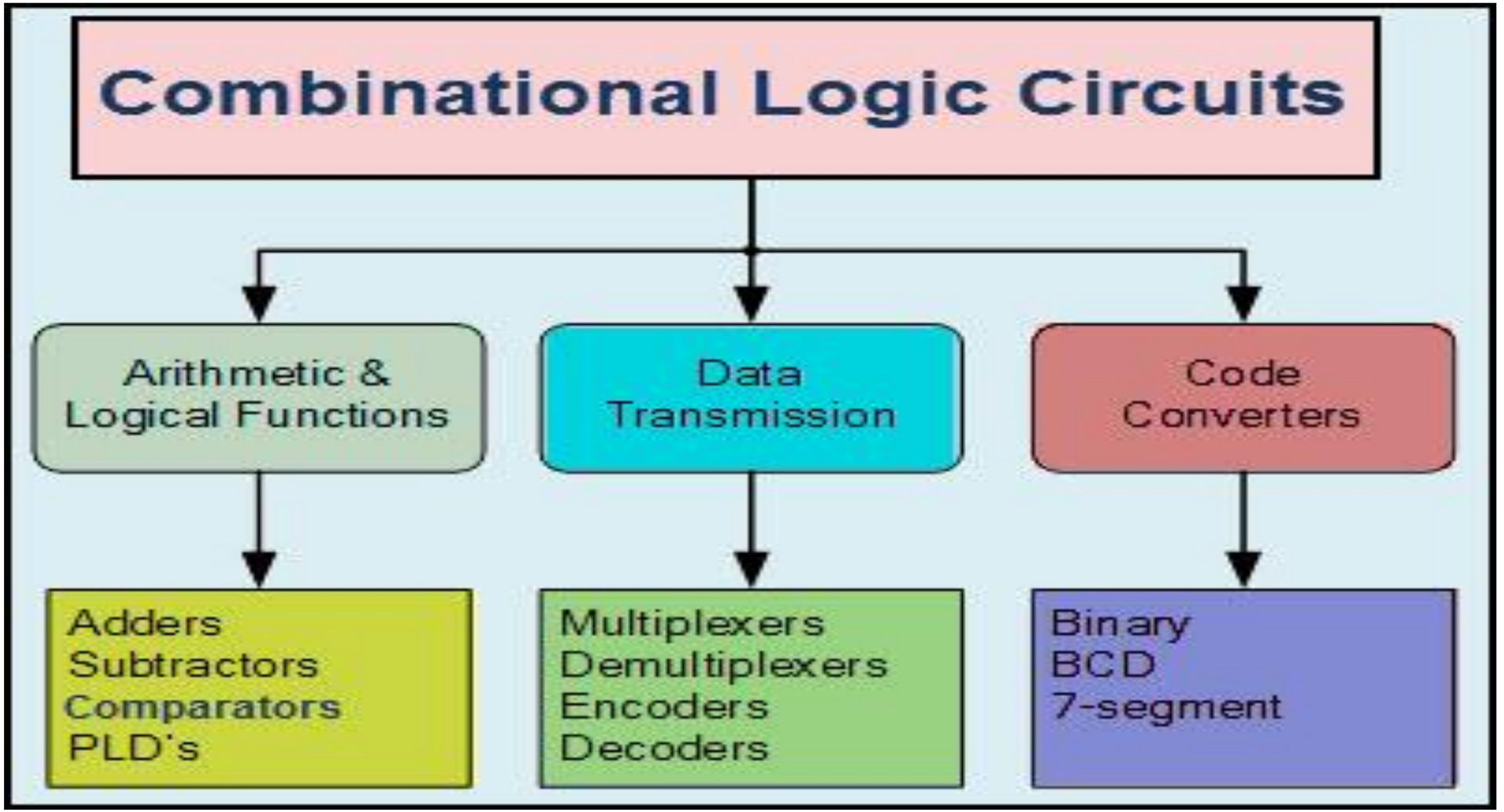
LOGICAL DIAGRAM



IMPLEMENTATION OF FULL ADDER USING TWO HALF ADDERS



APPLICATIONS OF COMBINATIONAL CIRCUITS



THANK YOU