



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

23ECB201 – Digital Systems Design

II YEAR/₁ III SEMESTER

UNIT 2 – COMBINATIONAL and SEQUENTIAL CIRCUITS

2.2 - Design Procedure - Subtractor



HALF SUBTRACTOR



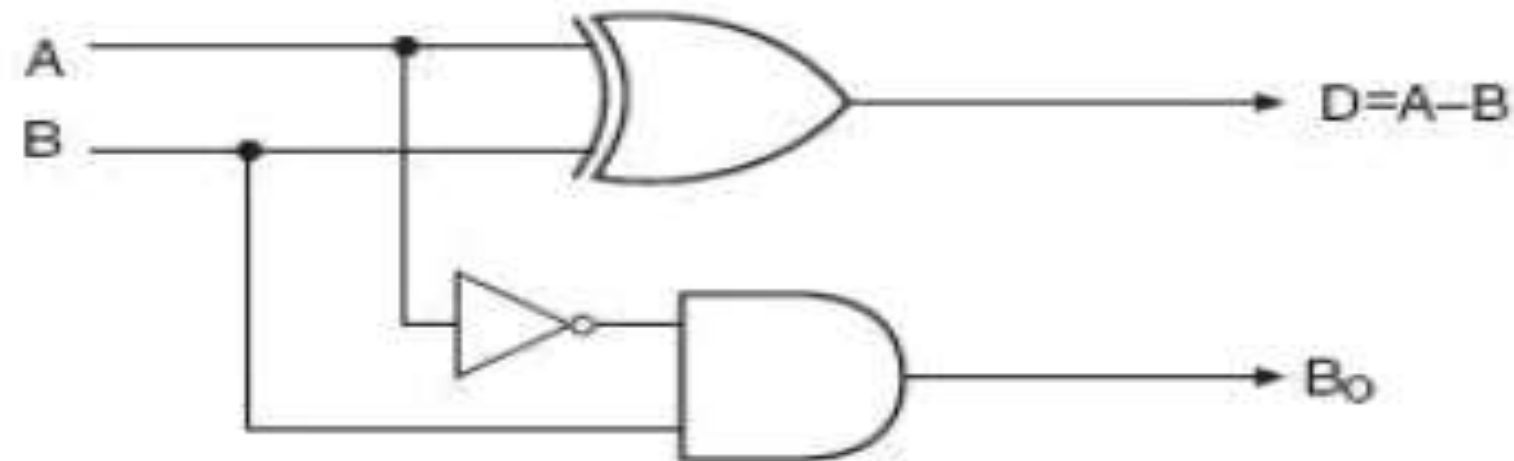
$$D = \bar{A}.B + A.\bar{B}$$

$$B_o = \bar{A}.B$$



A	B	D	B _o
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

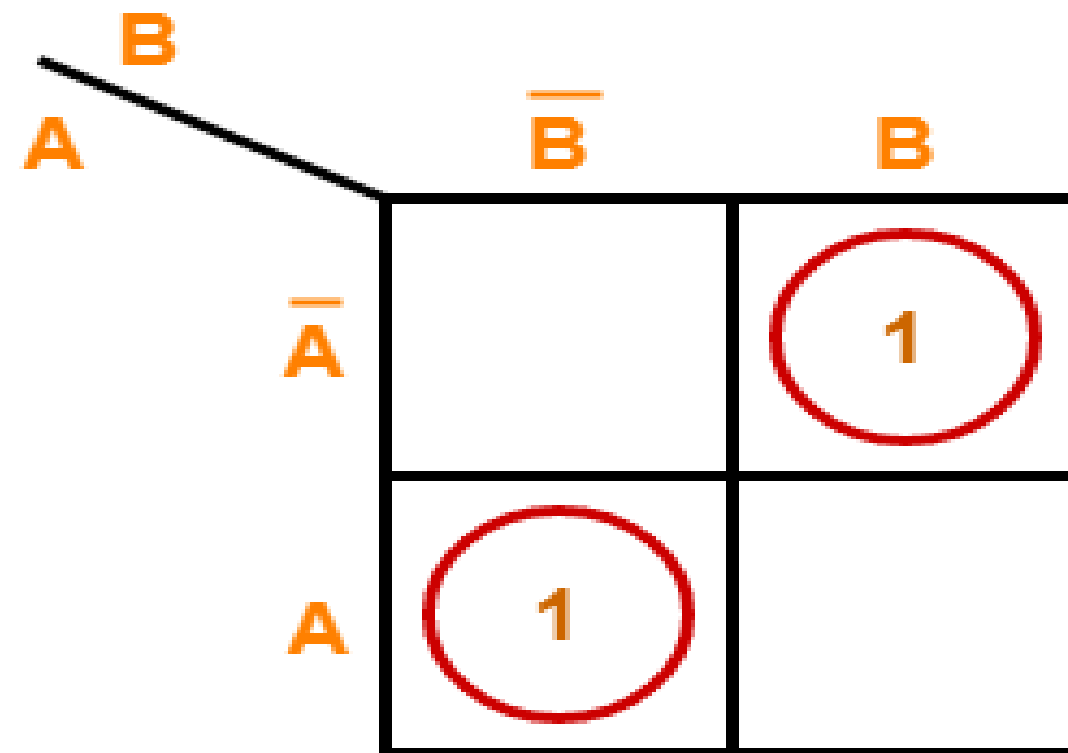
Half Subtractor





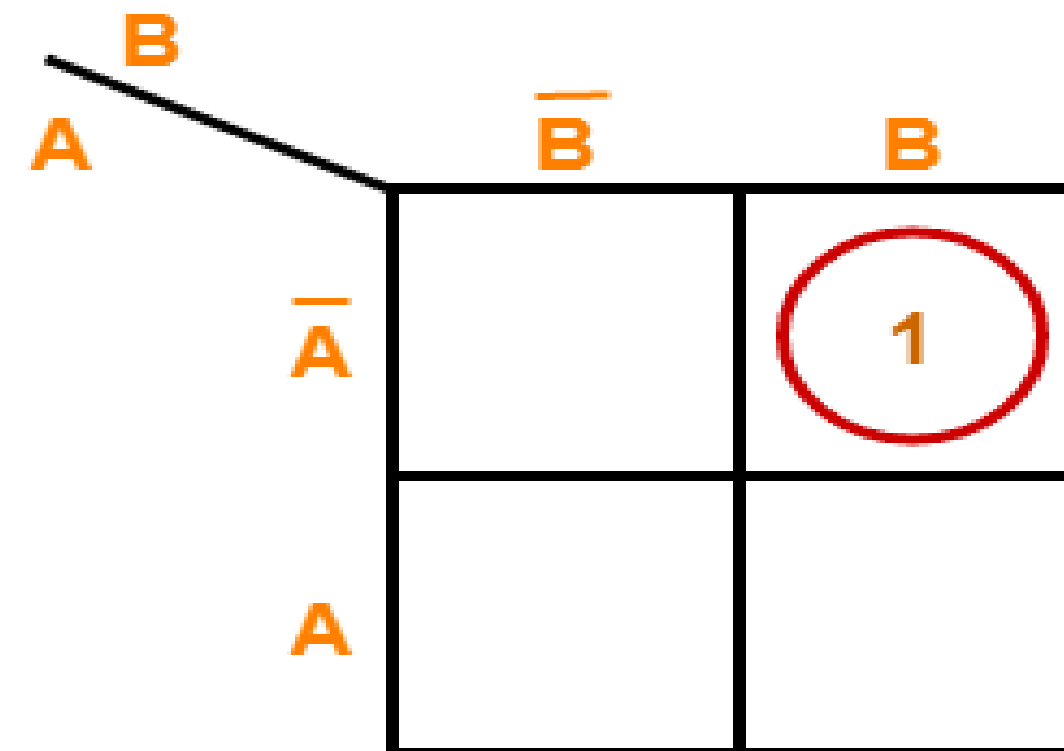
HALF SUBTRACTOR

For D:



$$D = A \oplus B$$

For b:

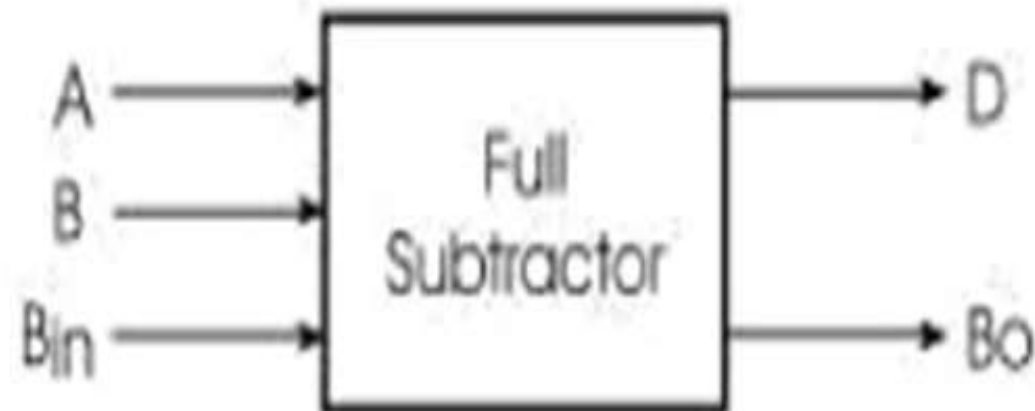


$$b = \bar{A}.B$$

K Maps



FULL SUBTRACTOR



Minuend (A)	Subtrahend (B)	Borrow In (B_{in})	Difference (D)	Borrow Out (B_o)
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1



FULL SUBTRACTOR



For Difference :-

A \ B	$B B_{in}$ 00	$\bar{B} B_{in}$ 01	$B \bar{B}_{in}$ 11	$\bar{B} \bar{B}_{in}$ 10
\bar{A} 0		1		1
A 1	1		1	

$$\therefore \text{Difference} = A \oplus B \oplus B_{in}$$

$$\begin{aligned} \therefore \text{Difference} &= \bar{A} \bar{B} B_{in} + \bar{A} B \bar{B}_{in} + A \bar{B} \bar{B}_{in} + A B B_{in} \\ &= \bar{A} (\bar{B} B_{in} + B \bar{B}_{in}) + A (\bar{B} \bar{B}_{in} + B B_{in}) \\ &= \bar{A} (B \oplus B_{in}) + A (B \odot B_{in}) = \bar{A} (B \oplus B_{in}) + A (\overline{B \oplus B_{in}}) \\ &= A \oplus B \oplus B_{in} = A \oplus B \oplus B_{in}. \end{aligned}$$

For B_{out} :-

A \ B	$B B_{in}$ 00	$\bar{B} B_{in}$ 01	$B \bar{B}_{in}$ 11	$\bar{B} \bar{B}_{in}$ 10
\bar{A} 0		1	1	1
A 1			1	

$$\therefore B_{out} = \bar{A} B + \bar{A} B_{in} + B B_{in}$$

$$\therefore B_{out} = \bar{A} B + \bar{A} B_{in} + B B_{in}$$



FULL SUBTRACTOR

For D:

	BB_{in}	$\bar{B}\bar{B}_{in}$	$\bar{B}B_{in}$	BB_{in}	$B\bar{B}_{in}$
\bar{A}		1			1
A	1		1		

$$D = A \oplus B \oplus B_{in}$$

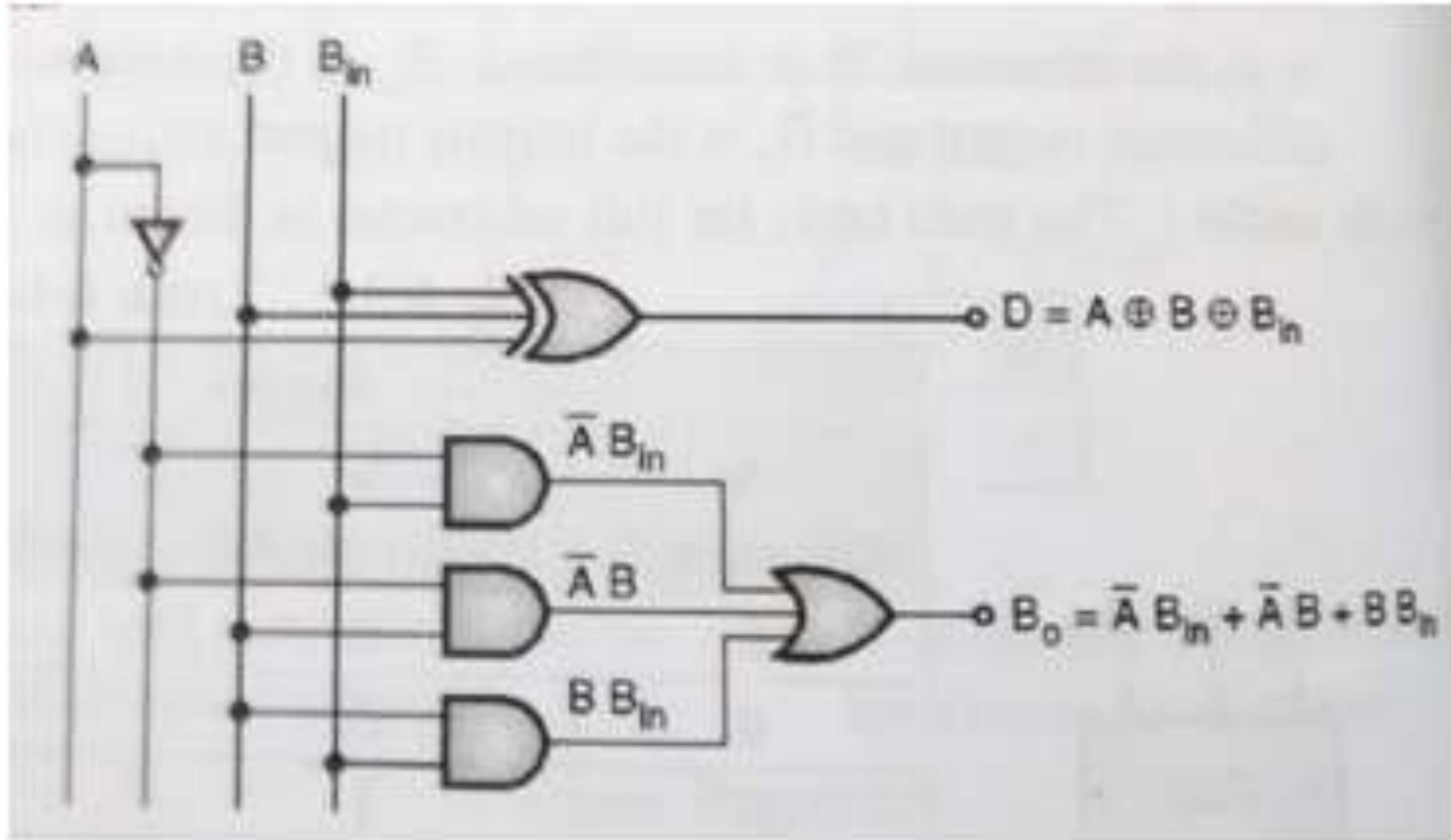
For B_{out} :

	BB_{in}	$\bar{B}\bar{B}_{in}$	$\bar{B}B_{in}$	BB_{in}	$B\bar{B}_{in}$
\bar{A}			1	1	1
A				1	

$$B_{out} = \bar{A}B + (\bar{A} + B)B_{in}$$

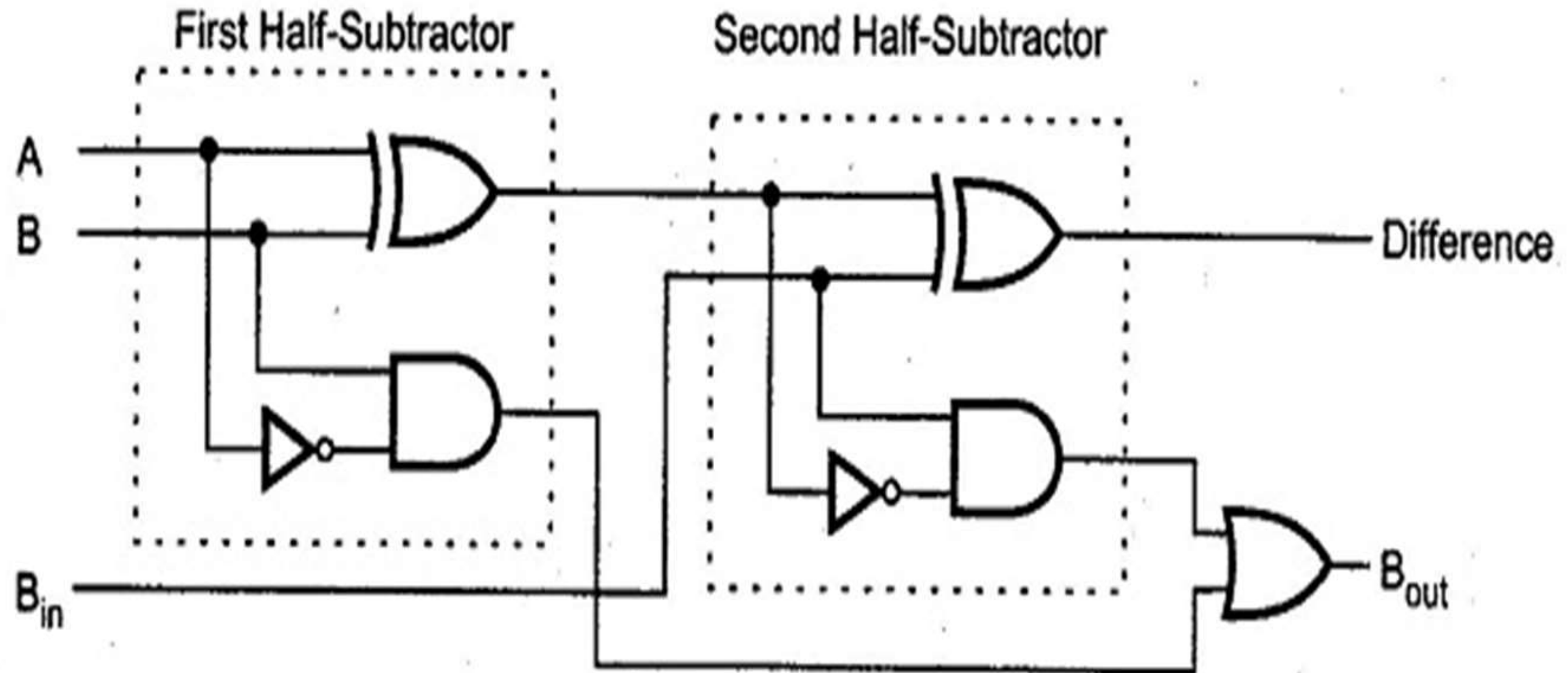


FULL SUBTRACTOR



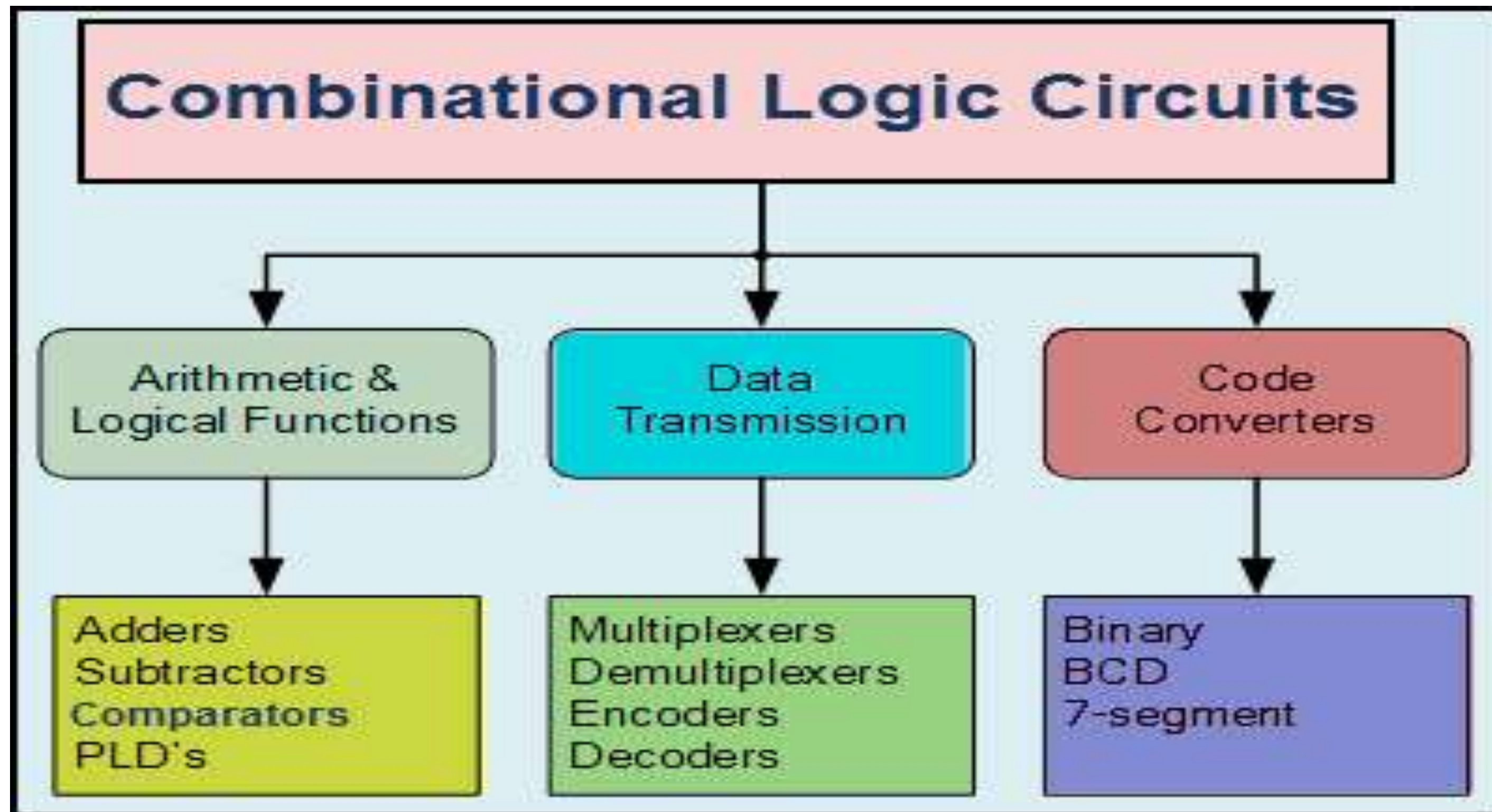


IMPLEMENTATION OF FULL SUBTRACTOR USING TWO HALF SUBTRACTORS





APPLICATIONS OF COMBINATIONAL CIRCUITS





ASSESSMENTS



1. Draw the block diagram of Half adder and Half subtractor.
2. Draw the logical diagram of Full adder.
3. What is Full subtractor?



THANK YOU