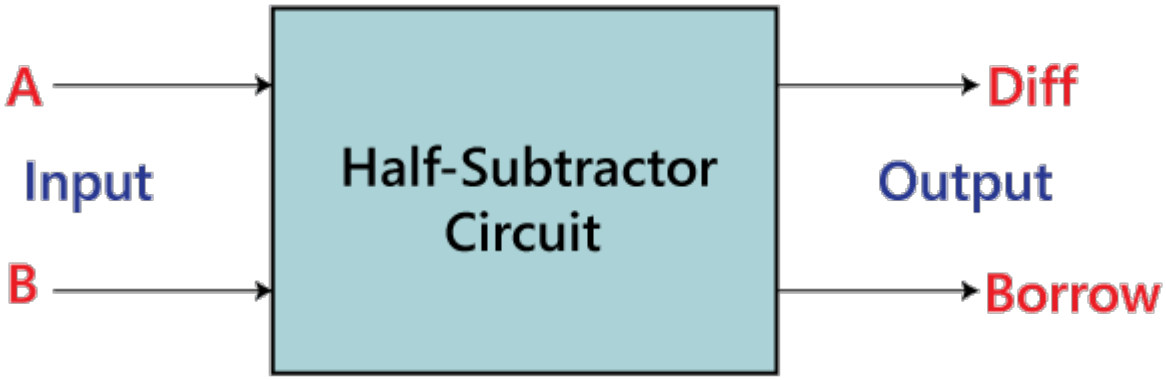
HALF SUBTRACTOR

- **Half Subtractor is a combinational logic circuit.**
- **It is used for the purpose of subtracting two single bit numbers.**
- **It contains 2 inputs and 2 outputs (difference and borrow).**

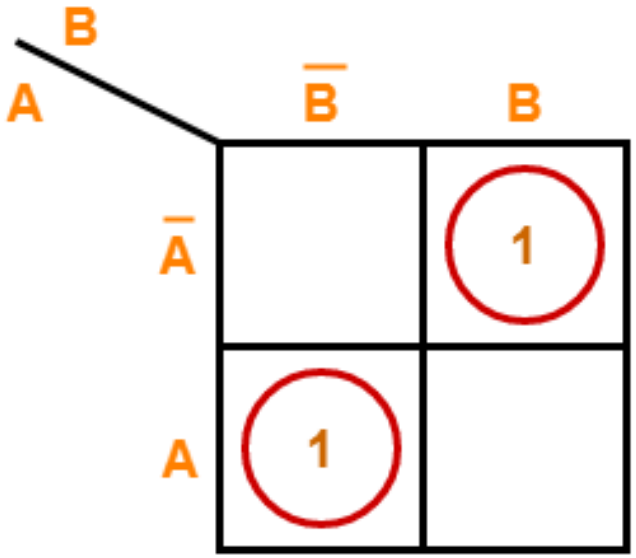

A
Input
B
Half-Subtractor
Circuit
Diff
Output
Borrow

Truth Table

INPUTS		OUTPUTS	
A	B	D (Difference)	B (Borrow)
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

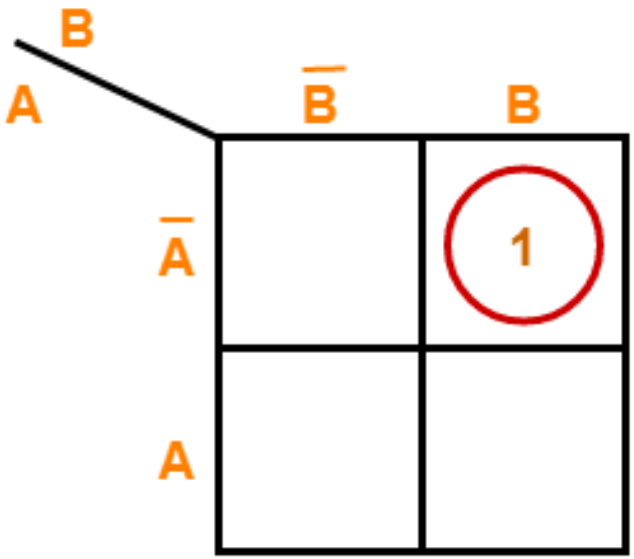
K-maps

For D:



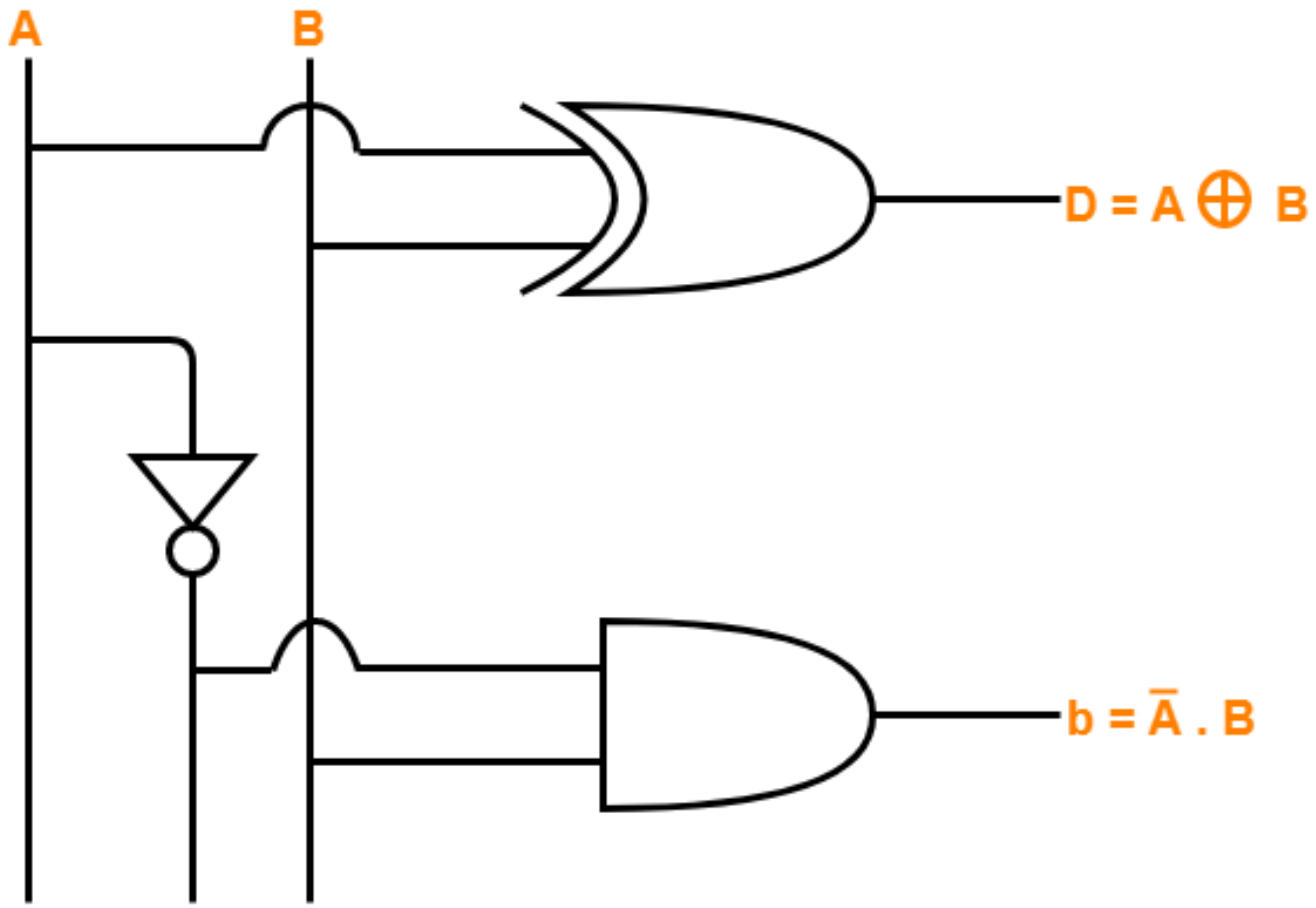
$D = A \oplus B$

For b:



$b = \overline{A}.B$

Logic Diagram



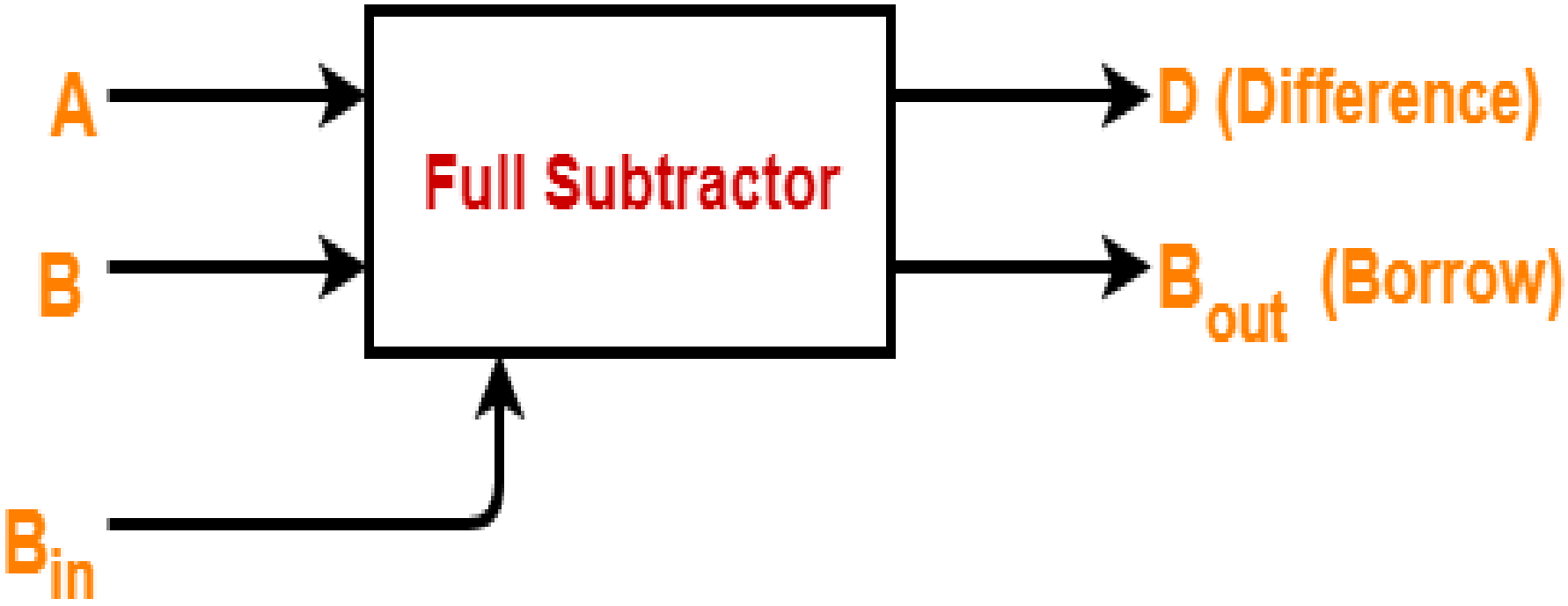
Half Subtractor Logic Diagram

Limitation of Half Subtractor

- Half subtractors do not take into account “Borrow-in” from the previous circuit.
- This is a major drawback of half subtractors.
- This is because real time scenarios involve subtracting the multiple number of bits which can not be accomplished using half subtractors.
- To overcome this drawback, Full Subtractor comes into play

Full subtractor

- **Full Subtractor is a combinational logic circuit.**
- **It is used for the purpose of subtracting two single bit numbers.**
- **It also takes into consideration borrow of the lower significant stage.**
- **Thus, full subtractor has the ability to perform the subtraction of three bits.**
- **Full subtractor contains 3 inputs and 2 outputs (Difference and Borrow) as shown-**



Block Diagram of Full Subtractor

Truth Table

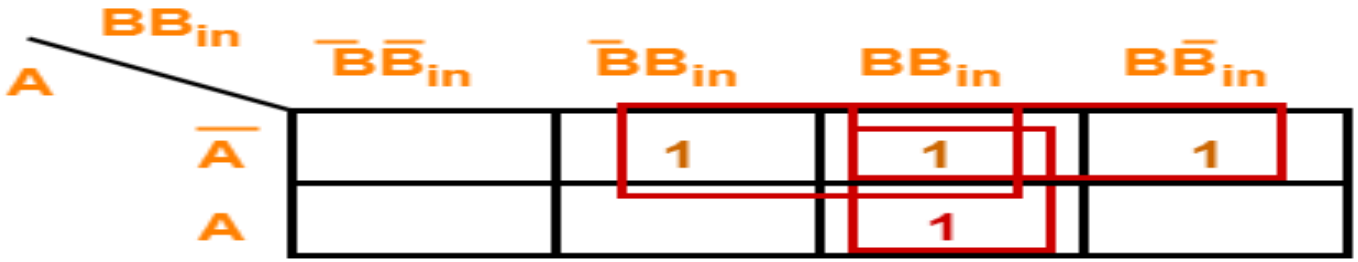
INPUTS			OUTPUTS	
A	B	B_{in}	B_{out}(borrow)	D(difference)
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

K-maps

For D:

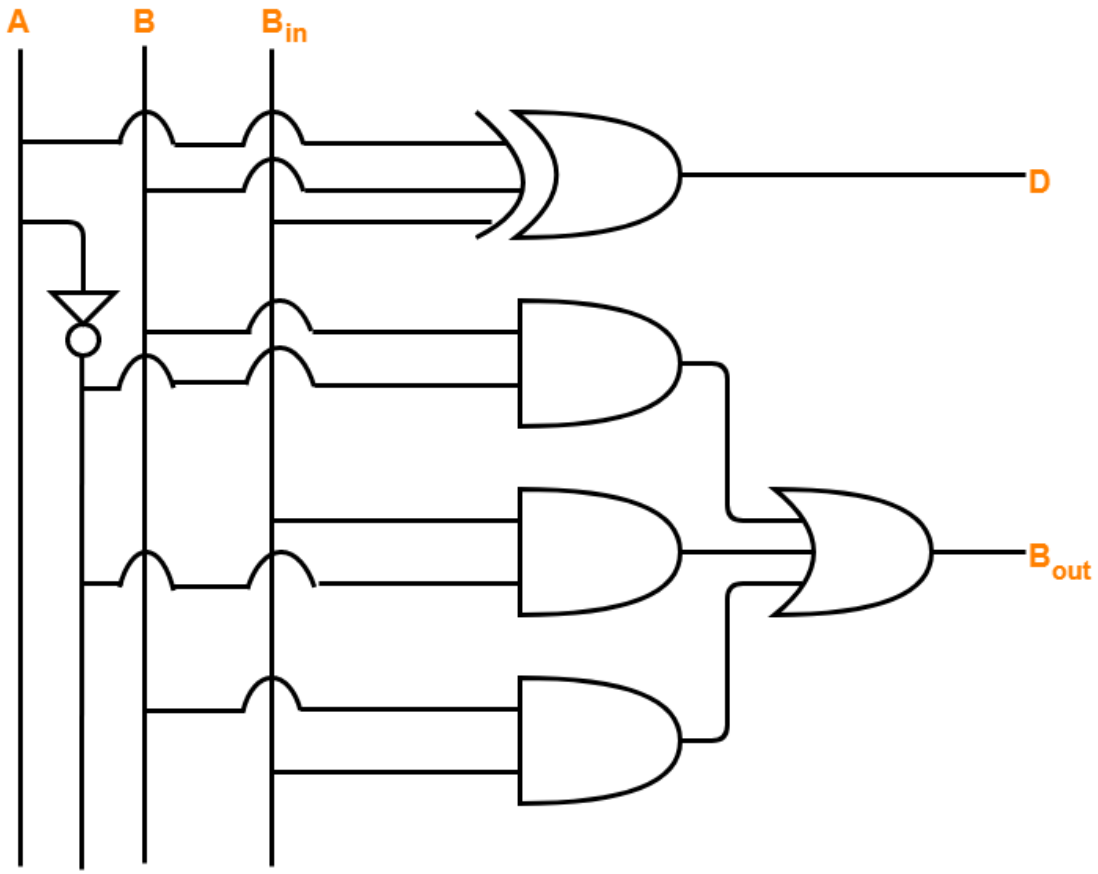
$$D = A \oplus B \oplus B_{in}$$

For B_{in}:



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

Logic diagram



Full Subtractor Logic Diagram