



Subtractor

- An Subtractor is a digital logic circuit in electronics that implements subtraction of numbers.
- In many computers and other kinds of processors, Subtractor are used not only in the arithmetic logic units, but also in other parts of the processor, where they are used to calculate addresses, increment and decrement operators, and similar operations.
- Subtractor are classified into two types: 1)half Subtractor.
2) full Subtractor.



Let us first take a look at the subtraction of single bits.

➤ $0-0 = 0$

➤ $0-1 = 11$ (i.e. $0-1 = 1$ with borrow = 1)

➤ $1-0 = 1$

➤ $1-1 = 0$



Half Subtractor

- ▶ The half Subtractor subtracts two single binary digits A and B .
- ▶ It has two outputs, Difference (D) and borrow (B).
- ▶ The borrow signal represents an overflow into the next digit of a multi-digit subtraction.



Truth Table

INPUTS		OUTPUTS	
A	B	DIFF	BORROW
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Solving truth table using K-map

	A	0	1
B	0	0	0
	1	1	0

For Borrow
Borrow = $\bar{A}.B$

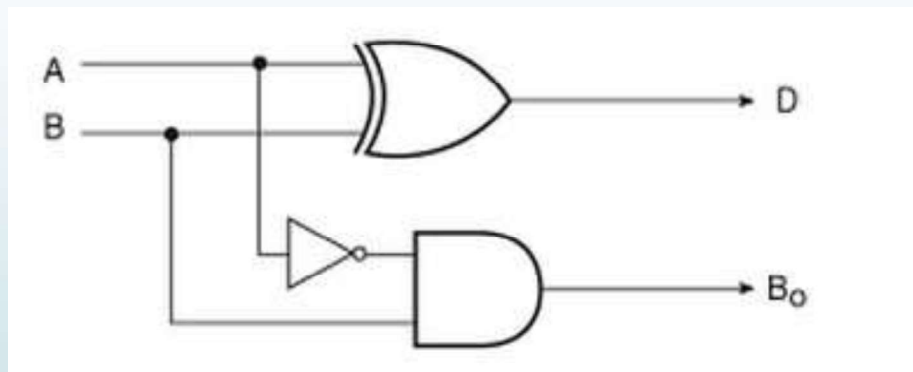
	A	0	1
B	0	0	1
	1	1	0

For Difference
Difference = $A \oplus B$

Analysing results

- ▶ No of inputs = 2
- ▶ No of outputs = 2
- ▶ Inputs are A , B.
- ▶ Outputs are Difference , Borrow.
- ▶ Difference can be obtained using XOR logic gate.
- ▶ Borrow can be obtained using NOT and AND logic gate.

Designing circuit





Full Subtractor

- A full Subtractor subtracts binary numbers and accounts for values borrowed in as well as out.
- The main difference between a half- Subtractor and a full- Subtractor is that the full- Subtractor has three inputs and two outputs.
- A one-bit full Subtractor subtracts three one-bit numbers, often written as A , B , and B_{in} .
- It has two outputs, Difference (D) and borrow (B).

Truth Table

A	INPUTS		OUTPUTS	
	B	BIN	BOUT	Difference
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	1	0
1	0	0	0	1
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

Solving Truth Table using K-Map

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

For Borrow

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

For Difference



Analysing results

- ▶ No of inputs = 3
- ▶ No of outputs = 2
- ▶ Inputs are A , B , B_{in} .
- ▶ Outputs are Difference, B_{out} .

Designing circuit

