Combinational Logic

Part II: Arithmetic Circuits

- Binary Adder and Subtractor
- Decimal Adder
- Binary Multiplier
- Magnitude Comparator

BINARY SUBTRACTOR

Binary Subtraction Circuits

Another basic arithmetic operation to be performed by Digital Computers is the Subtraction. Subtraction is a mathematical operation in which one integer number is deducted from another to obtain the equivalent quantity. The number from which other number is to be deducted is called as 'Minuend' and the number subtracted from the minuend is called 'Subtrahend'.

- Similar to the binary addition, binary subtraction is also has four possible basic operations. They are:
- 0 – 0 = 0
- 0 – 1 = (Borrow)1 1
- 1 – 0 = 1
- 1 – 1 = 0

Binary Subtraction Circuits

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Similar to the adder circuits, basic subtraction circuits are also of two types:

- Half Subtractor
- Full Subtractor

Half Subtractors

A Half Subtractor is a multiple output Combinational Logic Circuit that does the subtraction of two 1-bit binary numbers. It has two inputs and two outputs. The two inputs correspond to the two 1-bit binary numbers and the two outputs corresponds to the Difference bit and Borrow bit (in contrast to Sum and Carry in Half Adder).

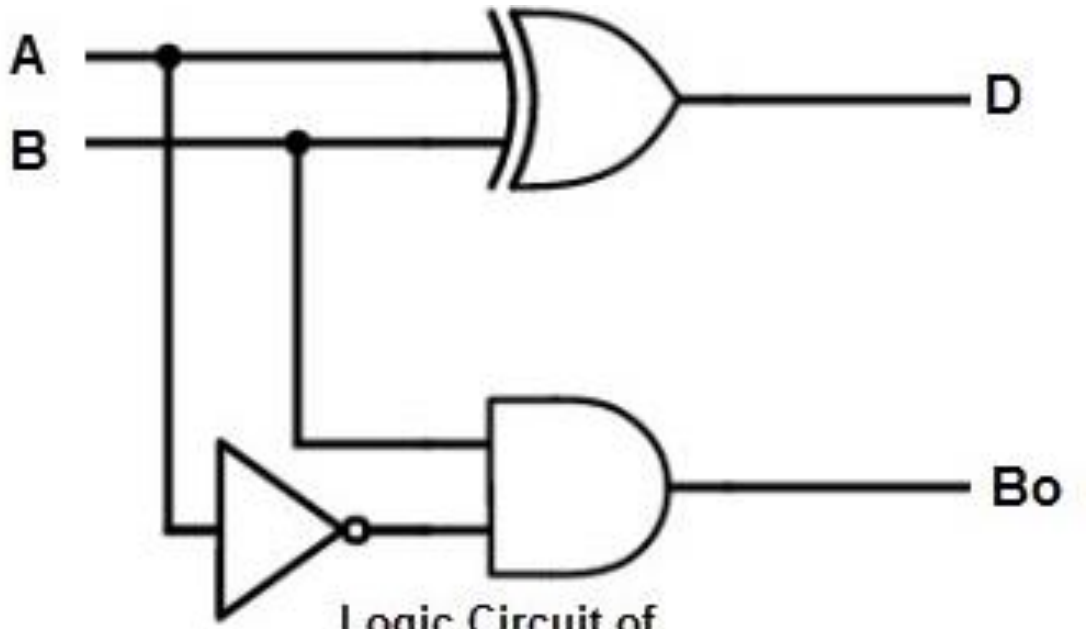
Truth Table

A	B	D	B_0
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

$D = A'B + AB' = A \oplus B$

$Bo = A'B$

Logic Circuit



Logic Circuit of
Half Subtractor

Assignment #3:

- Design a combinational circuit for Full Subtractor having 3 inputs (A,B,C) and 2 outputs, difference D and borrow bits B.

Truth Table

A	B	B_{in}	D	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**