

# 4-BIT BINARY ADDER-SUBTRACTOR

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**Abstract:-** In Digital Circuits, A binary Adder-Subtractor is a combinational circuit which is capable of performing binary addition and subtraction in one circuitry. The operation mode can be selected using control signal. This circuit majorly required the prerequisite knowledge on XOR gate.

## Reference Circuit details :-

→ The circuit shown in the reference diagram (a) has total of 9 input ports, In which a0 to a3 and b0 to b3 are the binary inputs, K is the control signal input which decides the mode of operation. Cin, c0 to c2 are the internal wires. S0 to s3 are the output ports with gives the addition or subtraction value depending on the selected mode and cout is also a output port which may give carry in case of addition and borrow in case of difference .

As it is 4 bit adder-subtractor we are using four xor gates and 4 one bit full adders.

The diagram (b) show the internal circuitry of the one bit full adder which is having 3 input ports(a,b,cin) and 2(cout,sum) output ports.

The gate used in the diagram a,b are:-

1. xor      3.or

2. and

boolean equations for full adder:-

$$\text{SUM} = A \oplus B \oplus C$$

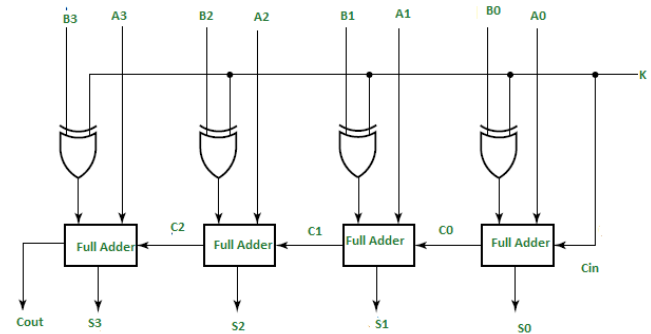
$$\text{CARRY} = A.B + A.C_{in} + B.C_{in}$$

boolean equations for full subtractor:-

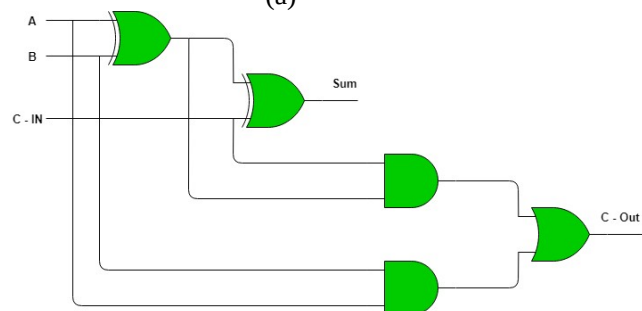
$$\text{DIFFERENCE} = A \oplus B \oplus C$$

$$\text{BORROW} = A'.B + A'.C_{in} + B.C_{in}$$

## Reference Circuit diagrams:-

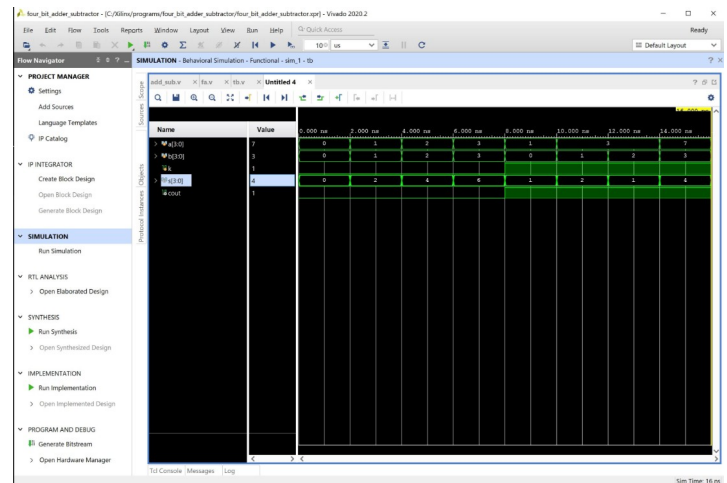


(a)



(b)one bit full adder

## Reference waveforms:-



## Reference Websites:-

→ <https://www.geeksforgeeks.org/4-bit-binary-adder-subtractor/>

→ <https://www.javatpoint.com/coa-binary-adder-subtractor>