N Bit Full adder and Subtractor

T.Priyanka & M.Priyanka

March 8, 2019

Bullet Points

- Let A and B be two N-bit inputs(which are N input buses, each) and Cin is input carry.
  Cin is 0 N-bit addition is performed when its 1 N-bit subtraction is performed.
- Output consists of N+1 bits i.e N bit sum or difference and 1 bit carry or borrow
- We can construct a N Bit Full Adder using four 1 Bit Full Adders in a specific way.
- Lets see how the Truth Table of a 1 Bit Full Adder looks.
- S = A.B.Cin + Cout!(A+B+Cin)
- Cout = A.B + B.Cin + Cin.A

A	B	Cin	S	Cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

{Table 2} : Truth Table of a 1 Bit Full Adder.

- For a N bit adder we have N bits in the A bus: An,A(n-1)...., A2, A1, A0 and N bits in the B bus: Bn,B(n-1),..., B2, B1, B0.
- Here, the bits An and Bn represent the MSB (Most Significant Bit).
- The corresponding bits are added, bitwise and if theres Carry generated its passed on to the next bit where it should be added.
- Since we are adding only two such numbers, N bits for Sum and one additional bit for Carry-Out would be sufficient.

- For a N Bit Subtractor, we can obtain the result using 2s complement of B.
- 2s complement of B would be B! + 1. Hence A - B = A + B! + 1.
- Hence by including an XOR gate just before sending the input bits of B to the Full Adder, we can get the operation of Subtraction.
- The two inputs to the XOR gate would be each individual B bit along with Cin.

The End