Assignment-3 (CS 232) by Utkarsh Ranjan

4-bit Ripple Carry Adder-Subtractor

Components

1 4-bit Ripple Carry Adder, 4 XOR gate

Gate Level Description

4-bit Ripple Carry Adder Subtractor ≡ 1 x 4-bit Half Adder + 4 x XOR Gate
≡ 8 x XOR gate + 8 x And gate + 4 x Or Gate + 4 x XOR Gate
≡ 12 x XOR gate + 8 x And gate + 4 x Or Gate

Description

- 3 Inputs: two 4-bit Strings (A , B) , one bit (Cin)
- 2 Outputs: one 4-bit String (Sum), one bit (Cout)

Idea

- A Binary Adder-Subtractor is one which is capable of both addition and subtraction of binary numbers in one circuit itself.
- The operation being performed depends upon the binary value the control signal holds.
- If cin=0 then A and A are added (a+b). If cin=1 then B should be subtracted from A (a-b)
- The idea is very simple since :=
    1. A xor 0 = A
    2. A xor 1 = -A
- We simply take the Xor of B and Cin, which makes sure that bits of B are inverted before feeding into the 4-bit ripple carry adder
- This ensures that the same 4-bit ripple carry adder performs subtraction when cin = 1 and addition when cin = 0.
- Also Cin of 4-bit ripple carry adder is 1 (i.e, Cin) when Cin is 1 which is also desired while preforming subtraction.