CS 232 Lab 3 Q1

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1-bit half-adder(`OnebitHalfAdd.vhd`)

I have designed the 1-bit half-adder using the basic gates i.e. NOT Gate, AND Gate and OR Gate in a structural way.

The 1-bit half-adder Logical Expression is as follows,

Sum = A XOR B = $(A + B).(\overline{A} + \overline{B})$
Carry(cout) = A.B

1-bit full-adder(`OnebitFullAdd.vhd`)

I have designed the 1-bit full-adder using only 1-bit half-adders and OR Gate.

The 1-bit full-adder Logical Expression are as follows,

Sum = (A XOR B) XOR cin = Half-Adder-SUM(Half-Adder-SUM(A,B), cin)

Cout = A AND B OR cin(A XOR B) = Half-Adder-COUT(A,B) + Half-Adder-COUT(cin, Half-Adder-SUM(A,B))

p = Half-Adder-SUM(A,B),
q = Half-Adder-COUT(A,B),
r = Half-Adder-COUT(cin, p),

sum = Half-Adder-SUM(p,cin),
cout = q + r

Therefore using the above shown way I created the 1-bit half-adder where 'a' and 'b' are the two 1-bit numbers that are to be added. 'cin' is the input carry that should be added with 'a' and 'b'. 'sum' and 'cout' are the sum and carry outputs respectively.

Half-Adders = 2
OR Gate = 1

Inside 1-bit Half Adder,
NOT Gate = 2
OR Gate = 2
AND Gate = 2