Cairo University
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Computer Engineering

Computer Architecture
Lab 2

Continue the design of a 8-bit ALU that accepts a 2 8-bit input values “A” , “B” and a 1-bit Cin and provides a 8-bit output “F” and a 1-bit output Cout. The ALU has 4-bit selection inputs “S” (S0->S3) and Cin input. The ALU will provide 16 operations according to the following table:

	S3	**S2**	**S1**	**S0**	**Cin =0**	Cin =1
Part A	0	0	0	0	F=A	F=A+1
	0	0	0	1	F=A+B	F=A+B+1
	0	0	1	0	F=A-B-1	F=A-B
	0	0	1	1	F=A-1	F=B
Part B	0	1	0	0	F = A or B, Cout = 0	
	0	1	0	1	F = A and B, Cout = 0	
	0	1	1	0	F = A nor B, Cout = 0	
	0	1	1	1	F = Not A, Cout = 0	
Part C	1	0	0	0	F = Logic shift left A, Cout = shifted bit	
	1	0	0	1	F = Rotate left A, Cout = rotated bit	
	1	0	1	0	F = Rotate Left A with carry (cin), Cout = rotated bit	
	1	0	1	1	F = 0000, Cout = 0	
Part D	1	1	0	0	F = Logic shift right A, Cout = shifted bit	
	1	1	0	1	F = Rotate right A, Cout = rotated bit	
	1	1	1	0	F = Rotate right A with carry (cin), Cout = rotated bit	
	1	1	1	1	F = Arithmetic Shift A	

Requirement:

1- Implement part A using fulladder not (+) or (-) in a separate file.
2- Compile your code without any errors or warning.
3- Integrate PartA with last time assignment (rest of the parts).
4- Add the following cases to your testbench.
Note: Borrow is the opposite of carry, you report carry.

Operation	A	B	Cin	F	Cout
F=A	F0	B0	0	F0	0
F=A+B	F0	B0	0	A0	1
F=A-B-1	F0	B0	0	3F	1
F=A-1	F0	B0	0	EF	1
F=A+1	F0	B0	1	F1	0
F=A+B+1	F0	B0	1	A1	1
F=A-B	F0	B0	1	40	1
F=B	F0	B0	1	B0	0

Assignment:

1- Modify ALU to be generic N-bit ALU.

2- Use quartus to synthesize your implementation.

3- Take a screen shot of the RTL design of PartA.

Operation	A	B	Cin	F	Cout
OR	F0	B0	-	F0	0
AND	F0	0B	-	00	0
NOR	F0	B0	-	0F	0
NOT	F0	-	-	0F	0

Operation	A	B	Cin	F	Cout
Logic shift left	F0	-	-	E0	1
Rotate left	F0	-	-	E1	1
Rotate left with cin	F0	-	0	E0	1
F=0000	F0	-	-	00	0
Logic shift right	F0	-	-	78	0
Rotate right	F0	-	-	78	0
Rotate right with cin	F0	-	0	78	0
Arithmetic shift right	F0	-	-	F8	0
Rotate left with cin	F0	-	1	E1	1
Rotate right with cin	F0	-	1	F8	0