Cairo University

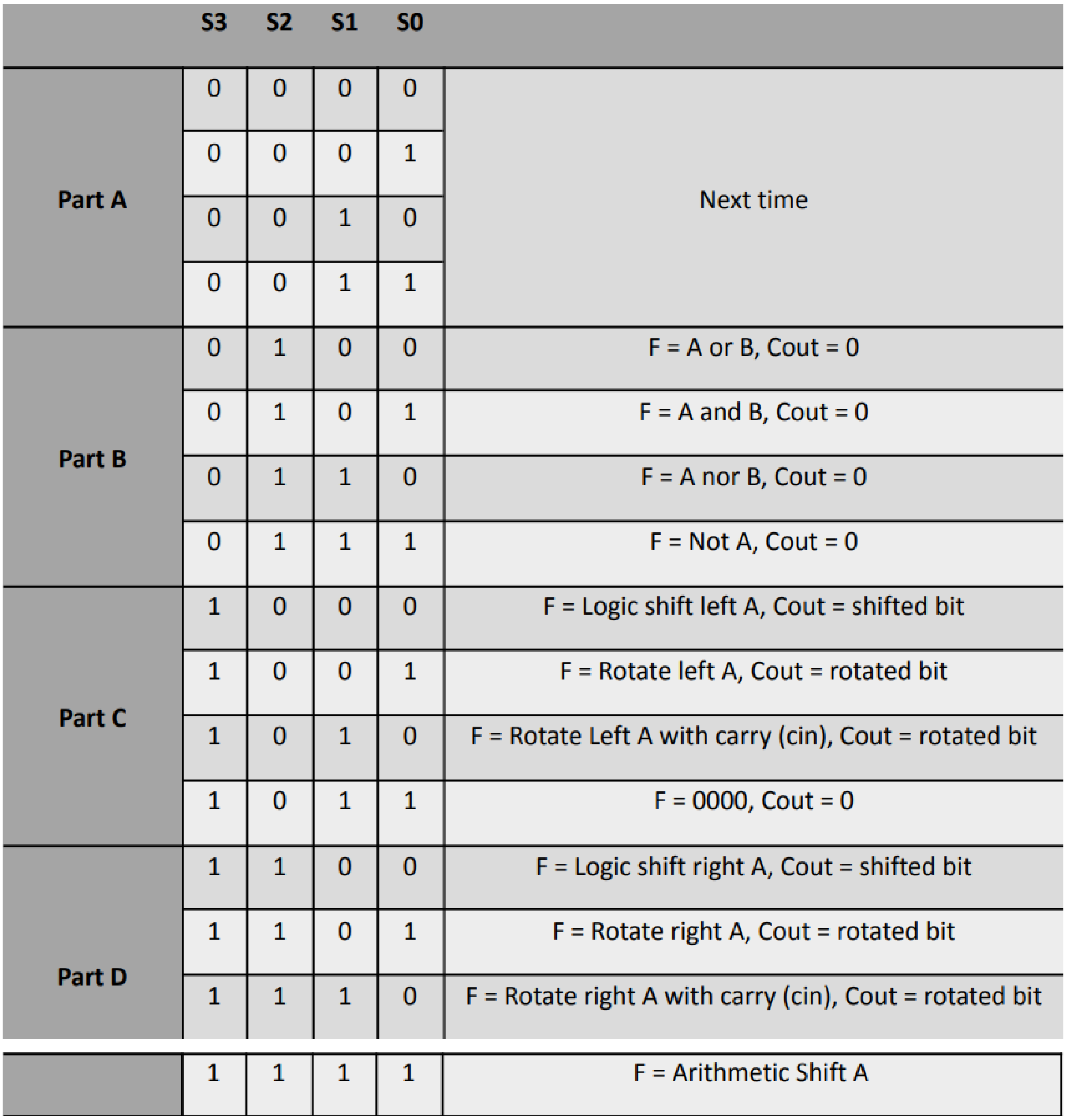
Faculty of Engineering

Computer Engineering

Computer Architecture

Lab 1

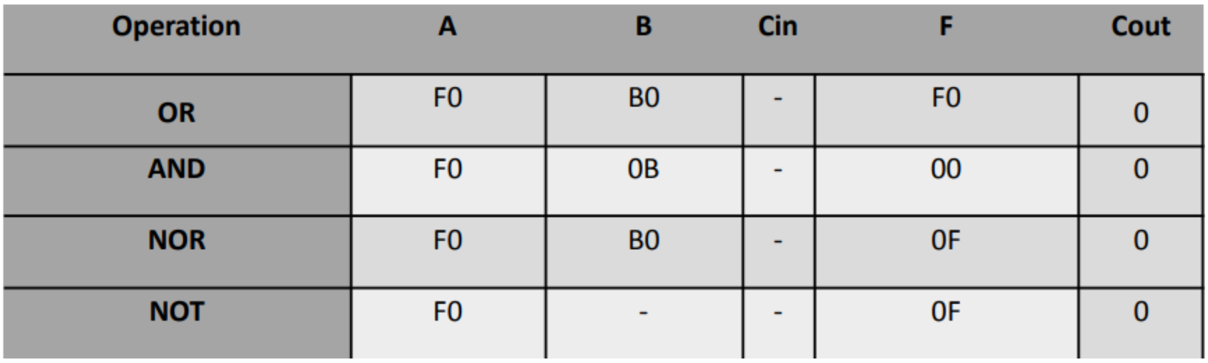
You are required to design a 8-bit ALU that accepts 2 8-bit input values "A" and "B" and provides a 8-bit output "F" and a 1-bit output Cout. The ALU has 4-bit selection inputs "S" (S3->S0) and Cin input. The ALU will provide 16 operations according to the following table:



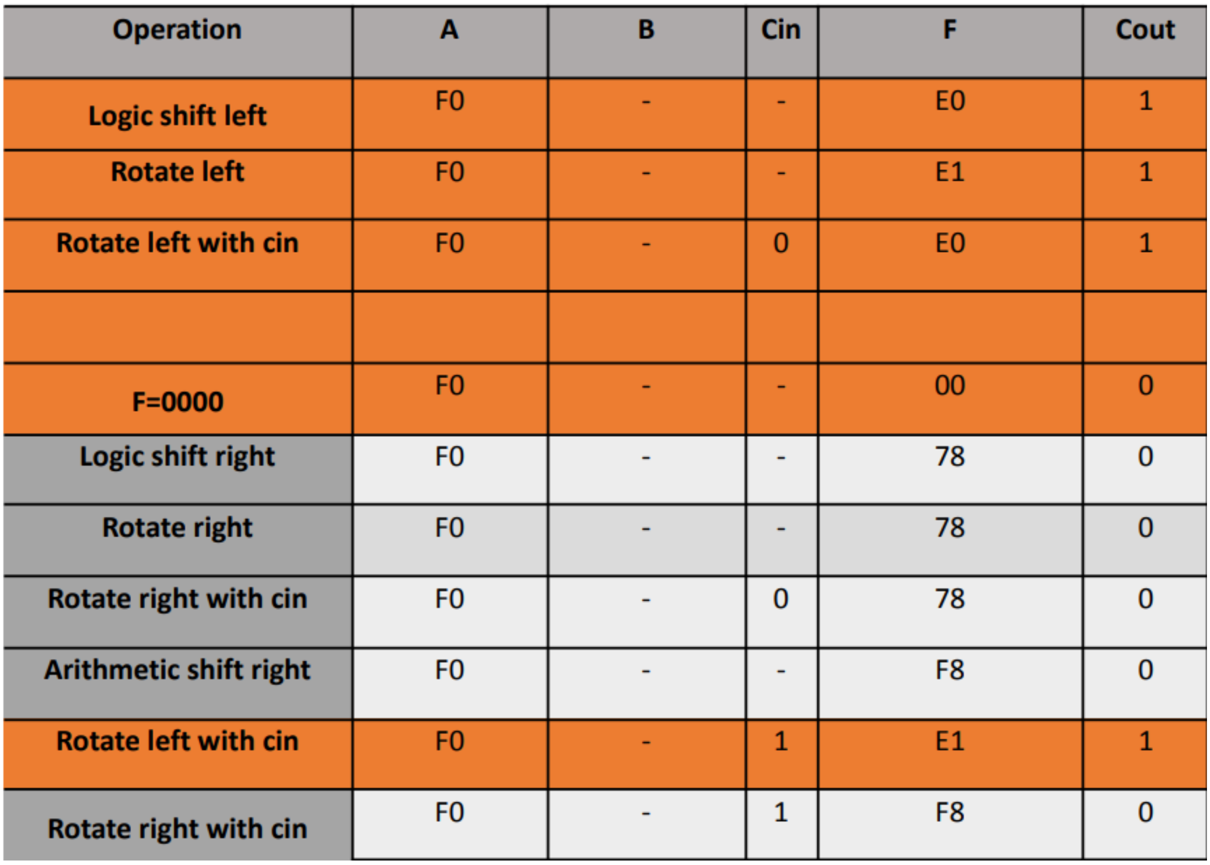
	S3	S2	S1	S0	
Part A	0	0	0	0	Next time
	0	0	0	1	
	0	0	1	0	
	0	0	1	1	
Part B	0	1	0	0	F = A or B, Cout = 0
	0	1	0	1	F = A and B, Cout = 0
	0	1	1	0	F = A nor B, Cout = 0
	0	1	1	1	F = Not A, Cout = 0
Part C	1	0	0	0	F = Logic shift left A, Cout = shifted bit
	1	0	0	1	F = Rotate left A, Cout = rotated bit
	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 B, C, D
2- Compile your code without any errors or warnings
3- Create a new component to integrate part B,C,D using a multiplexer
4- Test the code you implemented using the testcases in the table below "in order" where S = 01 chooses part B, S= 10 chooses part C, S = 11 chooses part D.



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

Rules:

1. Name every entity and its file exactly as is. E.g. (B, C, D, ALU)
2. Name every architecture as: Arch+Entity name. E.g. (ArchB, ArchC, ArchD, ArchALU)
3. Name selector as S(3 DOWNTO 0), A as A (7 DOWNTO 0), same for B and F
4. Declare ports ordered as (A, B, Cin(if any), S, F, Cout)