

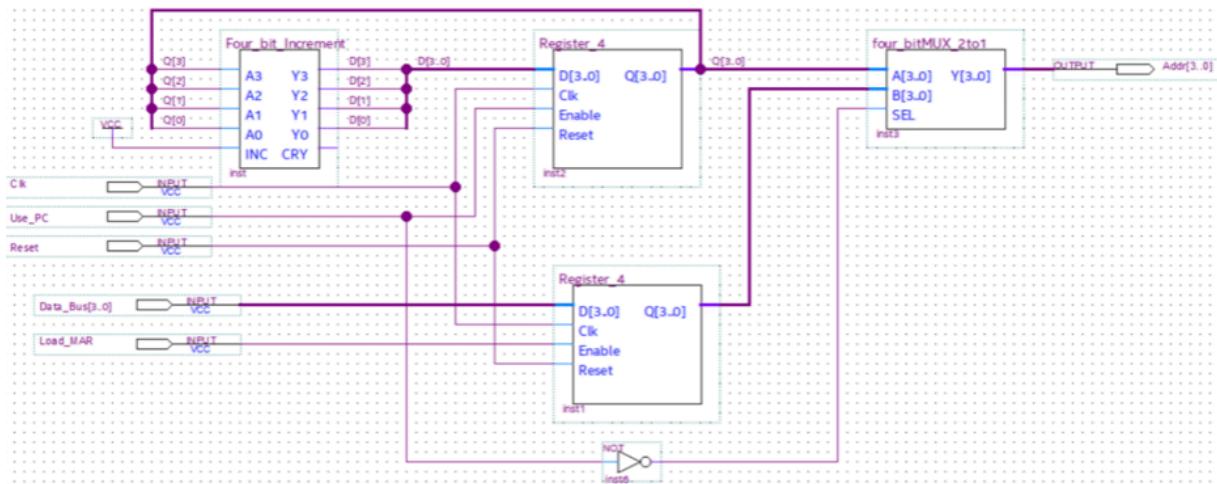
CSE/EEE 120

Lab 4 Answer Sheet The Complete Microporocessor

Name: Vishwas Mani Instructor/Time: Matar, Tuesday Thurs

Date: Task 4-1: Build and Test the Memory-Address-Generation Circuit

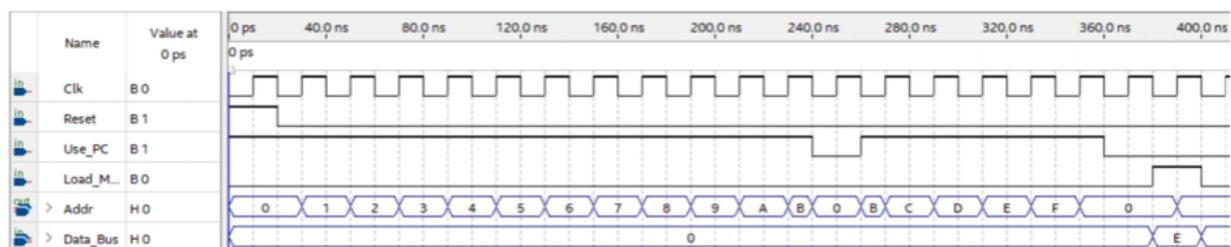
Include a picture of your Quartus circuit here:



Please comment on the single biggest issue you were facing when designing the circuit.

I faced no issues

Include a picture of your Quartus simulation (timing diagram) here:



Did the circuit behave as expected? If no, what was wrong?

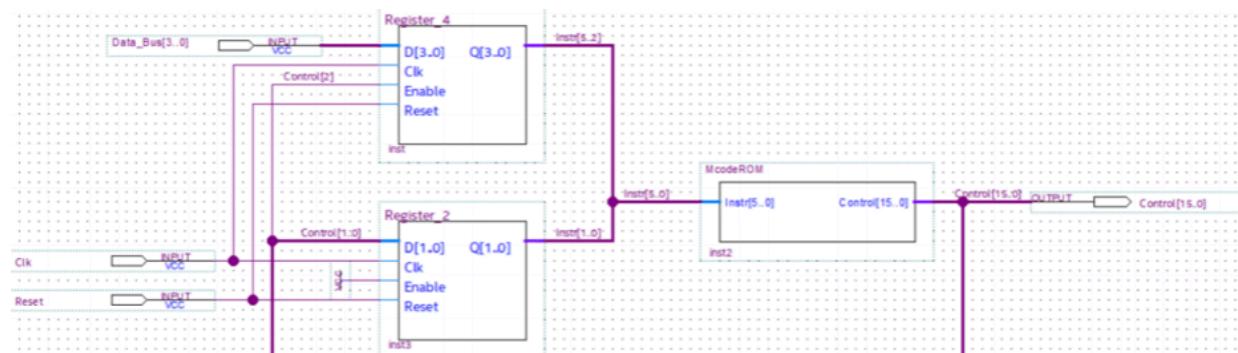
Yes

Please comment on the single biggest issue you were facing when simulating the circuit.

I faced no big issue

Task 4-2: Build and Test the Controller Circuit

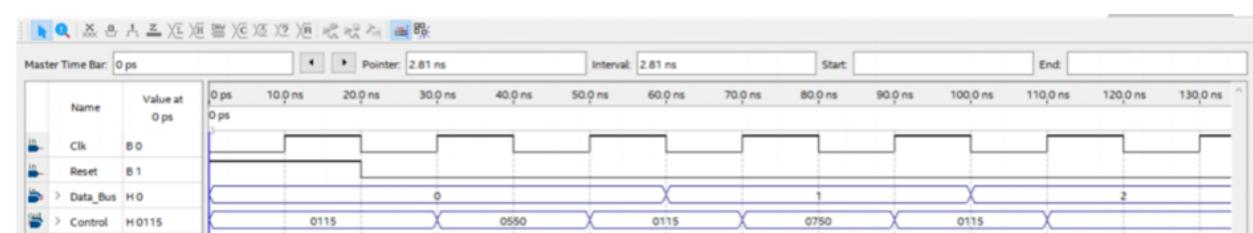
Include a picture of your Quartus circuit here:



Please comment on the single biggest issue you were facing when designing the circuit.

I faced no big issue

Include a picture of your Quartus simulation (timing diagram) here:



Did the circuit behave as expected? If no, what was wrong?

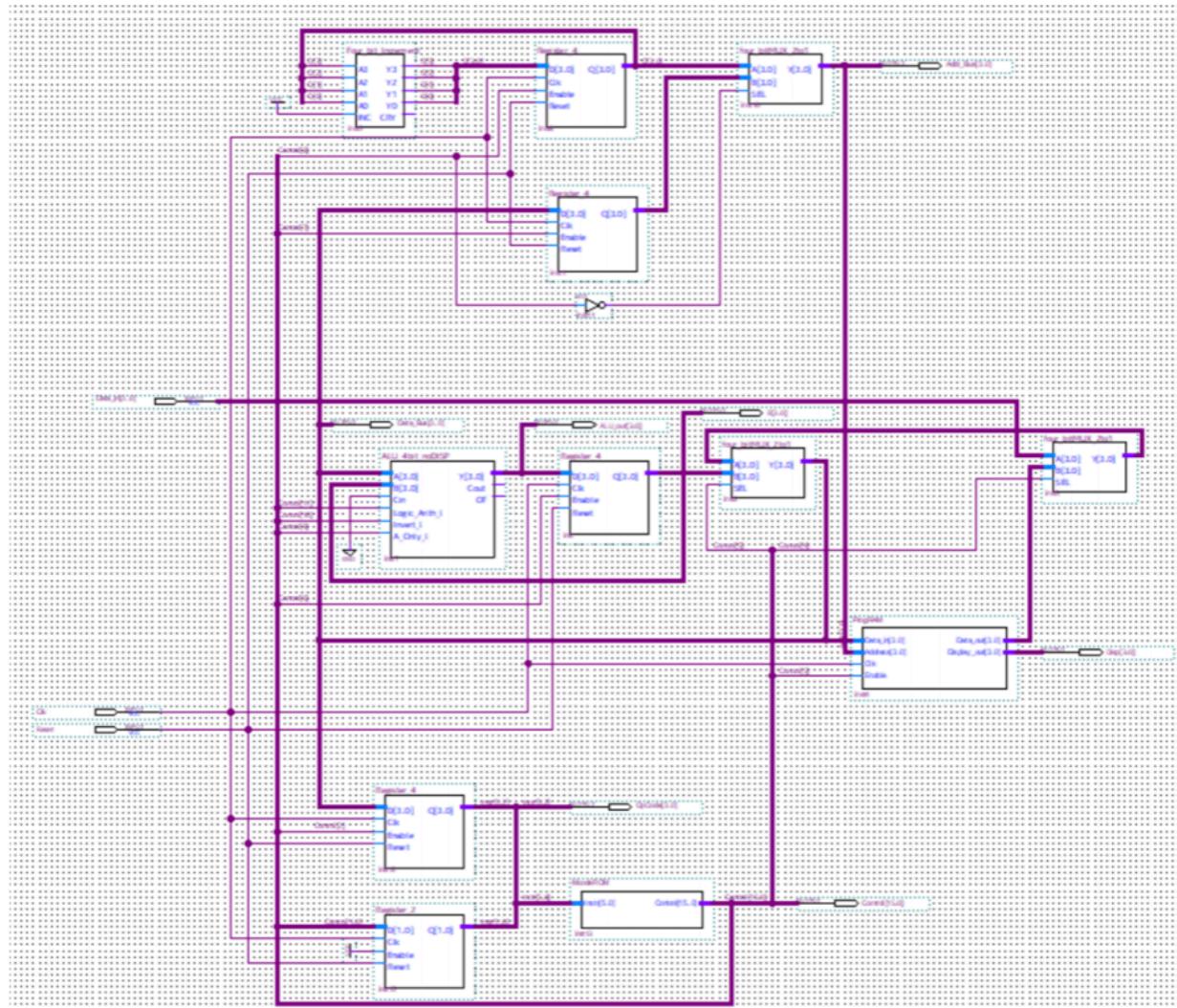
Yes it did

Please comment on the single biggest issue you were facing when simulating the circuit.

I faced no big issue

Task 4-3: Build the Complete Microprocessor Circuit

Include a picture of your Quartus circuit here:

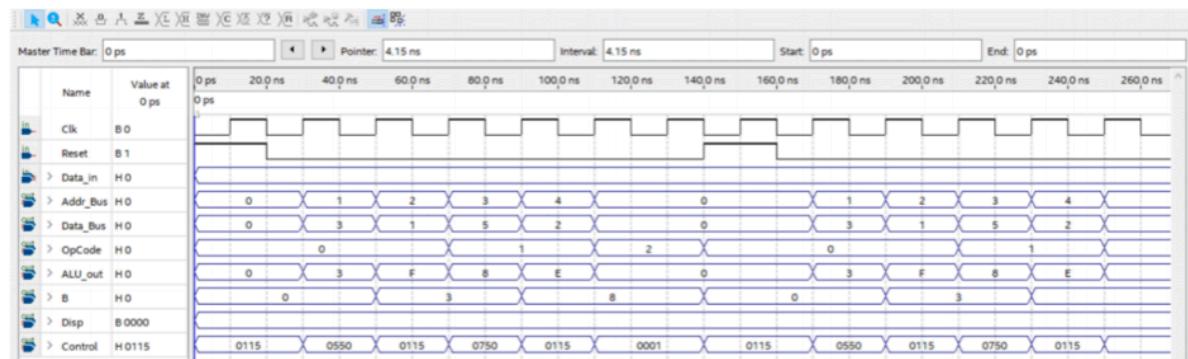


Please comment on the single biggest issue you were facing when designing the circuit.

I faced no big issue

Task 4-4: Write and Execute a Simple Program for Your Microprocessor in Simulation

Include pictures of your Quartus simulations (timing diagrams) here:



Did the circuit behave as expected? If no, what was wrong?

Yes it did

Please comment on the single biggest issue you were facing when simulating the circuit.

Task 4-5: Add the ‘AND’, ‘Zero’, ‘Subtract’, and ‘Store ACC’ Instructions

Use Table 1 and Table 2 to enter your values into the microinstruction definition table for each of the four instructions asked for in the laboratory manual. Be sure to label the name of each and every instruction.

Table 1

Instruction	Opcode				
		3		4	
		00	01	02	03
Description	Pin number				
Next State Bits	1-0	01	00	00	00
		01	00	00	00

Load IR	2	1	0	0	0	1	0	0	0
Write	3	0	0	0	0	0	0	0	0
Read	4	1	1	0	0	1	0	0	0
ACC to Data Bus	5	0	0	0	0	0	0	1	0
Load ACC	6	0	0	0	0	0	1	0	0
Load MAR	7	0	0	0	0	0	1	0	0
Use PC	8	1	1	0	0	1	1	0	0
/~A_only	9	x	1	0	0	x	x	x	0
/~Invert	10	x	0	0	0	x	x	x	0
Logic/~Arith	11	0	0	0	0	0	1	0	0
X	12	x	x	0	0	x	x	x	0
X	13	x	x	0	0	x	x	x	0
X	14	x	x	0	0	x	x	x	0
X	15	x	x	0	0	x	x	x	0
	HEX equiv	01 15	13 50	00 00	00 00	01 15	192 192	00 28	00 00

Table 2

Description	Pin number	Instruction				Subtract				Store ACC			
		Opcode		5		6		7		8		9	
		Pres. State	00	01	02	03	00	01	02	03	00	01	02
Next State Bits	1-0	01	00	00	00	01	10	00	00	01	10	00	00
Load IR	2	1	0	0	0	1	0	0	0	1	0	0	0
Write	3	0	0	0	0	0	0	0	0	0	1	0	0
Read	4	1	1	0	0	1	1	0	0	1	0	0	0
ACC to Data Bus	5	0	0	0	0	0	0	0	0	0	1	0	0
Load ACC	6	0	1	0	0	0	0	0	0	0	0	0	0
Load MAR	7	0	0	0	0	0	0	1	0	0	0	0	0
Use PC	8	1	1	0	0	1	1	0	0	1	0	0	0
/~A_only	9	x	1	0	0	x	x	x	x	x	x	x	0
/~Invert	10	x	0	0	0	x	x	x	x	x	x	x	0
Logic/~Arith	11	x	0	0	0	x	x	x	x	x	x	x	0
X	12	x	x	0	0	x	x	x	x	x	x	x	0
X	13	x	x	0	0	x	x	x	x	x	x	x	0
X	14	x	x	0	0	x	x	x	x	x	x	x	0
X	150	x	x	0	0	x	x	x	x	x	x	x	0
	HEX equiv	0115	0350	0000	0000	0115	0192	0028	0000				

Test your instructions by writing and executing programs. Record at least four programs and the output of each program in tables like that of Table 3.

Table 3		
Program #0 (Example: ADD = 3+5)		
Address	Value	Operation (In English)
0	0	The 'Load ACC' Opcode
1	3	The number '3' to be loaded into the Accumulator
2	1	The 'Add to ACC' Opcode
3	5	The number '5' to be added to the Accumulator
4	2	The 'Stop' Opcode
What was the final output of your program? <u>8</u>		
Was the program successful? <u>YES</u>		
If not what error(s) did you find in your circuit?		

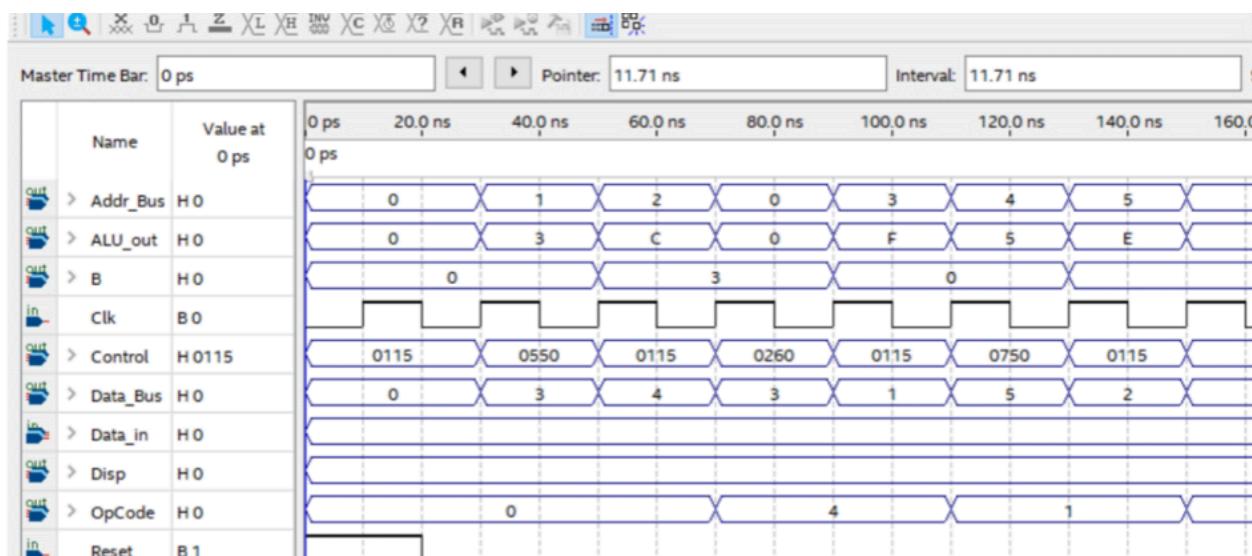
Program # ()		
Address	Value	Operation (In English)
0	0	The Load ACC Opcode
1	5	The number 5 to be loaded into the Accumulator
2	5	Subtract from ACC opcode
3	3	3 to be subtracted
4	2	Stop Opcode
What was the final output of your program? <u>2</u>		
Was the program successful? <u>Yes</u>		
If not what error(s) did you find in your circuit?		

Include pictures of your Quartus simulations (timing diagrams) here (one diagram for each program):

Program 1:



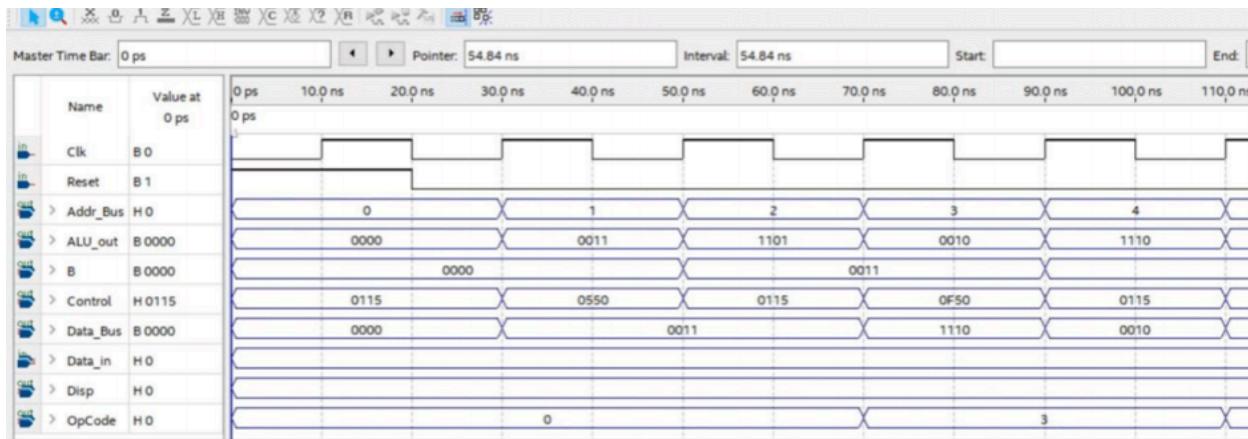
Program 2:



Program 3:

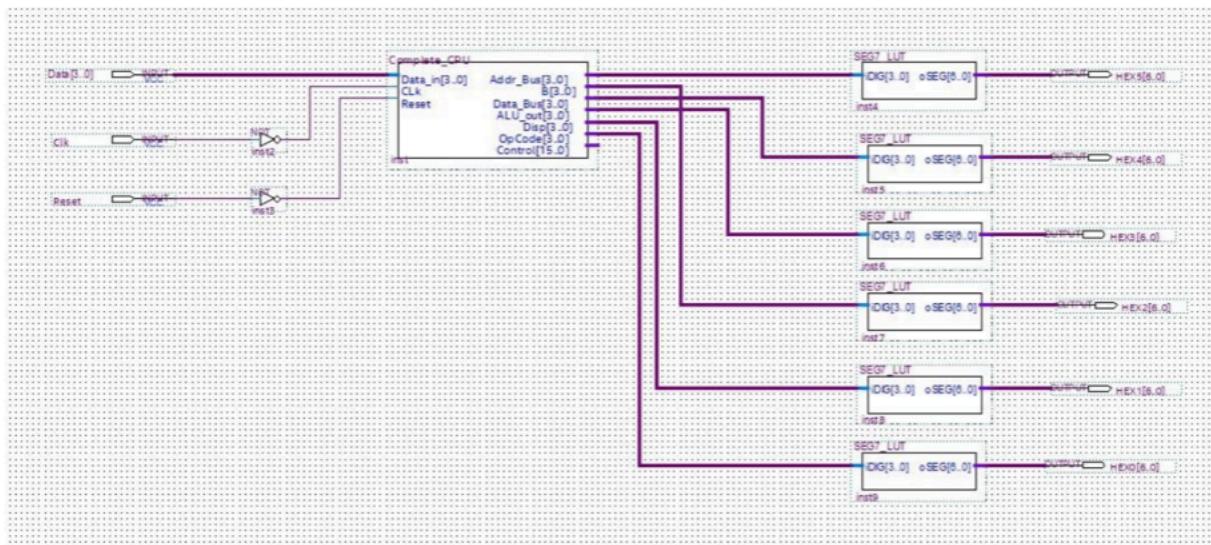


Program 4:

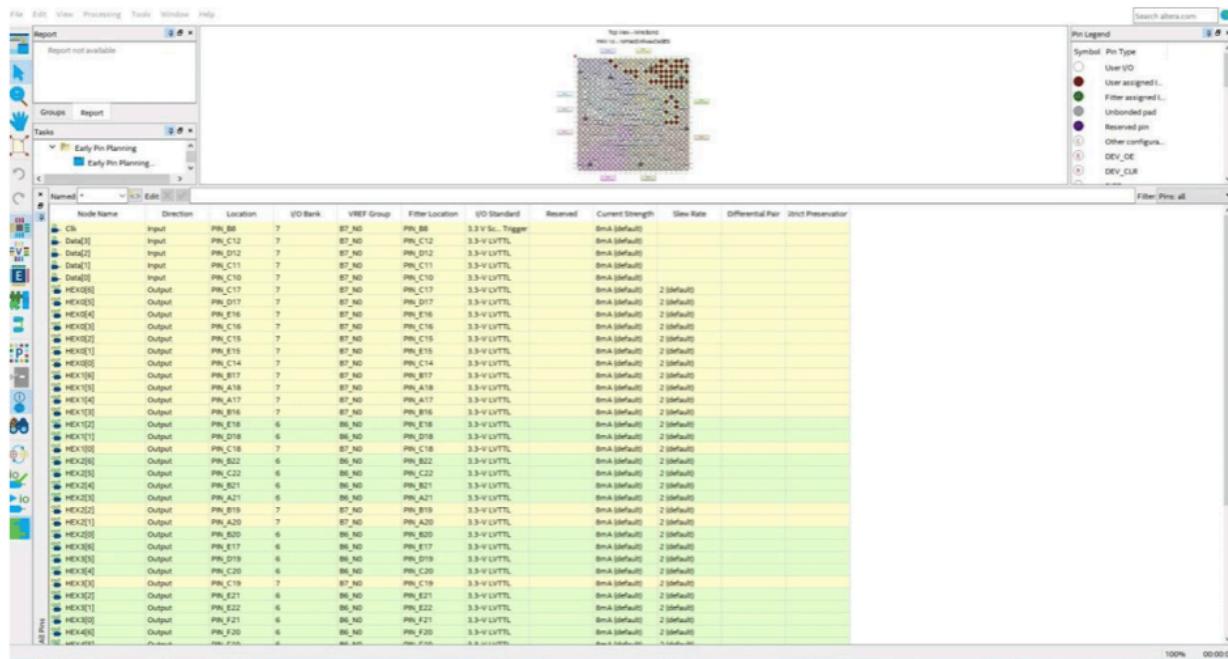


Task 5-6: Write and Execute a Simple Program for Your Microprocessor on Hardware

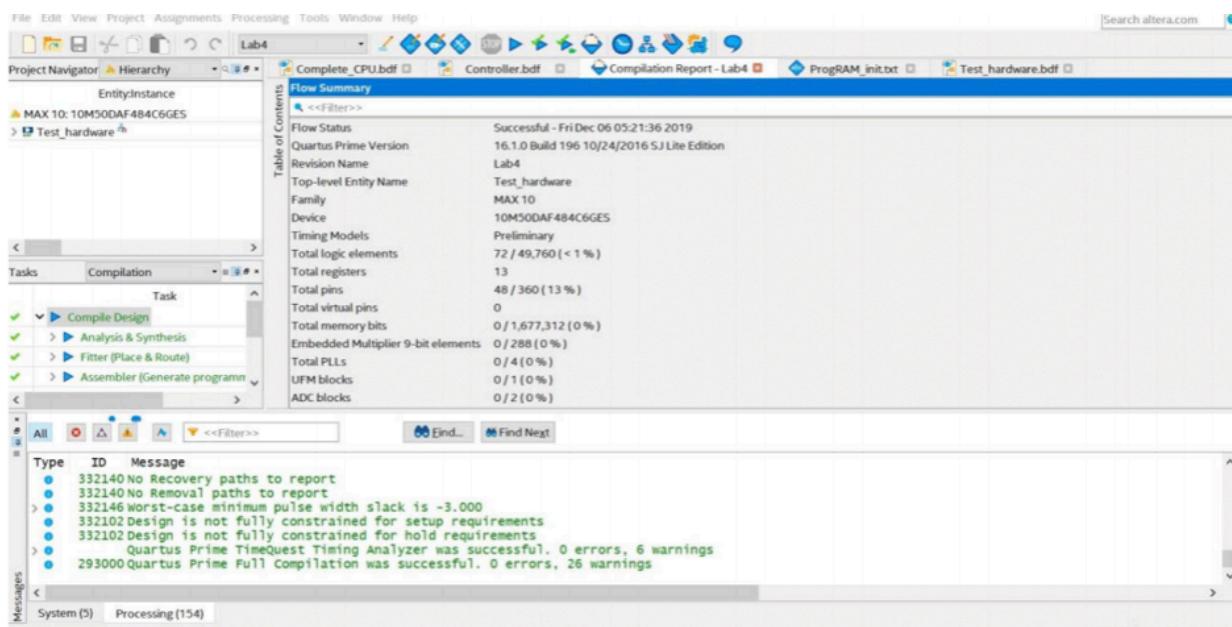
Include a picture of your Quartus circuit here:



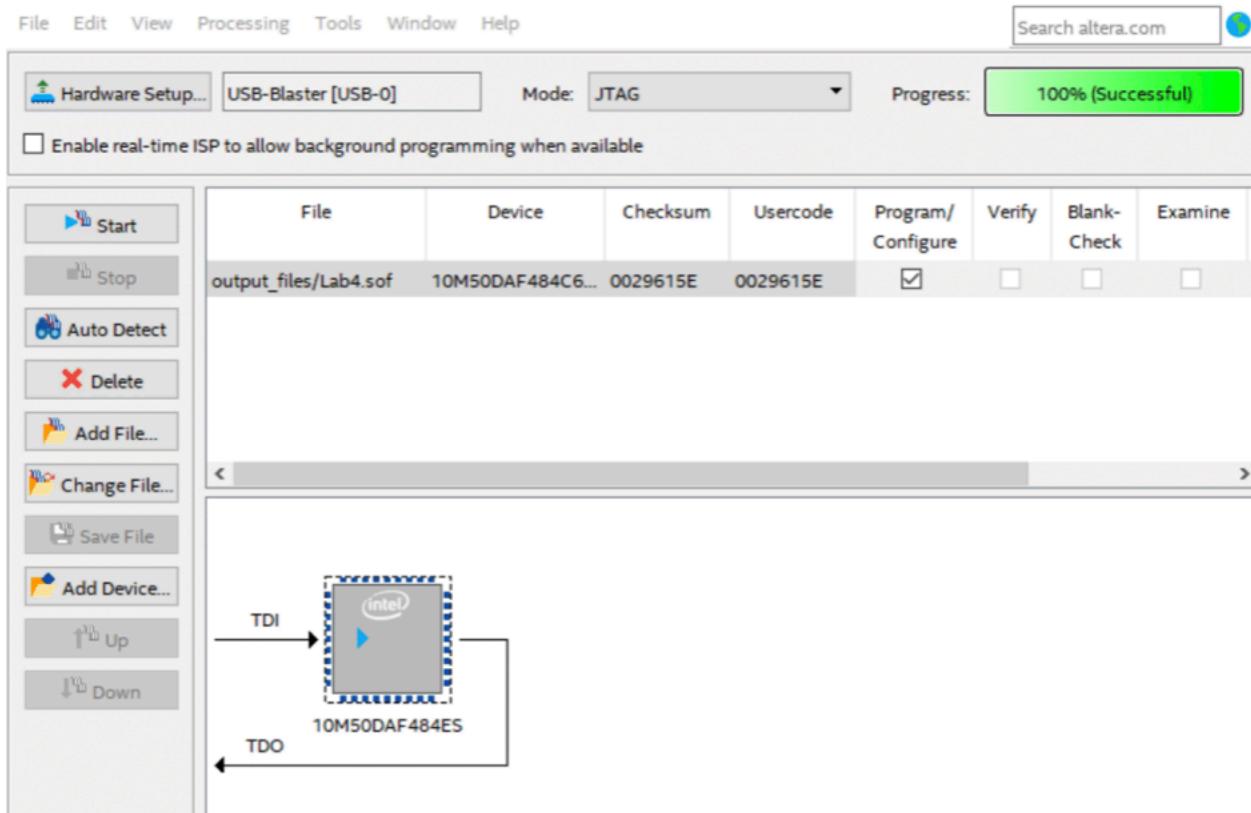
Include a picture of your Pin Planner assignment window here:



Include a picture of your Quartus System Message Window (Flow Summary) here:



Include a picture of your Programmer Window here:



Was the test on the FPGA board successful?

Yes

What was the biggest issue you were facing when you prepared the design for hardware upload?

I faced no issues.

Make sure that the TA verifies that you did complete the hardware tests and uploads your hardware demo score onto Canvas!

Task 5-7: Invent Your Own Instruction (Extra Credit)

Fill in the following two tables for your invented instruction.

	Instruction	7							
	Opcode	00	01	02	03	00	01	02	03
Description	Pin number								
Next State Bits	1-0								
Load IR	2								
Write	3								
Read	4								
ACC to Data Bus	5								
Load ACC	6								
Load MAR	7								
Use PC	8								
/~A_only	9								
/~Invert	10								
Logic/~Arith	11								
X	12								
X	13								
X	14								
X	15								
	HEX equiv								

Program # ()		
Address	Value	Operation (In English)

What was the final output of your program? _____		
Was the program successful? <u>Yes or No</u>		
If not what error(s) did you find in your circuit?		

LAB 4: LAB REPORT GRADE SHEET

Nam _____

Instructor Assessment

Grading Criteria	Max Points	Points Lost
Description of Assigned Tasks, Work Performed & Outcome		
Task 4-1: Build and Test the Memory-Address-Generation Circuit	10	
Task 4-2: Build and Test the Controller Circuit	10	
Task 4-3: Build the Complete Microprocessor Circuit	10	
Task 4-4: Write and Execute a Simple Program for Your Microprocessor in Simulation	10	
Task 4-5: Add the 'AND', 'Zero', 'Subtract', and 'Store ACC' Instructions	10	
Task 4-6: Write and Execute a Simple Program for Your Microprocessor on Hardware	10	
Task 4-7: Invent Your Own Instruction (Extra Credit)	10	
Lab Score (60 points total)	Points Lost	
	Late Lab	
	Lab Score	