ECE 2544: Fundamentals of Digital Systems
Learning Experience F.2: Simple Computer Control Unit Implementation
Validation Sheet (Page 1)

Name: Logan Johnson

Last four digits of your student ID: 7722

Operation implemented: AND **NAND** (choose one)

Student: The 2nd half of the **Validation Table** lists the elective operations. Delete the rows that contain operations that you did NOT implement. Do NOT change the order of the rows.

You are responsible for correctly modifying data.txt and instruction.txt as described in the specification. Failure to do so will result in incorrect validation results.

GTA: SW[3:0] values from 0000 to 0111 select registers R0-R7. The PC register is displayed for SW[3:0] = 1000. The instruction (IR[15:0]) is displayed for SW[3:0] = 1001. The PC value can also be displayed on the LEDs in binary, but only 8 bits at a time, using SW[4] to toggle between the upper and lower byte.

The student is responsible for correctly modifying data.txt and instruction.txt as described in the specification. Failure to do so will result in incorrect validation results.

1. Program the FPGA on the DE10-Lite board using the Start button on the programmer window.
2. When the programming has successfully completed, reset the design by pressing and holding KEY1, and while keeping KEY1 pressed, pressing and releasing the KEY0 pushbutton.
3. Set the switches to “1000” to show the program counter (PC). Press and release KEY0. The PC should read 0x01.
4. Set the switches to “0010”, and record the 16-bit value for R2 in the Validation Table (next page) as four-digit hex.
5. **Compare the four digits from step 4 to the last four digits of the student’s ID number. If the four digits do not match the last four digits of the student’s ID number, STOP THE VALIDATION. DO NOT CONTINUE. ENTER A VALIDATION SCORE OF 0**
6. Use KEY0 to step through the remaining instructions in the program, recording the 16-bit value for the appropriate register after each KEY0 press.

Validation Table

PC value (in hex) shown on LEDs[7:0] for SW[4]=0	*Instruction Description*	*Register*	*SW[3:0] setting*	*Expected Results* **Register Contents (in hex)**	*X*
0001	LD R2, R1	R2	0010	Last 4 digits of student's ID	
IF R2 DOES NOT CONTAIN THE STUDENT'S ID, STOP THE VALIDATION					
0002	ADI R1, R1, 1	R1	0001	0001	
0003	LD R2, R1	R2	0010	72B5	
0004	ADI R1, R1, 1	R1	0001	0002	
0005	LD R3, R1	R3	0011	5D84	
0006	ADI R1, R1, 1	R1	0001	0003	
0007	LD R4, R1	R4	0100	F0F3	
0008	ADI R1, R1, 1	R1	0001	0004	
0009	LD R5, R1	R5	0101	EA74	
000A	ADD R7, R2, R3	R7	0111	D039	
000B	SUBI R7, R4, 6	R7	0111	F0ED	
000C	NOT R7, R2	R7	0111	8D4A	
000D	MOD8 R7,R5	R7	0111	0004	
000E	MOVA R7, R0	R7	0111	0000	
000F	DIV4 R7,R5	R7	0111	FA9D	
0010	SUB R7, R4, R5	R7	0111	067F	
0011	AND R7, R2, R4 / NAND R7, R2, R4	R7	0111	70B1 / 8F4E	
0012	ANDI R7, R2, 6 / NANDI R7, R2, 6	R7	0111	0004 / FFFB	
Student: For the remaining rows, 1) Delete rows containing instructions you did NOT implement. 2) Do NOT change the order of instructions.					
	SUBBA R7, R2, R5	R7	0111	77BF	
	NEGA R7, R2	R7	0111	8D4B	
	NEGB R7, R5	R7	0111	158C	
	NOR R7, R4, R5	R7	0111	0508	
	NOTB R7, R5	R7	0111	158B	
	CSL R7, R5	R7	0111	D4E9	
	CSR R7, R2	R7	0111	B95A	

Comments: (only required if something is unusual or wrong)