ECE3073 – Computer Systems
Sem 1 – 2022
LabTest
LAB TEST - TAKE HOME PROJECT

General Note:

You will have to program NIOS Microcomputer as per the task mentioned in the Level – 1 to Level - 5. Each successful completion gives you 2 marks. You are advised to record the screen at the end of completing every level and keep the recording in your computer. Each level is a cumulative task with previous level that is, level 2 task comprise of Level 1 and new task for level 2. Let's say you were only able to do level 3, then your recording of level 3 output will show the results of level 1, 2, and 3 automatically. It's not necessary that you need to follow the sequence of levels, the expected results are independent to each other.

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Summary of NIOS computer system for the Labtest

1. NIOS - II (e)
2. Onchip RAM – 21504 bytes
3. PIO_0 = 16 RED LEDS (LEDR15 to LEDR0)
4. PIO_1 = Counter-3 MSB (1 bit) input (3 Second counter)- This means every 3 second you have a rising edge in this 1 bit PIO. Also this is configured as interrupt signal at level of IRQ0
5. PIO_2 = 6 GREEN LEDS (LEDG0 to LEDG5)
6. PIO_3 = 1 bit GPIO (LabsLand Switch SW2)
7. PIO_4=Seven Segment Display – HEX0,HEX1,HEX2,HEX3 (28 bits output)
8. UART --- Configured as IRQ1
9. PIO_5= Counter-1 MSB(1 bit) input(1 Second counter) -)- This means every 1 second you have a rising edge in this 1 bit PIO.
10. PIO_6=Counter-2 MSB(1 bit) input (2 Second counter)- This means every 2 second you have a rising edge in this 1 bit PIO.
11. PIO_7= Channel 1 of Oscilloscope
12. PIO_8 = Channel 2 of Oscilloscope

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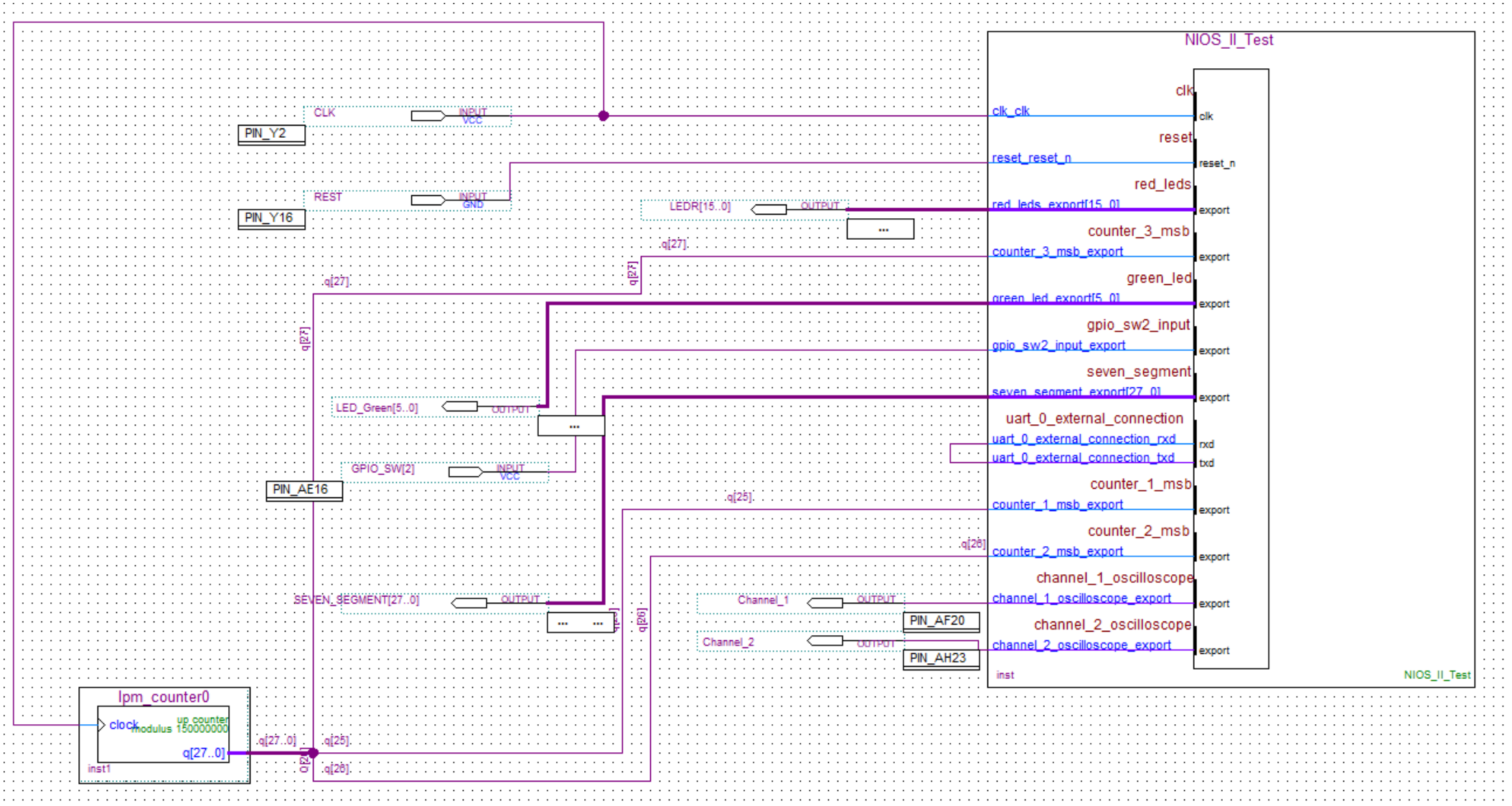
The NIOS Microcomputer Architecture for the LabTest



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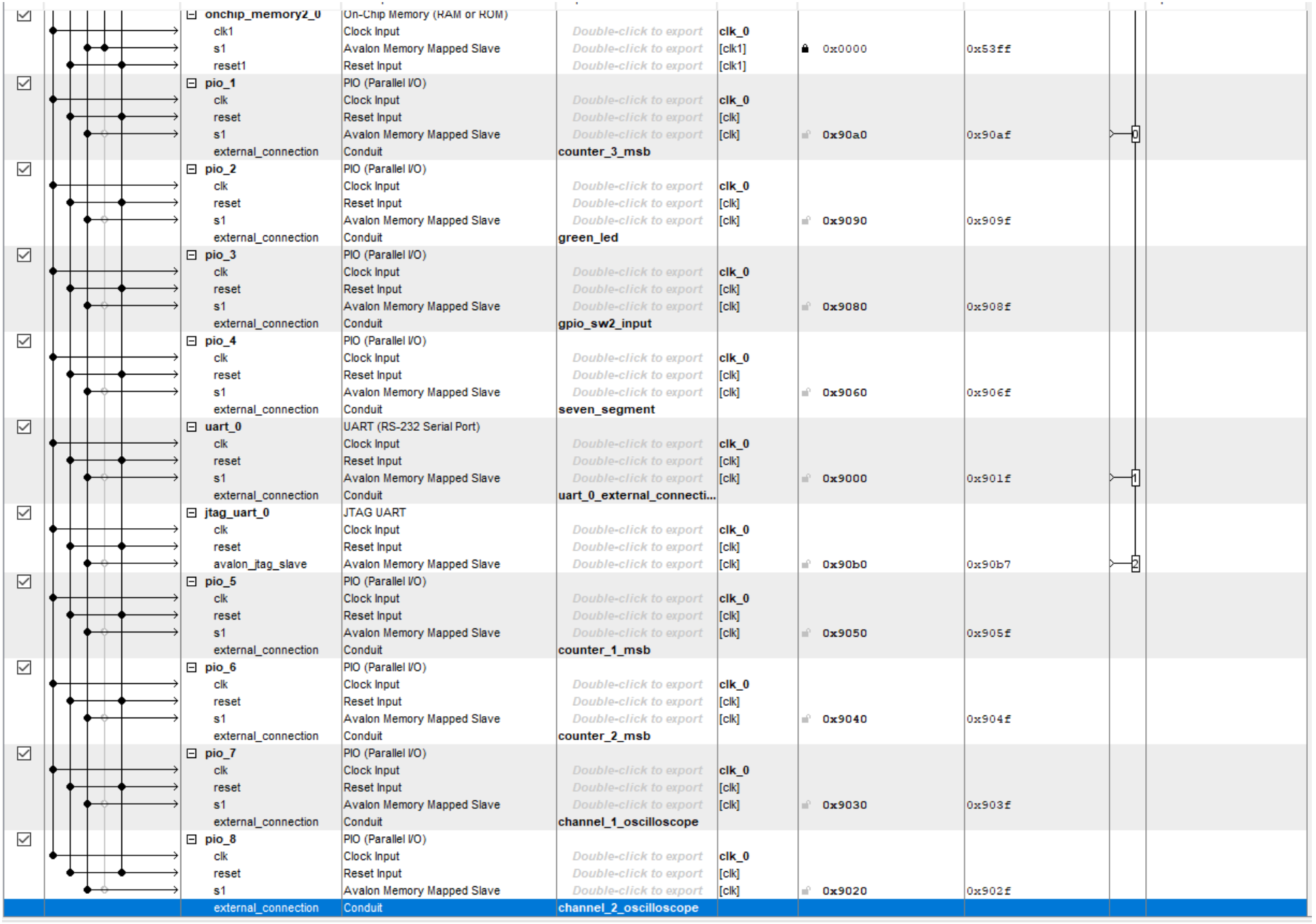

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The NIOS Microcomputer QYSYS

Base Address – Memory Map

Base address (Starting address)

End address

	nios2_qsys_0.data_master				nios2_qsys_0.instruction_master
nios2_qsys_0.jtag_debug_module	0x8800	–	0x8fff		0x8800 – 0x8fff
pio_0.s1	0x9070	–	0x907f	Red_LEDs	
onchip_memory2_0.s1	0x0000	–	0x53ff	Memory RAM	0x0000 – 0x53ff
pio_1.s1	0x90a0	–	0x90af	Counter_3_MSB(INPUT to NIOS)	
pio_2.s1	0x9090	–	0x909f	Green_LEDs	
pio_3.s1	0x9080	–	0x908f	LabsLand SW2 switch	
pio_4.s1	0x9060	–	0x906f	Seven Segment Display	
uart_0.s1	0x9000	–	0x901f	UART	
jtag_uart_0.avalon_jtag_slave	0x90b0	–	0x90b7	No need to worry about this its JTAG	
pio_5.s1	0x9050	–	0x905f	Counter 1 _MSB	
pio_6.s1	0x9040	–	0x904f	Counter 2 _MSB	
pio_7.s1	0x9030	–	0x903f	Channel 1 Oscilloscope	
pio_8.s1	0x9020	–	0x902f	Channel 2 Oscilloscope	

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Level – 1 (2 Marks)

Detect counter 1 (1 seconds counter) MSB rising edge and display the count of the rising edges on to the GREEN LEDs (LEDG 0- LEDG5) in binary format (picture below indicates the physical location).

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Level – 2 (2 Marks)

At the same time, whenever counter 1 MSB rising edge occurs transmit your student ID as character to UART transmitter . For every rising edge of the MSB counter-1 one character to be sent to the transmitter. As the receiver and transmitter are short , display the received character in the 8 bit binary format in 8-RED LEDs: LED R8 – LED R15.

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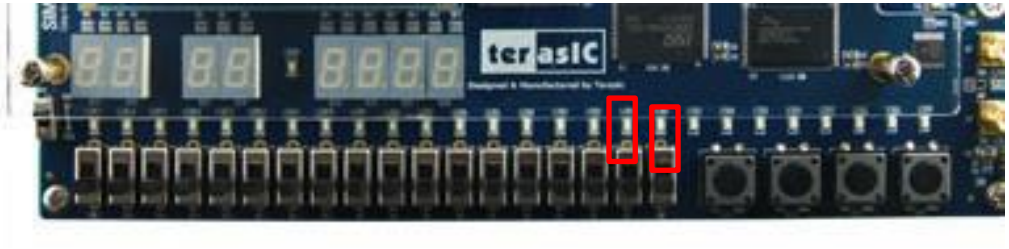
Level – 3 (2 Marks)

Further, program NIOS such that the microcomputer detects multiple of 5 counts of Counter – 1(1 sec counter) rising edge, flash ON the RED LEDs :LEDR0 and LEDR1 simultaneously for One second and OFF for next One second. Program such that the flashing of LEDs deactivated when LabsLand Switch SW2 is ON. The partial DE2-115 board shows the physical location of the LEDs I have meant here.



Level – 4 (2 Marks)

In addition to the above tasks prescribed in the levels, whenever a falling edge of the counter 1's (1 sec counter) MSB is detected by NIOS - display count of the falling edge in seven segment display – HEX0 (the right most hex display as shown in the picture below) and show till count 9 . Use polling , as counter 1 is not connected to interrupt controller.

Level – 5 (2 Marks)

In addition to all the levels, display the received character in UART (which is your student ID) in scroll mode. Refer to the video what I meant as scroll – the video shows left to right shifting of characters, you will use counter-3 rising edge for shifting purpose. (The characters shift from right to left - which means Hex 1 to Hex3) in Seven Segment display. You should note that Hex 0 should continue display as per the Level 4 task.