**CS210: Computer architecture**

**Lab 10:Study of MIPS multi- Cycle Processor implementation**

**Task 1: Study the following snippet of code. Identify the functionality (assume suitable array if necessary) and Compute CPI for the given design**

**addi $s7, $0, 9**

**loop1: addi $s6, $0, 0**

**add $s5, $0, $0**

**loop2: lw $s0, 0($s6)**

**lw $s1, 4($s6)**

**slt $s2, $s0, $s1**

**beq $s2, $0, swap**

**j next**

**swap: add $t0, $0, $s0**

**add $s0, $0, $s1**

**add $s1, $0, $t0**

**next: sw $s0, 0($s6)**

**sw $s1, 4($s6)**

**addi $s5, $s5, 1**

**addi $s6, $s6, 4**

**beq $s5, $s7, cont**

**j loop2**

**cont: subi $s7, $s7, 1**

**beq $s7, $0, stop**

**j loop1**

**stop: exit**

(5**0 points)**

|  |  |
| --- | --- |
| Array | CPI |
| 1,2,3,4,5,6,7,8,9 | 2026/531 = 3.815… |
| Total Instruction = 1 + 9\*2 + 45\*5 + 36\*6 + 9\*5 + 8\*3 +2 = 531  Total Cycles = 4 + 9\*8 + 45\*20 + 36\*22 + 9\*19 + 8\*10 + 7 = 2026 | |
| 9,8,7,6,5,4,3,2,1 | 2431/621 = 3.9146… |
| Total Instruction = 1 + 9\*2 + 45\*7 + 36\*6 + 9\*5 + 8\*3 +2 = 621  Total Cycles = 4 + 9\*8 + 45\*27 + 36\*22 + 9\*19 + 8\*10 + 7 = 2431 | |

**Task 2:**

**Implement two new instructions in the given multi-cycle design and test using the appropriate program. Add the new design as a library component. Test with an appropriate test program**

(5**0 points)**

addi $t1, $0, 0xF 2009000F

addi $t2, $0, 0x5 200A0005

or $t0, $t1, $t2 012A4025

and $t3, $t1, $t2 012A5824

$t0 = 0xF

$t3 = 0x5