CSE 490/590 Spring 2023 Homework 1 – Not Due (not for grading)

1) A program's run time is determined by the product of instructions per program, cycles per instruction, and clock frequency. Assume the following instruction mix for a MlPS-like instruction set on the right, Compute the overall CPI

Instructions	%	cycle
store and load	40%	2
branch	10%	4
integer ALU	30%	1
shift	10%	1
integer multiplies	10%	10

2) Consider three different processors P1, P2, and P3 executing the same instruction set. P1 has a 3 GHz clock rate and a CPI of 1.5. P2 has a 2.5 GHz clock rate and a CPI of 1.0. P3 has a 4.0 GHz clock rate and has a CPI of 2.2. Which processor has the highest performance expressed in instructions per second? (1 GHz = 10^9 Hz)

3) a) Provide the assembly language instruction for the following R type instruction: [Use Green Sheet]

0000 0010 0001 0000 1000 0000 0010 0000_2

b) Provide the binary of the following R type Instruction [Use Green Sheet]
sub $v1,$v1,$v0

4) For the following C statement, what is the corresponding MIPS assembly code? Assume that the variables f, g, and h, are given and are assigned to registers $s2, $s3, and $s4 respectively. Use a minimal number of MIPS assembly instructions.

f = (g + h) - 5;

5)

a) Consider a byte-addressable memory system with the following contents:

Memory Location	Value
0x2000	01
0x2001	56
0x2002	70
0x2003	12
0x2004	23
0x2005	45
0x2006	67
0x2007	89

lw $s0,4($s1)

$s1 contains the address 0x2000 . What will $s0 contain?

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b) Assume that $s0 contains the value 0x12121212 and $s1 contains the address 0x1FFF111.

Assume that the memory data, starting from address 0x1FFF111 is: 88 77 66 55. What will be the value of $s0 after the following code is executed:

lb $s0, 0($s1)

c) Assume that $t1 contains the value 0x0000000A. What will be the value of $t0 after the following code is executed:

sll $t0,$t1,5

6) Given the following instruction,
beq $s0, $s1, L1

replace it by using other instruction(s) that offers a much greater branching distance.

7) Main routine M1 calls a procedure P1 (The return address is a value RM. Assume the initial stack pointer has a 32 bit value of 0x0700C. Procedure P1 will be using $s0, $s1, $s2 and need to be saved on the stack. RM (which is in $ra) need to be saved on the stack (since there is a call to another procedure). In P1, there is a call of procedure P2 (return address is a value RP1). Procedure P2 is likely to use $s4, $s5 (and hence need to be saved on stack). Show the SP value right after $s5 is saved. Also, show the stack contents (updated in this sequence).