CSE 320 Fall 2014 ***Homework #7 Quiz Version A***

Name:_____ ***ID:_____***

No calculators, notes, or textbooks allowed. Show all your work for full credit.
Time limit: ***20 mins***

Problem 1: [2 pts] What is the formula for the total execution time of a program?

Execution time = No. of instructions * CPI * clock cycle time

Problem 2: Two CSE320 student implemented multi-cycle datapaths for the same MIPS instruction set. Student A and Student B's implementations each execute the following instruction types in different number of cycles.

Type	A (cycles)	B (cycles)	Instruction Mix
jump	2	3	25%
R-type	3	3	20%
beq	4	4	17.5%
sw	8	5	12.5%
lw	12	14	25%

(a) [4 pts] What is the CPI for Student A's and B's implementations?

A = 0.25 * 2+ 0.2*3 + 0.175 * 4 + 0.125 * 8 + 0.25 * 12 = 5.8 cycles/instruction
B = 0.25 * 3+ 0.2*3 + 0.175 * 4 + 0.125 * 5 + 0.25 * 14 = 6.175 cycles/instruction

(b) [3 pts] What is the clock rate (Machine cycles per second) required for processor A to be a 1000 MIPS processor?

6.175 cycles/instruction * 1,000,000,000 instructions/second = 6175000000 Hz = 6.175Ghz

(c) [3 pts] If Student A's implementation has a 2 GHz clock, at what clock speed with Student B's implementation be faster (2 decimal places)?

B's Cycle time = 6.175I/2GHZ = $3.0875I*10^{-9}$ seconds
A's Cycle time = 5.8/x = $3.0875I*10^{-9}$ seconds. A must be faster than 1.878GHz

(d) [3 pts] If Suppose Student A's implementation requires an extra 20 machine cycles to retrieve/store data operands from memory. What is the effective CPI of Student A's implementation?

lw/sw are 37.5% of the instructions.
5.8 * 0.6.25 + (25 + 5.8) * 0.375 = 15.175

CSE 320 Fall 2014 ***Homework #7 Quiz Version B***

Name:_____ ***ID:_____***

No calculators, notes, or textbooks allowed. Show all your work for full credit.
Time limit: 20 mins

Problem 1: [2 pts] What is the formula for the total execution time of a program?

Execution time = No. of instructions * CPI * clock cycle time

Problem 2: Two CSE320 student implemented multi-cycle datapaths for the same MIPS instruction set. Student A and Student B's implementations each execute the following instruction types in different number of cycles.

Type	A (cycles)	B (cycles)	Instruction Mix
jump	3	3	25%
R-type	3	4	25%
beq	4	3	10%
sw	5	5	15%
lw	7	6	25%

(a) [4 pts] What is the CPI for Student A's and B's implementations?

A = 0.25 * 3+ 0.25*3 + 0.1 * 4 + 0.15 * 5 + 0.25 * 7 = 4.4 cycles/instruction
B = 0.25 * 3+ 0.25*4 + 0.1 * 3 + 0.15 * 5 + 0.25 * 6 = 4.3 cycles/instruction

(b) [3 pts] What is the clock rate (Machine cycles per second) required for processor A to be a 1000 MIPS processor?

4.4 cycles/instruction * 1,000,000,000 instructions/second = 4400000000 Hz = 4.4Ghz

(c) [3 pts] If Student A's implementation has a 2 GHz clock, at what clock speed with Student B's implementation be faster (2 decimal places)?

A's Cycle time = 4.4I/2GHZ = $2.2I*10^{-9}$ seconds
B's Cycle time = 4/x = $2.2I*10^{-9}$ seconds. B must be faster than 1.81GHz

(d) [3 pts] If Suppose Student A's implementation requires an extra 20 machine cycles to retrieve/store data operands from memory. What is the effective CPI of Student A's implementation?

lw/sw are 40% of the instructions.
4.4 * 0.6 + (20 + 4.4) * 0.4 = 12.4