#4 CS/SE 2340 Assignment
FALL SEMESTER 2025, Sections 002, 004, 006, 501

INSTRUCTOR: DR. ALICE WANG

Submit all of your work in a PDF file to eLearning by the due date.

Note: name your PDF files for homework submission as follows:

HW<hw#>_<FirstName>_<LastName>.ZIP, e.g. HW04_Jane_Doe.PDF

Goal: The goal of this assignment is to practice doing binary multiplication, division and CPU performance.

Part 1 - CPU Performance (50pts)

Consider two different processors executing the same instruction set. Show your work to get full credit.

	Processor 1	Processor 2
Clock rate (MHz)	3.0	2.0
CPI	2.5	1.0

a) If the processors each execute a program in 100 seconds, find the instruction count for each processor. (10pts)

b) For a program with the same instruction count, which processor has better performance? (10pts)

c) For a program with the same instruction count, which processor has higher MIPS (Millions of Instructions per second)? (10pts)

d) If I want to improve Processor 2's performance by 20%, what should the new Clock rate be?

e) If I improve Processor 1's CPI by 2X, how much does the performance improve?

Part 2 - Binary Arithmetic and Fixed Point (50pts)

Show all of your work to get full credit in this section.

a) Perform Binary Multiplication of two unsigned numbers:
0b1101_0101, 0b0010_0110

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  0b11010101
X0b00100110
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Check your math by providing the equivalent decimal numbers for the multiplicand, multiplier, and product.
Multiplicand = _____, Multiplier = _____, Product = _____

b) Perform Binary Division of two unsigned numbers:
0b1100_1010 divided by 0b0000_0111 using the division pseudocode provided in the lecture and filling out the below table.

R’	R	D = R - B	Q

Check your math by providing the equivalent decimal numbers for the dividend, divisor, quotient, and remainder.

Dividend = _____, Divider = _____

Quotient = _____, Remainder = _____

(c) Convert the decimal number 45.3125 to an unsigned fixed-point binary representation using 6 integer bits, and 6 fractional bits. Round to the nearest representable value.