

CSE 775
Spring 2006

Homework 1

Instructor: Lauria

1. (25 points) Problem 1.3 of the textbook on page 75.
2. (25 points) Your friend has opened a PC company and has appointed you as a consultant. He is selling a model for \$1000. To grow his business, he has developed a floating-point accelerator board to enhance floating-point execution by a factor of 5. Adding this board alone to the PC, he gets an overall speedup of 1.25 for a typical application widely used by his customers. Similarly, he has a disk-access enhancer board to reduce average disk access time by half. This board alone, after being added to the system, leads to a speedup of 1.38.
 - (a) Your friend wants to know what fraction of the typical application use floating-point unit and disk, respectively.
 - (b) He also wants to know what speedup can be obtained by adding both boards to the system.
 - (c) He is trying to fix price for the boards. He wants to take your advice in this regard so that smart and intelligent customers will always prefer buying both the boards instead of individual boards to upgrade their systems from a cost-performance perspective. At the same time, your friend does not want to go out of business by offering two boards for the price of one board. As his consultant, can you fix the price constraint for the boards in a reasonable manner.
3. (25 points) An application running on a 1GHz pipelined processor has 55% load-store, 30% arithmetic, and 15% branch instructions . The individual CPIs of these instructions are 5, 4 and 4, respectively.
 - (a) Determine the overall CPI of this program execution on the given processor.
 - (b) A new embedded version of the processor is being modified to operate at 600 MHz. In this new version, the individual CPIs of load-store and arithmetic instructions are remaining unchanged. However, the individual CPI of branch instructions is getting stretched to 6 clock cycles. A new compiler is also developed for the new processor which eliminates 25% of load-store and 5% of arithmetic instructions for the given application.
 - i) Determine the overall CPI of this program execution on the new processor together with the new compiler technology.
 - ii) Determine the factor by which the application will run faster or slower on the new processor with the new compiler technology.
4. (25 points) The execution times (in seconds) of four programs on three computers are given below:

Program	Computer A	Computer B	Computer C
Program 1	2	10	20
Program 2	1000	100	200
Program 3	500	1000	250
Program 4	200	800	100

Assigned on 4/3 - Due on 4/10 in class

Assume the frequencies of the programs being used on the computers are as follows: Program 1 (40%), Program 2 (30%), Program 3 (20%), and Program 4 (10%).

- (a) Determine the weighted arithmetic mean of the programs on the three computers. Based on these means, can you determine the relative performance of these computers.
- (b) Assume 10^{10} instructions were executed in each of the four programs. Calculate the MIPS rating of each program on each of the three computers. Determine the weighted geometric means of the programs on these computers and derive the relative performance of these computers based on the weighted harmonic means.