Homework 1

Due Date: 9/8/2017 2:00 PM

1. Discuss the different performance metrics by which we judge a computer's performance. Suppose you are a programmer and working in two settings A and B which is described below. However the two settings have something in common. We have 3 tasks T1, T2 and T3 with instruction types A, B, C and D. The CPI for A, B, C, D are 1,2,3,4 respectively. Each task has 500,000 instructions.

	A	B	C	D
T1	30%	20%	40%	10%
T2	40%	20%	20%	20%
T3	20%	10%	30%	40%

a. There is a simple computer C which runs these three tasks in a program. Give the performance of the computer C which has 3.5 GHz processor, and explain your choice of metric. (25)

b. This setting is a data center with 300 computers for Task T1, 200 computers running task T2, and 300 computers running T3. All computers have 3.5 GHz processor. What is the performance of the data center assuming that each task has the same reward? (25)

Justify your choice of metric in both the settings.

2. Section 1.10 of the book cites as a pitfall the utilization of a subset of the performance equation as a performance metric. To illustrate this, consider the following two processors. P1 has a clock rate of 4 GHz, average CPI of 0.9, and requires the execution of 5.0E9 instructions. P2 has a clock rate of 3 GHz, an average CPI of 0.75, and requires the execution of 1.0E9 instructions.

a. One usual fallacy is to consider the computer with the largest clock rate as having the largest performance. Check if this is true for P1 and P2. (10)

b. Another fallacy is to consider that the processor executing the largest number of instructions will need a larger CPU time. Considering that processor P1 is executing a sequence of 1.0E9 instructions and that the CPI of processors P1 and P2 do not change, determine the number of instructions that P2 can execute in the same time that P1 needs to execute 1.0E9 instructions. (10)

c. A common fallacy is to use MIPS (millions of instructions per second) to compare the performance of two different processors and consider that the processor with the largest MIPS has the largest performance. Check if this is true for P1 and P2. What are the merits and demerits of this performance metric? (15)

d. Another common performance figure is MFLOPS (millions of floating-point operations per second), defined as MFLOPS = No. FP operations / (execution time × 1E6) but this figure has the same problems as MIPS. Assume that 40% of the instructions executed on both P1 and P2 are floating-point instructions. Find the MFLOPS figures for the programs. (15)