

CSCI 564: Homework 1

Name: _____ CWID: _____

For each of the following questions, please show all of your work, and explain your answers.

1. (12.5 points) Compute the Clocks Per Instruction (CPI) of a machine which has an average CPI for ALU operations of 1.1, a CPI for branches/jumps of 3.0, and a hit rate of 60% in the cache. A hit in the cache takes 1 cycle, and a miss takes 120 cycles. Assume 22% of instructions are loads, 12% are stores, 20% are branches/jumps, and the rest are ALU operations. Show all of the steps of your computation, and when you introduce a new term, explain where the term comes from.

2. (12.5 points) You are a processor designer and have to make a decision between building two different processors:

1. a processor which executes at 1GHz and has an average CPI of 1.2, or
2. a processor which executes at 2GHz but has a CPI of 2.

Which is better to build? Explain your reasoning and provide quantitative analysis.

3. (12.5 points) A revolutionary new technology in memory improves your memory subsystem so that memory latencies are reduced by a factor of 3.5. After replacing your old memory with the new system, you observe that your workload now spends half of its time waiting for memory. What percentage of the original execution time of your workload (with the old memory system) was spent waiting for memory? Explain your answer.

4. (12.5 points) You're currently using a single-core machine, but you want to figure out if it's worth investing in a dual-core machine. Assuming your application is 60% parallelizable, by how much could you decrease the core frequency while achieving the same performance? Explain your answer.