

Homework 1

Problem 1 (25%): 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 cache miss takes 120 cycles. Assume 22% of instructions are loads, 12% are stores, 20% are branches/jumps and the rest are ALU operations.

Problem 2 (25%): You are a processor designer and have to make a decision between building a processor, which executes at 1GHz and has an average CPI 1.2 and a processor, which executes at 2GHz, but has a CPI of 2. Which is better to build and why?

Problem 3 (25%): 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 memory with the new ones, you observe that you now spend half your time waiting for memory. What percentage of the original execution (with the older memory system) was spent waiting for memory?

Problem 4 (25%): 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 frequency and get the same performance?