

Score: _____ Name: _____

ECE 3055 Quiz 1

1. (5 points) An AMD 3 GHz X86 (CISC) processor runs the SPEC2006 Benchmark Programs shown in the table below. Compute the average CPI achieved on each of the two Benchmarks and fill in the missing table entries.

$$1200 = 336 \times 10^9 \times \text{CPI}_{\text{mcf}} \times \frac{1}{3 \times 10^9}$$

$$500 = 2118 \times 10^9 \times \text{CPI}_{\text{perl}} \times \frac{1}{3 \times 10^9}$$

Exec. Time = #instructions x CPI x Clock Rate

Benchmark	Instructions x 10 ⁹	Execution time (sec)	Average CPI
mcf	336	1200	10.71 (Floating pt.)
perl	2118	500	.71

2. (5 points) A thread is just a sequence of machine instructions to execute. On a PC, multiple threads can be executed in parallel on multiple processors. The OS can only schedule threads on different processors that are explicitly setup as threads in the programmer's code, it cannot automatically split a program into threads. A single threaded application program currently runs on one processor. 25% of its execution time is purely sequential code that can only run on one thread or processor. 75% of the application code could be executed in parallel on several processors, if the application was rewritten to include multiple threads for this portion of the code. A multicore processor is available with 8 processor cores. Compute the maximum possible speedup that could be obtained in the application on a multicore processor, assuming it was rewritten by the programmer to use 2, 4, and 8 threads.

$$1 / (.25 + .75/n) \quad n = 2, 4, 8$$

Amdahl's Law

With two threads the application could run up to 1.6 times faster.

With four threads the application could run up to 2.29 times faster.

With eight threads the application could run up to 2.91 times faster.