Score:_____ Name:_____

ECE 3055 Quiz 1

1. (*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 (i.e., cores). 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. 33% of its execution time is purely sequential code that can only run on one thread or processor. 67% 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 6 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 6 threads. Assume it is possible to evenly balance the processor time when using multiple threads.

$.33 + .67/n \qquad n = 2, 4, 6$

With two threads the application could run up to 1.5 times faster.

With four threads the application could run up to 2 times faster.

With six threads the application could run up to 2.25 times faster.

2. (*4 points*) An AMD 4 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.

$$CPI = \frac{\text{Exec. Time} \times \text{Clock Rate}}{\#\text{ Instructions}}$$

Benchmark	*Instructions x 10^9*	*Execution time (sec)*	*Average CPI*
mcf	336	1150	13.69
perl	2118	450	.85

3. (*1 point*) Why did high clock rate processors switch in recent years to a lower core voltage? *Explain and justify your answer with an equation.*

$$Power = C_L \times V^2 \times Freq$$

need to reduce power as clock Freq increases so drop V