Score:_____ Name:_____

ECE 3055 Quiz 1

1. (*4 points*) An AMD 4 GHz X86 (CISC) processor runs the SPEC2006 Benchmark Programs shown in the table below. Fill in the missing table entries.

Time = #instructions × CPI × Clock cycle time

Benchmark	Instructions x 10^9	Execution time (sec)	Average CPI
perl	2100	371.1	.707
mcf	336	850	10.11

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 (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. 33.3% of its execution time is purely sequential code that can only run on one thread or processor. 66.7% 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 new multicore processor is available with 4 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, 3, and 4 threads. Assume it is possible to evenly balance the processor time when using multiple threads that are running one thread per core, and that there is no overhead to synchronize the cores.

$$1/(0.667/n + 0.333)$$

With two threads the application could run up to ___1.5___ times faster on two cores.

With three threads the application could run up to ___1.8___ times faster on three cores.

With four threads the application could run up to ___2___ times faster on four cores.

3. (*1 point*) What undesirable problem would result if a current processor chip used 5V for the internal logic levels. Cite hard numbers using an equation to justify your answer.

$$P = C \times V^2 \times \text{Clock Freq.}$$

Vnow 1V, at 5V → 25x more power.