

CS203 Winter '16 - Project 1

1. Assignment Problems

1. Run each of the benchmarks using the default configuration file and fill out the following table. What is the arithmetic mean of the execution time?

Benchmark	Exec Time (sim)	nInst	Cycles	IPC
blackscholes	4.550 ms	10139922	7735131	1.31
crafty	4.600 ms	10139922	7820045	1.30
kernel_dhry	3.459 ms	10139922	5879809	1.73
sjeng	4.739 ms	10139922	8056284	1.26

**NOTE: Your cycle times may vary by a little*

2. Edit esesc.conf. Edit the following line: `frequency = 1700e6` to `frequency = 3400e6`. Here we are doubling the frequency of the processor from 1.7GHz to 3.4GHz. Fill out the following table using this modified configuration. What is the arithmetic mean of the execution time?

Benchmark	Exec Time (sim)	nInst	Cycles	IPC
blackscholes	2.275 ms	10139922	7735129	1.31
crafty	2.300 ms	10139922	7820950	1.30
kernel_dhry	1.729 ms	10139922	5879845	1.73
sjeng	2.370 ms	10139922	8056517	1.26

3. Does the IPC improve from doubling the processor frequency? Why or why not?
How can you further improve the IPC of a processor?
No, IPC does not improve from doubling of processor frequency. IPC is instruction per clock cycle. Clock cycle is not dependent on processor frequency (clock cycle time is dependent on processor frequency). We can improve IPC in many ways, such as branch prediction, improving cache hit rate, wider pipelines, etc.
4. Using the configuration from question 1 as the reference machine, what is the speedup for each benchmark? What is the geometric mean of the speedup?
The speedup of each benchmark is ~2. The geometric mean of the speedups are also ~2.
5. Assuming a program has 30% of instructions that uses the ALU, and we developed a technique to speedup ALU instructions, what is the maximum speedup that we can achieve?
Amdahl's Law Max Speedup: $1/0.7 = 1.43$
6. If 75% of a program can be done in parallel, what is the speedup on a machine with 4 cores vs a machine with 1 core?
Assume workload also grows with resources. Use Gustafson's Law. $1+0.75(4-1) = 3.25$*