SYSC 4507 Assignment 1

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1. (a)

$$\#\text{ of instructions} = \frac{\text{execution time}}{\text{CPI} \times \text{seconds/cycle}}$$

$$\#\text{ of instructions} = \frac{1.8\,\text{s}}{1.6 \times \frac{1}{900\,\text{MHz}}}$$

$$\#\text{ of instructions} = 1012500000$$

(b)

$$\text{MIPS} = \frac{1012500000\text{ instructions}}{1.8\,\text{s}}$$

$$\text{MIPS} = 562500000$$

(c) Using a processor that has a faster MIPS rating should result in a positive percent speedup. Since a higher MIPS-rated processor will execute the program faster, $T_{new} < T_{old}$, resulting in $\frac{T_{old} - T_{new}}{T_{new}}$ being positive.

2. Loop 1 executes n times. Loop 2 executes n times, loop 3 will execute $n \times (n - j)$ times, and loop 4 will execute $n \times (n - j) \times n$ times. The expression for the algorithm's run-time is then:

$$n + n^3 - jn^2$$

The highest-order variable in this expression is n^3, so this code fragment is of order $O(n^3)$.