CMPUT 229 - Quiz # 2 - Winter 2012

Name: Solution

Question 1 (100 points): When compiled with a compiler A, a computer program executes 2×10^9 instructions and requires 2 seconds to complete in a computer with a processor executing a frequency of 2 GHz ($1\ GHz = 1 \times 10^9\ Hz$).

A new compiler B was developed. When compiled with compiler B the same program executes 2 times faster in the same machine and the CPI of the code generated by compiler B is 0.5.

a. **[50 points]** What is the CPI for the code generated by compiler A?

$$\#\text{ clock cycles(compiler A)} = \frac{2 \text{ seconds}}{\frac{1 \text{ second}}{2\times10^9 \text{ cycles}}} = 4.0 \times 10^9 \text{ cycles}$$

$$CPI(\text{Compiler A}) = \frac{\#\text{ clock cycles}}{\#\text{ instructions}} = \frac{4.0 \times 10^9 \text{ cycles}}{2 \times 10^9 \text{ instructions}} = 2.0 \frac{\text{cycles}}{\text{instruction}}$$

b. **[50 points]** How many instructions the code generated by compiler B executes?

Execution time is given by:

$$\text{Execution Time}(B) = CPI(B) \times \#\text{ instructions}(B) \times \frac{1}{\text{Frequency}(B)}$$

$$1 \text{ second} = 0.5 \frac{\text{cycle}}{\text{instruction}} \times \#\text{ instructions}(B) \times \frac{1}{2 \times 10^9 \ \frac{\text{cycles}}{\text{second}}}$$

$$\#\text{ instructions(Compiler B)} = \frac{1 \times 2 \times 10^9}{0.5} = 4 \times 10^9 \text{ instructions}$$