CSE 141: Introduction to Computer Architecture Summer II 2019

Lab 1

Instructor: Devon Merrill

Name: _____ Date: _____

Instructions

- Answer each question in the boxes provided. Any writing outside of the boxes will NOT be graded. Do not turn in responses recorded on separate sheets.
- Handwritten or typed responses are accepted. In either case, make sure all answers are in the appropriate boxes.
- Graphs must be appropriately titled and labeled. Units must be included. Axes must have appropriate minimums and maximums.
- All responses must be neat and legible. Illegible answers will result in zero points.

You will need data gathered on the reference processor to complete this lab. See the course web page for instructions.

1. *Big O* (3 point):

   (a) Plot the matrix size vs. execution time for the 1000 MHz run of `code.exe`. Make sure to follow the graphing guidelines in the instructions for full credit.

   (b) This algorithm has a Big O run time of $O(n^3)$ to multiply two $n \times n$ matrices. Do your measurements agree with this Big O time? Why or why not?

2. *Clock Scaling* (3 point):

   (a) Plot the execution time vs. clock rate for the largest inputs at each clock rate measured. Make sure to follow the graphing guidelines in the instructions for full credit.

   (b) With an unknown clock rate, the execution took 24.1 seconds with an input size of 768. Use a linear trend line to predict the clock rate. Clock rates on the reference processor can only be set in multiples of 100 MHz.

3. *Power* (4 point):

(a) Calculate the package power for each data point. Plot the power vs. clock rate using the data for the largest inputs at each clock rate. Power should be normalized to the lowest value. Make sure to follow the graphing guidelines.

(b) What is the R value of a linear trend line to this power vs. clock rate data?

(c) From the power equation we expect power to scale linearly with frequency. Does this match what you measured? Why or why not?

4. *CPI* (4 point):

   (a) The program used 15 889 893 807 instruction to execute 5 iterations on the 768 $\times$ 768 matrices at 100MHz (this is the actual number). Calculate the average CPI.