CS 277 Lab 7
Performance Tuning
Due 11:59pm Thursday April 24, 2014

Purpose

The purpose of this lab is to investigate cache performance and other optimizations in order to improve the performance of a memory-intensive C function.

Assignment

You are given C code for a function: **`transpose(int *dest, int *source, int dims)`** where the function parameters are a source matrix (*source), a destination matrix (*dest) and the matrix dimension (dims). This function copies and transposes the elements of one **`NxN`** integer matrix into a result matrix. In other words, for source matrix **`S`** and destination matrix **`D`**, copy element $s_{i,j}$ to element $d_{j,i}$. Your assignment is to implement **`transpose_O(int *dest, int *source, int dims)`** - a transpose function that performs the same operation but exhibits a performance improvement with respect to speed. Use the provided **`transform.c`** and **`transform.h`** files to write your code and the provided **`driver.c`** file for comparing performance. A basic test has already been coded for you, but you can edit **`driver.c`** however you see fit as it will not be graded. Use the provided **`makefile`** to compile your code. You also have access to a library named **`libarch`** which provides functions for generating a random matrix and speed testing. The example code in the main function demonstrates how to use the library functions.

You will also create a **`README.txt`** file where you detail each of the optimizations you have introduced and why you introduced them.

Extra Credit

There are two opportunities for earning extra credit in this lab:

Opportunity #1: Head of the class. Once all submissions have been received, I will run each solution over a large data sample and plot the resulting speed performance. Depending on the distribution of scores, I will award the top performers with up to 10 lab points. (For example: for a normal distribution, the student(s) with a solution that produces results that are *at least* +1 standard deviation would be eligible for extra credit points).

Opportunity #2: Beat the professor. I will join in your suffering and write a solution of my own for this assignment. If I have *probable cause* to believe your solution is faster than mine (it beats mine roughly 51% of the time) you get five bonus points. If your solution beats mine *beyond a reasonable doubt,* then you get 10 bonus points. Do not think of this as an impossible challenge. I will likely only have time to write an implementation that makes use of the well known and more obvious approaches to this problem. There are many subtle ways you can boost performance. Some we have seen in class, others are in your textbook.

Submission

Create a .tar file named lab7-yourusername.tar and include **`transpose.c`**, **`tranpose.h`** and your **`README.txt`** file. Email the .tar file to me (mharmon@lclark.edu) before the due date and time.

Evaluation

+30 Compiles + Runs.
+30 New function performs transpose operation correctly.
+30 New function demonstrates a performance improvement over the given transpose function.
+10 README.txt file is complete and included.