Homework 3

Due: Monday 10/19 at the beginning of class

Complete the following. Submit the first problem via handin as assignment hwk3, and the others on paper or via email.

1. (8 points) Use pthreads to complete two parallel versions of the mandelbrot program. (You started this in lab 4.) The first version should parallelize the main nested loop in the order it appears in the given code (splitting iterations of i between 2 threads). The second should do so after swapping the loop order (moving the j loop to the outside and splitting its iterations between 2 threads). Submit the code with handin. Note that you can submit multiple files by listing them all on the command line:

   handin cs226 hwk3 file1.c file2.c

2. (2 points) Report running times for the serial code and both of your parallel versions. Also calculate the speedup achieved by each parallel version.

3. (6 points) An alternative way to parallelize the program would be to parallelize the inner loop. (Create threads inside the i loop of the original program to split iterations of the j loop.)

   (a) Would this version increase or decrease the overhead compared to the first parallel version above (splitting iterations of the outer i loop)?

   (b) Which version would give a better load balance?

   For both parts, be sure to explain your answer. (Note that I want an explanation rather than experimental results.)

4. (4 points) Consider 3 parameters in the code: numRows, numCols, and maxIteration. The first two determine the image size and the third is the number of iterations at which the mandelbrot function stops. How would increasing each of these affect (i.e. increase or decrease) the percentage of the program that runs serially? How would doing so change the speedup achieved by your parallel versions? Be sure to explain both answers. (Note that I want an explanation rather than experimental results.)