Advanced Algorithms | Fall 2018
CS 5350/6350 | Professor L. Longpré

Programming Project, Part II

General Description:

In this second part of the project, you will implement the divide and conquer algorithm for finding the closest pair of points, as described in our textbook on pages 957–961.

Detailed Description:

Implement the divide and conquer algorithm for finding the closest pair of 2-D points as described in our textbook on pages 957–961. As we saw in class, in the merge operation, you can keep the list of left points and right points in separate arrays, and only compare the current point with the next 2 points of the other side. Similarly, if you put the points all in one array, you only need to compute the distance of a point p to the next 4 following points. (The textbook says next 7 points and says 5 points in an exercise. I once have a proof for next 3 following points, but could not reproduce it.) You can implement the algorithm on the computer of your choice, and using the language of your choice. But since you will have to combine this program with the program you wrote in part I, you should use the same language and machine, otherwise you will have to redo part I before you do part I.

Assume the time taken by your program on an input of size n is of the form $xn \lg n + yn + z$. Find the values of constants x, y and z that best approximate your experiment.

Compute the optimal threshold to switch from the recursive version to the quadratic version in two different ways:

1. Use a very large but feasible input of fixed size. Calculate the time taken with different thresholds and plot the results.

2. Use the equations provided in class to compute a theoretical result. In particular, assuming a, b, c from part 1, assuming $d = x$ and $e = 2y + x$ from this part, solve the quadratic equation $\frac{a}{2}n^2 - dn - (c + e) = 0$.

Turn in: A report that includes a summary of your Part I results, a description of the experiments you performed, the source code you used, the data that you gathered, how you made the analysis to compute x, y and z, the experimental and theoretical optimal thresholds. Send an e-mail with your submission attached and with subject line "CS 5350 Project Part II" or "CS 6350 Project Part II", depending on which course you are registered for.

Due date: December 5th. The penalty is 1% per hour late, up to 10% per day, for up to 4 days late.