COMP163 Homework Assignment 6
Due Friday, November 30, 2018

Reading:
Continue reading in the yellow/blue book and possibly the red book to expand your understanding of computational geometry, as well as more particularly the topics of linear programming, closest pair, rectilinear computational geometry, and range searching.

Problems:

Give the most efficient algorithms that you can.

1. Data structures

   (a) Describe a data structure to maintain a set S of horizontal segments in the plane, described by an interval and a y-position $([lx_i, hx_i], y_i)$, such that all segments that intersect a vertical query line segment $q = (x, [l_y, h_y])$ ($s \in S | q \cap s \neq \emptyset$) can be reported efficiently. Analyse the preprocessing time and space used.

   (b) Describe a method of organizing a set S of n points in R^2 so that all points contained in a query rectangle $R = [l_1, h_1]X[l_2, h_2]$ can be reported in $O(\log n + A)$ time. [HINT: Use treaps as secondary data structures hanging off of the nodes of a primary binary search tree.]

2. Boundary of Intersection

   (a) Provide and analyse an algorithm for computing the boundary of the intersection region(s) of any two arbitrary simple polygons of n vertices each.

   (b) Provide and analsye an algorithm for computing the boundary of the intersection region(s) of any two rectilinear polygons of n vertices each.

3. Rectilinear Contour of Union Draw an example involving 4 rectilinear polygons on integer coordinates, build the segment tree, and walk through the performance of the two algorithms we studied: Lipski-Preparata, and Wood.

   This exercise is undertaken to increase your comprehension of these two algorithms and of the potential functionality of the segment tree. You do not need to turn this work in.