Assignment 6
CSCI-4963/6962: Geometric Algorithms

Due: Thursday, April 27, 2000

The topics covered in this assignment are arrangements, convex hulls, and robot motion planning. Answer any **three** of the following problems.

Please hand in your assignments to Pam Paslow in Amos Eaton 132 by 10:00am on April 27. Assignments must be done individually and will be graded on the basis of correctness, clarity, and legibility. Assignments handed in late will receive no credit.

1. Let S be a set of n line segments in the plane. Give an algorithm to decide if there exists a line that intersects all the segments in S. Such a line is called a *transversal* or *stabber*.

2. Given a point $p = (p_x, p_y, p_z)$ in R^3, let p^* be the plane $z = p_x x + p_y y - p_z/2$. For a non-vertical plane h, define h^* such that $(h^*)^* = h$. Show that:

   a. A point p lies on a plane h if and only if h^* lies on p^*.

   b. A point p lies above h if and only if h^* lies above p^*.

3. What does the Minkowski sum of two circles with radius r_1 and r_2 look like? Justify your answer.

4. When all obstacles are convex polygons we can improve the shortest path algorithm by only considering common tangents rather than all visibility edges.

   a. Prove that the only visibility edges that are required in the shortest path algorithm are the common tangents of the polygons.
   OR

   b. Give a fast algorithm to find the common tangents of two disjoint convex polygons.