Assignment 6

Robotics 811, Fall 2015

DUE: TUESDAY, December 1, 2015

Please note: There will be no resubmission opportunity for this assignment. The two problems below are implementations. You will know yourself whether you have produced a successful solution.

1. Implement two-dimensional convex hull.

   Your algorithm should take as input a finite set of two-dimensional points and produce as output a polygon constituting the boundary of the minimal convex set containing all the input points.

   ("minimal convex set" means that the set is a subset of any other convex set that contains all the input points.)

2. Implement shortest-path motion planning for convex polygons in two dimensions (translations only, no rotations).

   Specifically, the input to your algorithm should consist of a "robot" and its environment, along with start and goal configurations for the robot. The output should be a piecewise linear path as described below.

   The robot should be an arbitrary nondegenerate convex polygon. The environment should consist of a collection of arbitrary nondegenerate (possibly overlapping) convex polygons. Given arbitrary start and goal configurations of the robot, your algorithm should produce a shortest intersection-free path between the start and goal, if such a path exists. "Intersection-free" means that the robot may touch obstacle boundaries, even slide along obstacle boundaries, but may not touch the interior of any obstacle. If no such path exists, your algorithm should report that fact. Your algorithm should operate by searching a visibility graph constructed from the robot's configuration space.

Demonstrate the correctness of your code with appropriate pictures of sample runs: In Problem 1, show some examples of points and their convex hulls (some examples with a just few points and some examples with many points; for fun, see how high you can make that number) . In Problem 2, show paths found for some robots and environments.