Shortest Path with Polygonal Obstacles

CS 2104 Extra Credit Assignment 1

30 points

The Problem. An instance of the problem is a finite set of non-overlapping, simple polygons in the plane, plus two points s and t that are not in the interior of any polygon. See Figure 1 for a sample instance. The problem is to describe a continuous path from s to

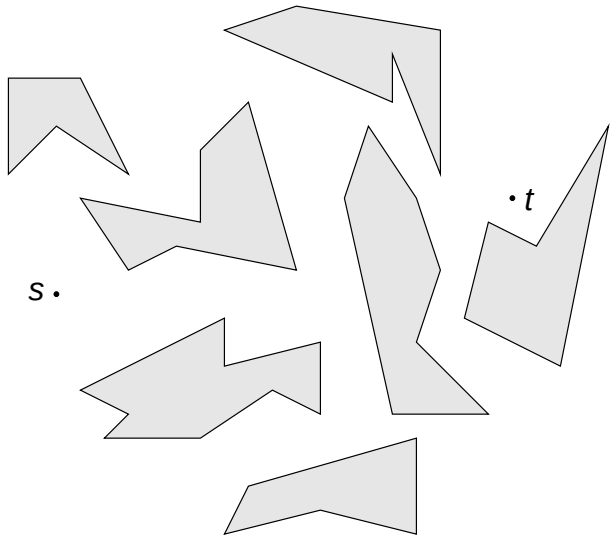

Figure 1: A sample instance of the problem. There are seven polygons with their interiors shaded. Points s and t are the desired origination and destination for a shortest path.

t that avoids the interiors of the polygons and that is as short as possible (use Euclidean distance). It is fine for a path to go through a vertex or go along an edge of a polygon. You are to work towards a method (an algorithm) for finding a shortest path.

The Assignment. This assignment is optional, that is, for extra credit. It is to be done by a group of two to four students. Grading will be based on group insights into the problem solving process and the quality of the written submission. It is possible for a particularly insightful submission to receive full points, even if it does not fully solve the original problem.

Here are some thoughts to help group discussions.

1. Find several paths from s to t for the sample instance. Which is shortest?
2. Develop some notation and terminology for talking about the problem and its solution.
3. Argue that there is always at least one path from s to t.

4. What are characteristics of a shortest path? Is there always at least one shortest path?

5. Are there special cases of the problem that are easier to solve? Simplify!

6. How can you encode an instance for computer solution?

7. How can you encode a solution for computer output?

Do not feel constrained by this list. Use your creativity!

Submission. The submission for this assignment must be a prose document that carefully describes the group insights towards a solution to the problem. It is important to reveal the thought processes that the group went through. Your written solution must be uploaded as a PDF file. Follow the "general assignment guidelines" on teh class' site. Only one file should be uploaded per group. The file should identify the members of the group!