ASEN 5519 - Algorithmic Motion Planning
Fall 2021

Homework 1

Assigned August 27; Due September 3

Exercise 1. Draw the trajectories produced by Bug 1, Bug 2, and Tangent Bug (with unlimited radius) algorithms for a point robot in the workspace shown in Figure 1.

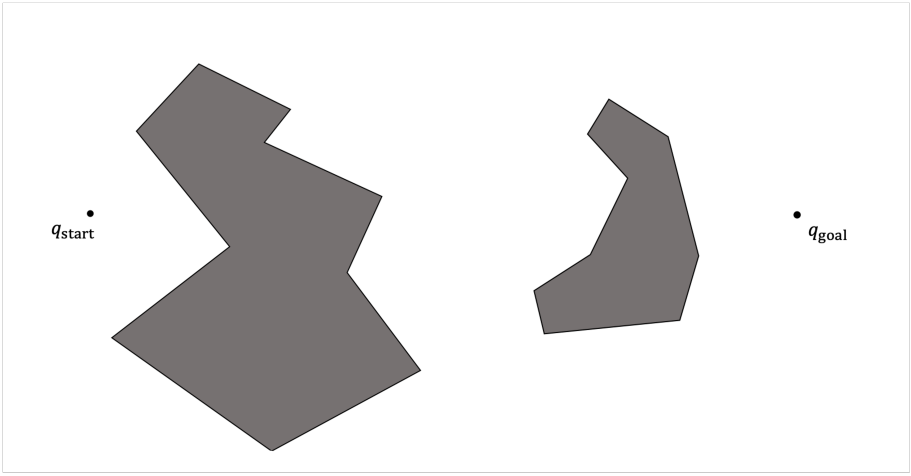

Figure 1: Simple environment.

Exercise 2. Construct an example for which the upper bound of the traveled path for Bug 1 is obtained. How does Bug 2 perform in this example?

Exercise 3. What is the difference between the Tangent Bug algorithm with zero range detector and Bug 2? Draw examples.

Exercise 4. Consider a point robot at q_{start} with the goal of reaching q_{goal} in workspace W which consists of a set of obstacles $WO = \bigcup_{i=1}^{n} WO_i$, where WO_i for all $i \in \{1, 2, \ldots, m\}$ $(m < n)$ is within the radius of $d(q_{\text{start}}, q_{\text{goal}})$ from q_{goal} and the rest of the obstacles are outside of this radius. What is the maximum number of obstacles the robot will encounter if it uses BUG 1 algorithm? Justify your answer.

Exercise 5. Is the Tangent Bug algorithm complete? Show a counter example or a proof.