

ASEN 5254 - ALGORITHMIC MOTION PLANNING  
FALL 2024  
HOMEWORK 1

Assigned Aug. 30; Due Sep. 6 by 5pm

**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.

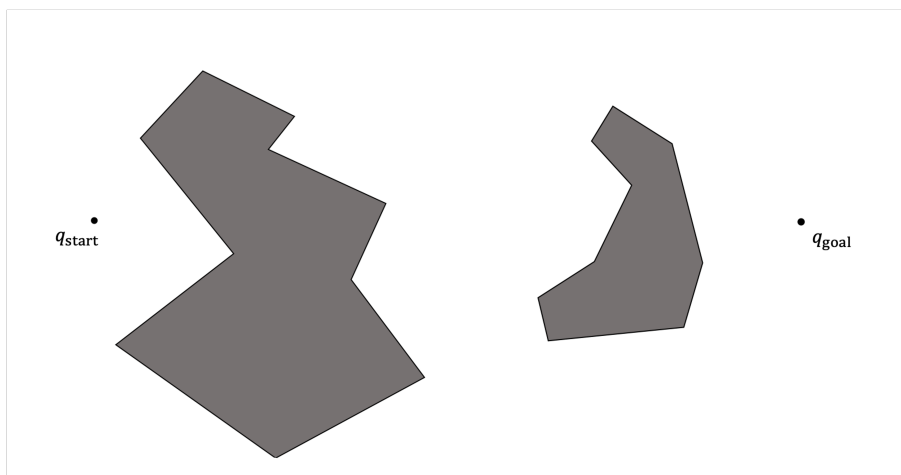


Figure 1: Simple environment.

**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  $i \in \{1, 2, \dots, m\}$  ( $m < n$ ) is within the radius of  $d(q_{start}, q_{goal})$  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 Bug 2 algorithm complete? Show a counter example or a proof.