

# Homework 5

16-311: Introduction to Robotics

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## Learning Objectives

1. Finish motion planning topics.
2. Practice graph search algorithms.

# 1 Visibility Graph

Here, we will create a visibility graph for a sample workspace with polygonal obstacles. Assume that the start and goal nodes are on the edge of the obstacles. The edges of the image are also obstacles so don't forget those.

Create the visibility graph for the following environment. You may hand-draw this, use an image editor or create a program to accomplish this task.

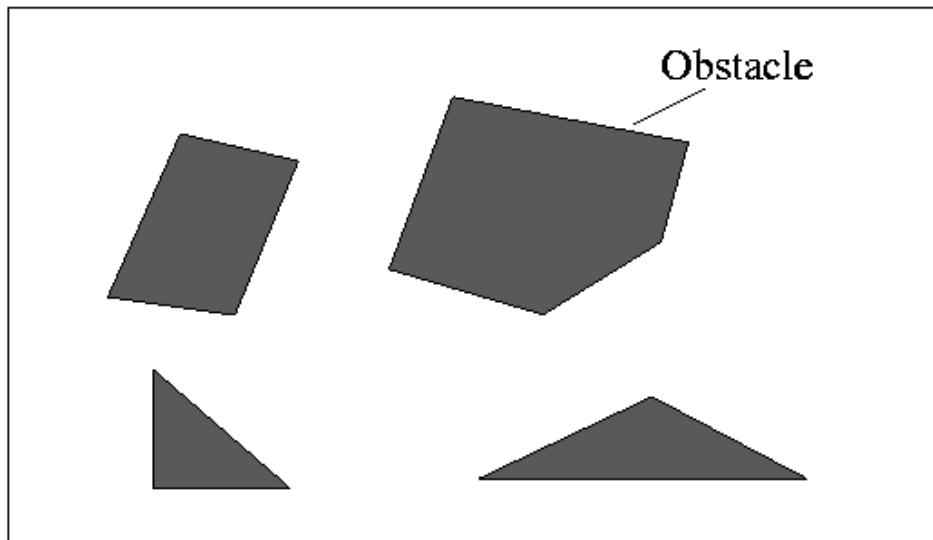


Figure 1: Sample Environment 1.

## 2 Voronoi Diagram

Using the environment bellow, draw a Voronoi diagram using the Euclidean distance metric (L2). For this metric, you can envision and circle that expands and contracts; when two or more points on the circle touch an obstacle, the center is on the Voronoi diagram.

You can draw this image by hand, use an image editor or write a program that accomplishes this task.

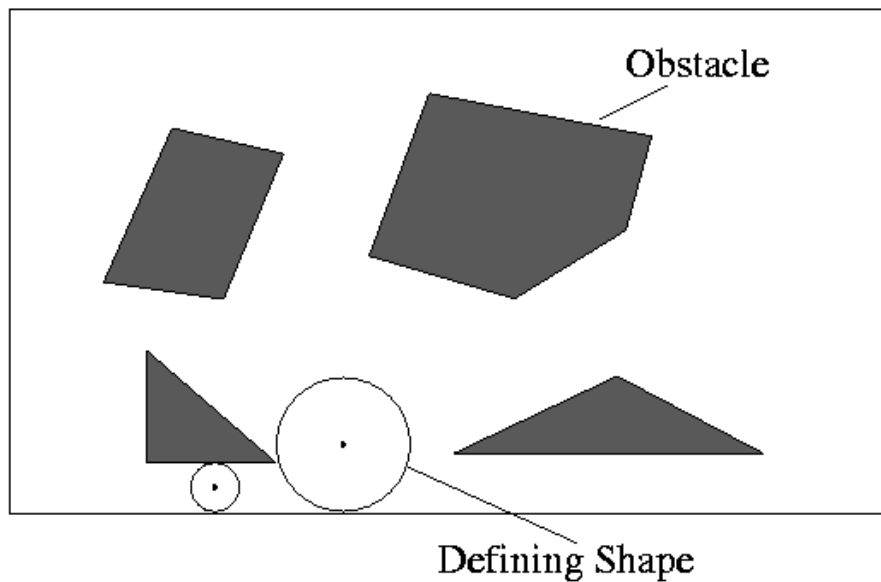


Figure 2: Sample Environment 1 with circle.

### 3 Graph Search

In this section, we will use breadth-first search to find a path from start to goal.

#### 3.1 Search the Graph

First we want to compare searching a graph with Breadth First Search. The image below shows our graph, a series of vertices (nodes) and directional edges (arrows). First off, we want to know if A is in our graph. H is our start and A is our goal, but we want to make sure that A is even possible to get to. Note that this search is uninformed, we don't know anything about the environment. Search through the following graphs using BFS. Visit nodes on the same level in alphabetical order. When you get to A (if it is possible), just stop for this question. Please the letters of the nodes you visit in the order you visit them in ending with A (even if there are nodes you haven't yet visited). Think about the best and worst case run times for this method.

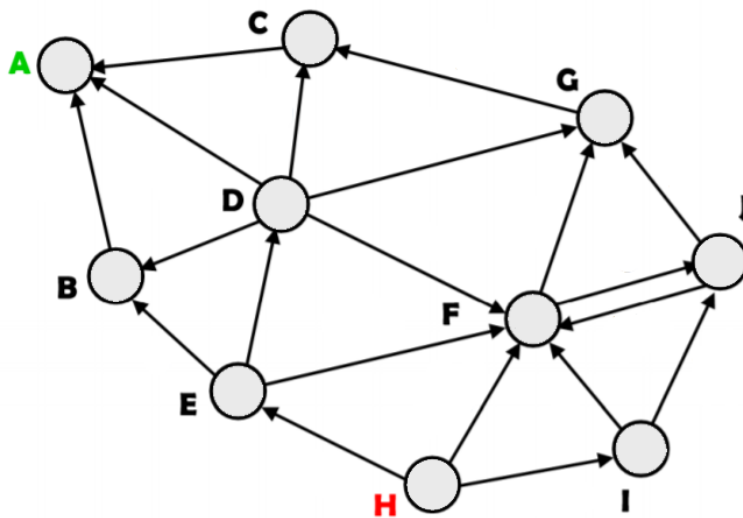


Figure 3: Unweighted graph.

## What To Submit

Submissions are due on Gradescope by the date specified in the Syllabus.

1. Create a .pdf file with the written answers ALL THE SECTIONS named hw5.pdf.
2. Ensure that your .pdf contain a picture for Part 1, a picture for Part 2, and one list and one path for Part 3.