

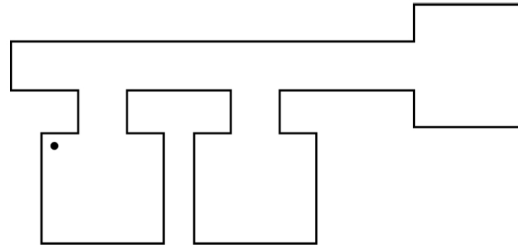
Homework 8

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1 Question 1

A robot, represented below by the small dot, wants to solve the Dudek-Romanik-Whitesides localization problem discussed in class. The environment is represented as a polygon, and the robot has a sensor that reports the visibility polygon of its position within the environment and a compass that reports the robot's orientation relative to the environment map.



1. Draw the visibility polygon for the robot's position.
2. Find all of the positions consistent with this initial sensor information. Mark each with a star.
3. Draw a path that would allow the robot to eliminate at least one of these candidates.

1.1 Solution

1.1.1 Visibility polygon for the robot's position

Figure 1 illustrates the visibility polygon for the robot. It was generated by connecting the robot's position to the visible vertices and extending the lines accordingly.

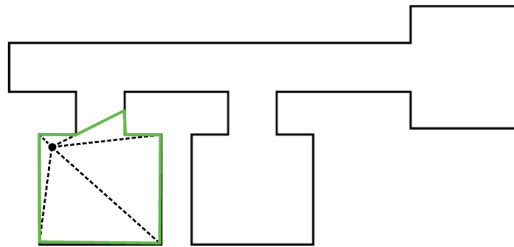


Figure 1: Visibility polygon for the robot

1.1.2 All of the positions consistent with this initial sensor information

Figure 2 highlights all possible locations that match the robot's initial sensor readings. While the top-right square could potentially fit the same visibility polygon, the robot can distinguish the difference using the compass. Therefore, there are only two possible locations.

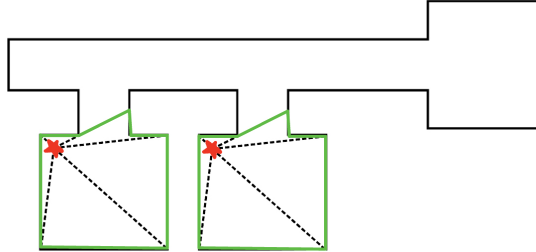


Figure 2: All the possible positions, marked by red stars, that are consistent with the initial sensor data.

1.1.3 Draw a path that would allow the robot to eliminate at least one of these candidates

Figure 3 shows a path that can eliminate other possible location candidates. This path lies within the original visibility polygon. The light-blue line represents one of the lines connecting two mutually visible vertices. As long as the robot crosses this line, it can gain the necessary information to refine its position. By following the path, the top-left corner will eventually appear within the robot's visibility polygon, while the other candidate locations will not. This enables the robot to differentiate its true position from the other possibilities.

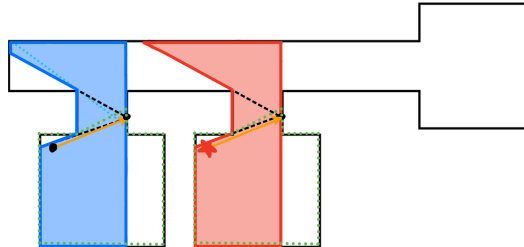


Figure 3: The path marked in orange enables the robot to eliminate confusion with other possible locations.