CS 470 Homework
Motion Planning
55 Points

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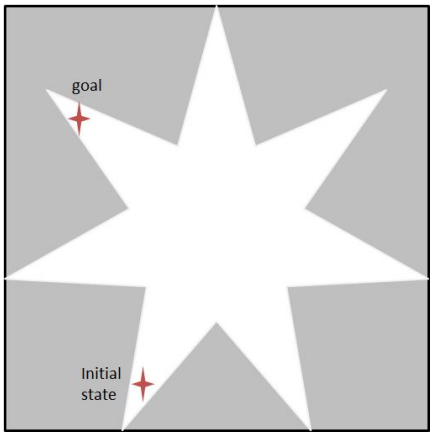
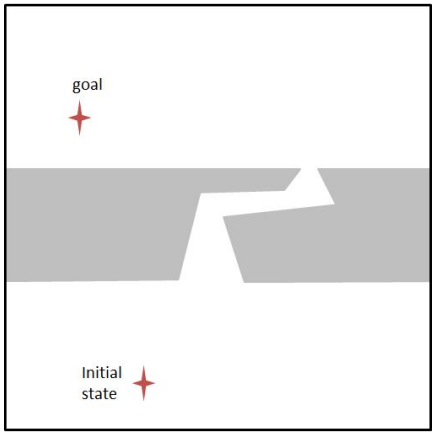
1. **[10 points] Probabilistic Roadmaps**. Consider the two configuration spaces (a and b) shown below, where white indicates free space, and grey occupied space. The goal and initial states in each space are indicated with the red marks.

   (a) **[5 points]** In which configuration space (a or b) would a basic probabilistic roadmap be expected to find a solution with fewer milestones?



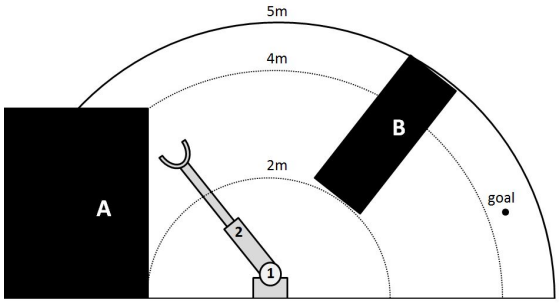
(a)



(b)

   (b) **[5 points]** Justify your answer.

2. [**45 points**] **Configuration Spaces**. Consider the following robotic arm. It can rotate around joint 1, and its arm (2) can extend from 0 to 5 meters. It is situated in a physical space with two obstacles (A and B) as shown in the following figure. The goal is to move the arm so that the end of the arm is at the point marked "goal" in the image.



In your solutions, draw a box similar to the one on this page, and in it do the following:

(a) [**30 points**] Draw the configuration space (including configuration space obstacles). Make sure to label the configuration space obstacles and the axes of your configuration space.

(b) [**5 points**] In your drawing, clearly identify the initial configuration of the robot, as it was shown in the figure

(c) [**5 points**] In your drawing, clearly identify the goal configuration, as it was shown in the figure

(d) [**5 points**] In your drawing, draw a valid path that the robot could use to move from the initial configuration to the goal configuration.