ASEN 5519 - Algorithmic Motion Planning
Fall 2021

Homework 5

Assigned September 24; Due October 1

Exercise 1. (a) Give a definition for a *complete* planning algorithm. (b) Give a definition for an *optimal* planning algorithm. (c) Recall the wave-front planner from Lecture 7. Is it a complete planner? Is it an optimal planner? Justify your answers in part (c).

Exercise 2. Implement a gradient descent planning algorithm with a potential function of the form $U = U_{att} + U_{rep}$.

(a) Demonstrate the performance of your planner on a simple example in a 2D C-space ($C = \mathbb{R}^2$) with $q_{\text{start}} = (0, 0)$, $q_{\text{goal}} = (10, 0)$ and two square obstacles with side length of 1 centered at $(4, 1)$ and $(7, -1)$. Choose a radius of $\epsilon = 0.25$ centered at q_{goal} for the termination condition at goal.

i. Plot the vector field.

ii. How did you choose the values for d^*_{goal} and Q^*_i for $i \in \{1, 2\}$?

iii. Plot the path generated by the planner.

iv. What is the length of the path?

v. Would you expect the same path length for different values of d^*_{goal} and Q^*_i?

(b) Solve the planning problems in **Exercise 2** of **Homework 2** using your gradient descent planner. Unlike the Bug algorithms, assume the obstacles are known. Choose a radius of $\epsilon = 0.25$ centered at q_{goal} for the termination condition at goal.

i. How did you choose the values for d^*_{goal} and Q^*_i?

ii. Plot the paths generated by the planner.

iii. What are the lengths of the paths?

iv. Would you expect the same path lengths for different values of d^*_{goal} and Q^*_i?