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# CS485 AUTONOMOUS ROBOTICS

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## Homework 2 Motion Control and Planning

**Due:** March 17 before class

**Name:**

**G Number:**

**Email:**

## 1 Motion Control

- 1.1 Write down the governing equation for a PID controller and describe what each term stands for. Use schematics if necessary. (5 points)
- 1.2 Describe the functionalities of the P, I, and D term of a PID controller. Why do we need these three terms respectively? (10 points)
- 1.3 What is the advantage of using an LQR over a PID controller? (5 points)

## 2 Motion Planning

### 2.1 Search Algorithms

(1) Please write down the order in which each node is visited when using (1) BFS and (2) DFS to search from **S** to **G** in the following graph. Terminate when **G** is reached. You may want to draw the search tree to help with visualization. (20 points)

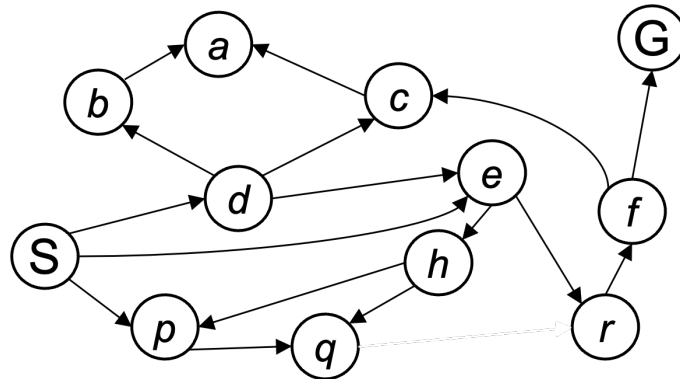


Figure 1: Search from **S** to **G**.

(2) For the above graph, if each edge is associated with a cost, what search algorithms can be used to solve for the path from **S** to **G**? What are their pros and cons? (15 points)

**2.2 List three ways to build a roadmap for motion planning. (5 points)**

**2.3 In which space does robot motion planning usually take place? (5 points)**

**2.4 Briefly describe PRM and RRT and compare them. (15 points)**

## 2.5 The BARN Challenge Motion Planners (20 points)

The default robot navigation stack (`move_base`) employs two motion planners, the global and the local planner. What approaches do these planners use? Briefly describe how these planners work, in the context and using the terminologies of what we discussed in class. If you describe what approach you would like to use for your own BARN Challenge submission, you will get 10 extra points.