

## LAB 4: Path Planning – Part I

### Due: Tuesday, March 29<sup>th</sup> for Part I (Blackboard)

The purpose of lab 4 is to develop pathfinding capabilities for Cozmo. This lab consists of two parts. In the first part, you will implement the RRT algorithm for searching in a simulated environment, and in the next part you will incorporate this with Cozmo to help explore a real environment.

#### Part I

For this part, you will complete the following methods in the file `rrt.py`:

`step_from_to`: This method will take two nodes and return the second one if the distance between them is less than the `limit` (a threshold value), or it will return a new node along the same line but `limit` distance away from the first node.

`node_generator`: This method will return a randomly generated node, uniformly distributed within the map boundaries while avoiding obstacles.

`RRT`: This is the main method for which we have provided a framework. You must complete the main loop by generating random nodes and assembling them into a tree in accordance with the algorithm. Goal detection, tracking parents, and generating the final path is already done for you as part of the `cmap.py` method.

**Note 1:** The file `utils.py` contains some general useful methods, as well as the definition of the `Node` class, and the file `cmap.py` contains some useful methods related to the map representation, so it is worth familiarizing yourself with these files though you will not be editing them.

**Note 2:** We have provided you with 3 maps (in the `maps` folder) for testing purposes. You can run the algorithm either on one map with a graphical visualizer by executing `rrt.py` (you can change the map in the main method at the bottom of the file), or you can run the code on all 3 maps at once without the visualizer by executing `python autograder.py gradecase1.json`.

**Evaluation:** The first part will be auto-graded using the 3 maps we have given you, as well as 3 new maps (similar in layout to the one we have given you). You will receive 10 points per successful solution, for a total of 60 points (the first item in the evaluation table).

**Submission:** Submit your final `rrt.py` on Blackboard (only this file). Make sure your code is entirely contained within this file. If you relied significantly on any external resources to complete the lab, please reference them in the submission comments. One submission per group.