EN.530.663: Robot Motion Planning
Homework 8

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due: 04/09/2021, midnight EST to Gradescope

Problems

1. Write a Matlab function code for build_RRT for planar point robot cases (as in the hand-outs). The specification of the code is the following:

- The function should be of the form:
  function $[path, V, E] = build\_RRT(q_I, q_G, NumNodes, \Delta q, O, x_{max}, y_{max})$
- The input includes:
  - q_I and q_G: initial and goal position of the robot.
  - $NumNodes$: the limit number of nodes.
  - Δq: step size (constant).
  - O is the cell array of obstacles.
  - Assume that the reachable workspace is a 2D (of course!) square box of which the lower left corner is the origin. You will then need the size of the box in the input, which is $x_{max} \times y_{max}$.
  - other inputs as necessary
- The output includes:
  - the $path \in \mathbb{R}_{2\times n}$ connecting q_I and q_G. (q_I and q_G should also be included)
  - The set of vertices V and the set of edges E
  - other outputs as necessary.

2. Write a Matlab function code for build_PRM for planar point robot cases (as in the hand-outs). The specification of the code is the following:

- the function should be of the form:
  function $[path, V, G] = build\_PRM(q_I, q_G, n, K, O, x_{max}, y_{max})$
- The input includes:
  - q_I and q_G: initial and goal position of the robot.

  - n: the limit number of nodes.
  - K: number of nearest neighbors.
  - O is the cell array of obstacles.
  - (x_{max}, y_{max}) the coordinates of the upper right corner of the workspace box (the origin is the lower left corner as in P1).
  - other inputs as necessary
- The output includes:
  - the path $path \in \mathbb{R}_{2\times n}$ connecting q_I and q_G.
  - The set of vertices V and the weighted adjacency matrix G
  - other outputs as necessary.

Note:

- You need to write the function isintersect_linepolygon as in the hand-outs for both of problems.

Submission Guideline

- Submit all your Matlab codes in a single .zip file. Name your single zip file submission as "YourName_HW8.zip". For example, "JinSeobKim_HW8.zip" for a single zip file. Submission will be done through the Gradescope.
- Please make sure to include *all the necessary files*, even files that were submitted in the previous homework assignments (of course the codes must be updated if necessary so as to be error-free). If TAs try to run your function and it does not run, then your submission will have a significant points deduction.
- Make as much comments as possible so that the TAs can easily read your codes.