EN.530.663: Robot Motion Planning
Homework 9

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due: 04/16/2021, midnight EST to Gradescope

This is exclusively used for Spring 2021 EN.530.663 RMP students, and is not to be posted, shared, or otherwise distributed.

Problems

1. Write a Matlab function code for the *vertical cell decomposition* for planar rigid-body robot cases (as shown in the handout). Note that you can use vertical cell decomposition or cylindrical vertical cell decomposition. The specification of the code is the following:
    - The input includes:
        - q_I and q_G: initial and goal position of the robot.
        - CB: C-obstacles (as a cell array; this includes the orientation of the robot already)
        - *bounds*: coordinates of the vertices of the rectangular box (environment or the world).
        - other inputs as necessary
    - The output includes:
        - the set of vertices of the graph
        - the weighted adjacency matrix for the graph
        - n_{init}, n_{goal}: the node numbers for q_I and q_G in the graph.
        - other outputs as necessary

    Specifically, implement:
    - **function** [V, G, n_init, n_goal] = vertical_cell_decomposition(qI, qG, CB, bounds)
        - qI, qG: 2×1 array
        - CB: a cell array. Each element is a 2×1 array representing one C_obs.
        - bounds: 2×4 array. Start from the bottom left corner and in CCW order.
        - V: $2 \times n$ array of vertices
        - G: $n \times n$ array of the weighted adjacency matrix for the graph
        - n_init, n_goal: node numbers for qI and qG
        - You can have additional inputs and outputs if necessary.
    - A MATLAB script *"RMP_HW9_VCD_test.m"* is provided for you to test your code. The script contains two test examples. The second test case is made a bit tricky and could be challenging. In this test case, the C-obstacles of two objects overlap.

Submission Guideline

- Submit all your Matlab codes in a single .zip file. Name your single zip file submission as "YourName_HW9.zip". For example, "JinSeobKim_HW9.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.