ASEN 5519 HW #3 | 10/12/20 | LAOUAR, ZAKARIYA

1) a) A complete planning algorithm generates a solution (path) or reports that no solution or path exists all in finite time.

b) Optimality in motion planning, is a property of the algorithm that is defined for a specific function, i.e. path length, execution time, energy consumption etc.

c) The planner is resolution complete since determining a path from start to goal depends on how fine the grid is. The planner is optimal in that it finds the shortest path from start to goal (manhattan distance as heuristic).

a planner can be resolution complete (i.e. completeness is dependent on the resolution of the discretized map) or probabalistic complete (i.e. if a solution can be found, the probability of a path will $\rightarrow 1$ as $t \rightarrow \infty$

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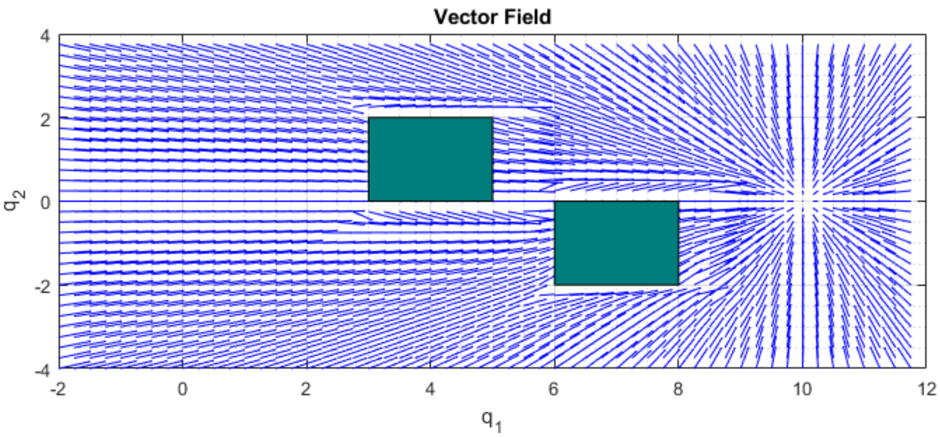
Housekeeping

i) Plot Vector Field

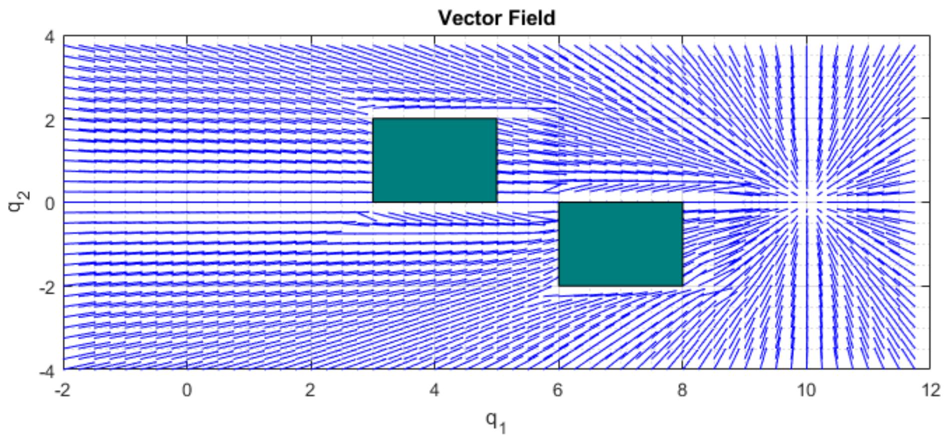


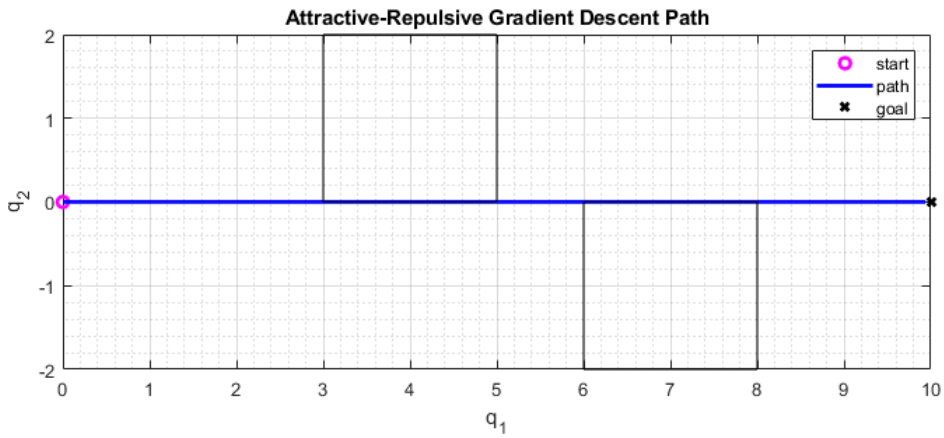
ii)

I started with a large dstar_goal and slowly decreased it *until I saw that the attractive forces were decreasing smoothly as the robot reached the gap between the obstacles. The Qstar for both obstacles were the same and the robot was able to move straight towards the goal without deviating from the obstacles*

iii) Plot Path

Load path from csv





iv)

The length of the path is: 9.937525

v)

Yes, I would expect different path lengths since the Qstar influences how close a robot can come to a certain obstacle and since the obstacles are near the robots path to goal the robot would surely be swayed if Qstar is decreased

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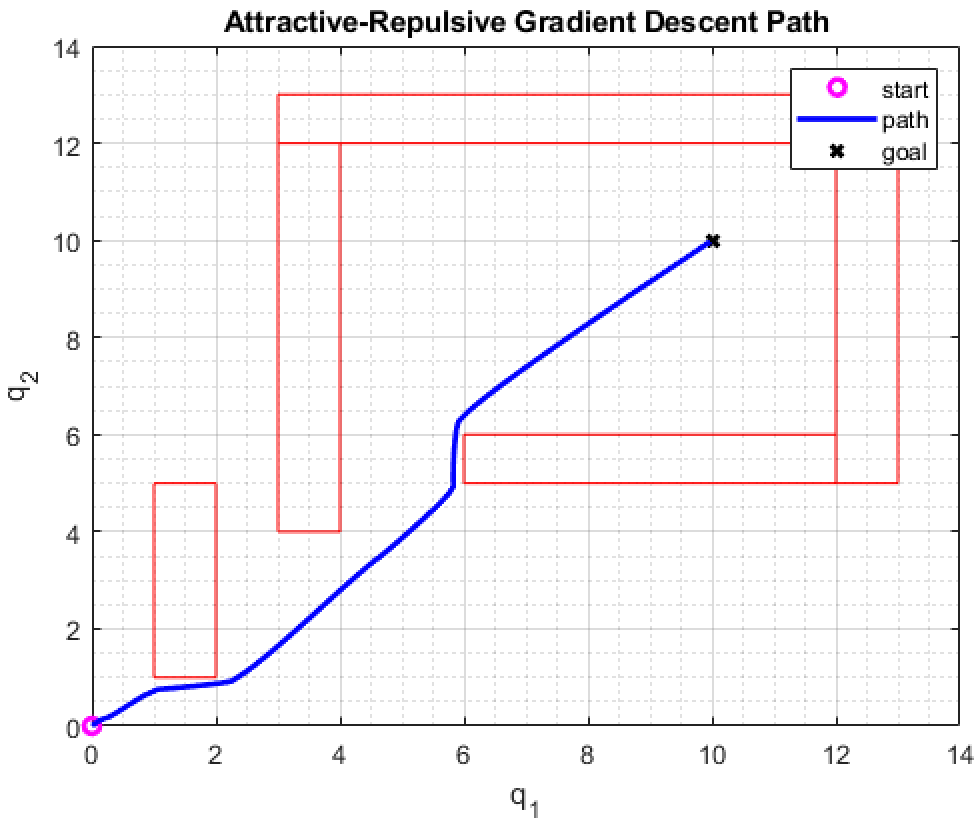
i)

I started with a large dstar_goal and slowly decreased it until I saw that the attractive forces were decreasing smoothly and the robot was able to escape the first obstacle to the right. The Qstar for the first obstacle was very small to help the robot escape the obstacle closesly. The Qstar for the rest of the obstacles were the same and slightly larger to push the obstacle to the right

ii) Path



iii)

The lenght of path 1 is: 14.742592

iv)

(After next map)

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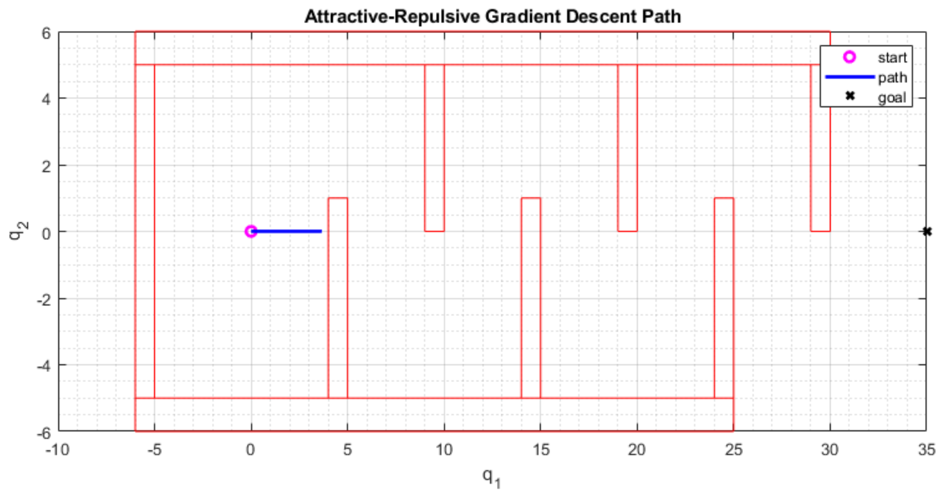
i)

I was unable to get the robot to move up from the start position Since the robot was surrounded evenly by obstacles from the top and bottom there was no force component in the up direction thus a local minimum was encountered

ii) Path



iii)

The lenght of path 2 is: 26.263250

iv)

No, I would expect different path lengths since the Qstar influences how close a robot can come to a certain obstacle and since the obstacles are near the robots path to goal the robot would surely be swayed if Qstar is decreased

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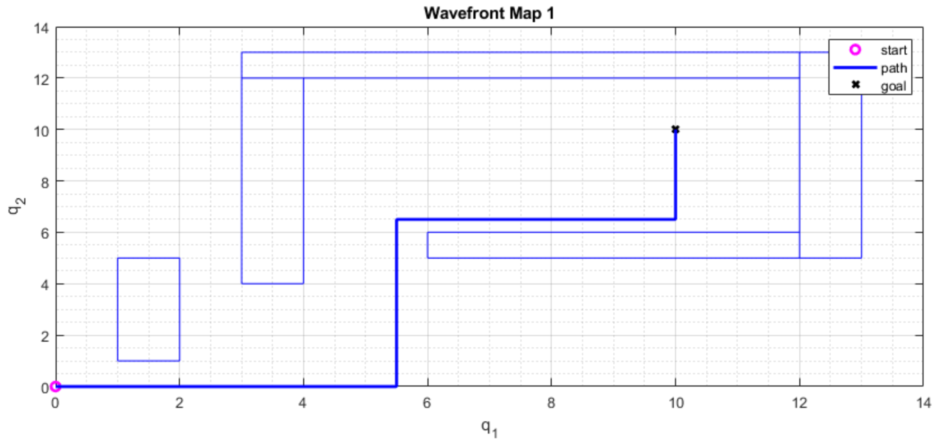
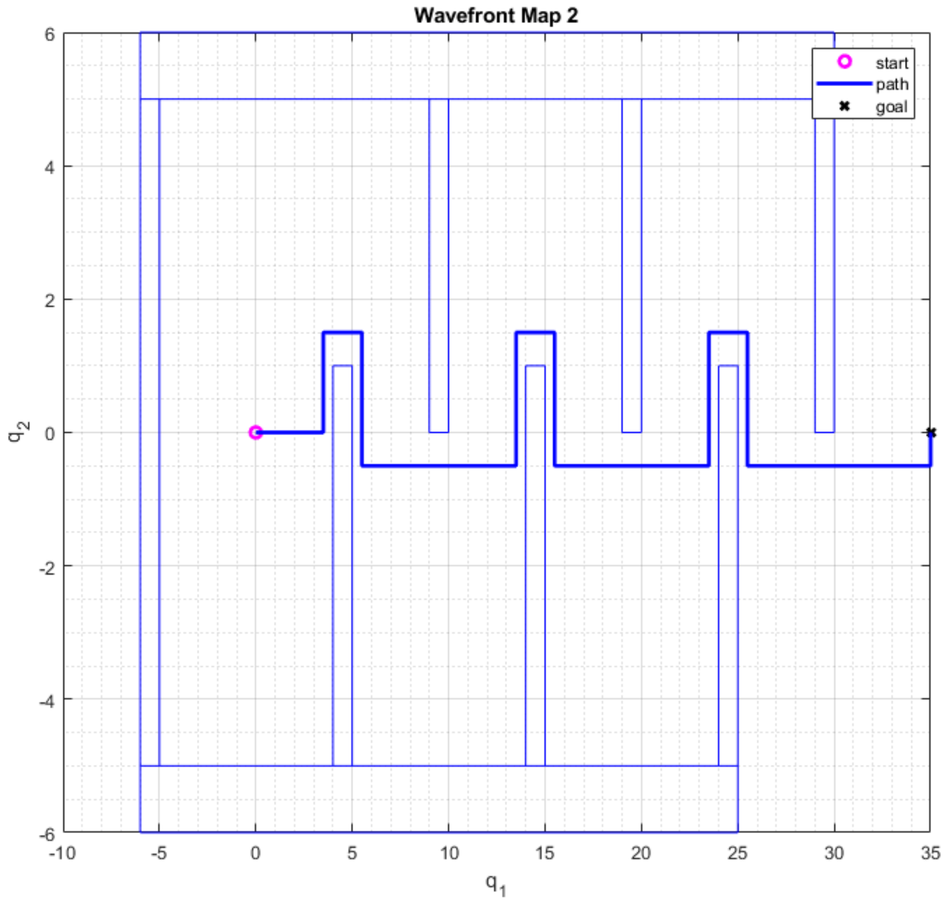
Plot Path Map 1



Plot Path Map 2



b)

The Length of the path for Map 1 = 20
The Length of the path for Map 2 = 47

c)

Yes, since the wavefront algorithm is a resolution complete algorithm. In other words, the more fine the grid is, the closer the robot can travel against the obstacles and in free space to minimize the Manhattan distance to goal

d)

This planner is resolution complete so as long as the resolution is high enough, there will be a path (as seen). The gradient descent

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planner on the other hand presented local minimas as seen on the
 second
map and no path was found. However the wavefront planner, because it
 is
resolution dependent, gives non optimal paths. The gradient descent
 planner
gave a shorter path for map 1 than the wavefront planner
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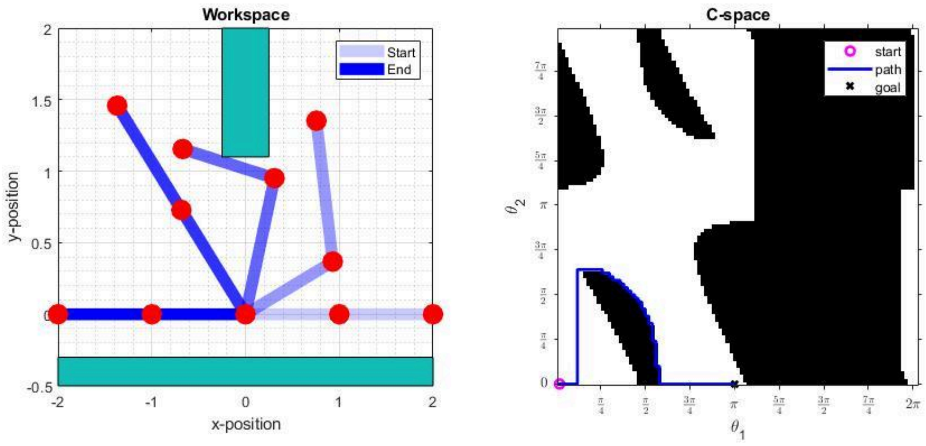
Problem 4



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