Exercise 1.

(a) Give a definition for a complete planning algorithm.

An algorithm is said to be complete if it computes a path to the goal if it exists in finite amount of time or returns failure if the path does not exist.

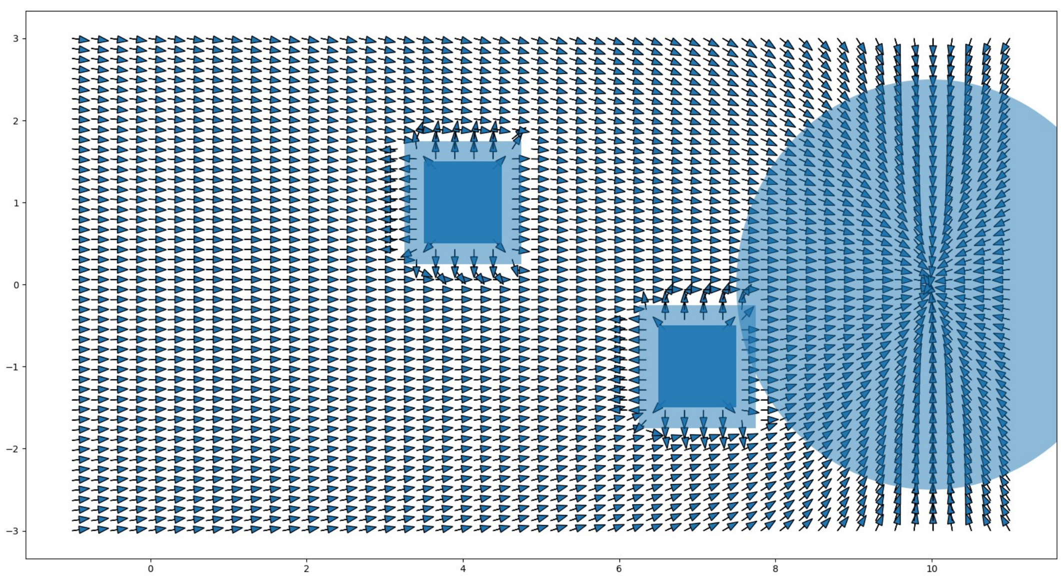
(b) Give a definition for an optimal planning algorithm.

(c) Recall the wave-front planner from Lecture 8. Is it a complete planner? Is it an optimal planner?

Exercise 2.

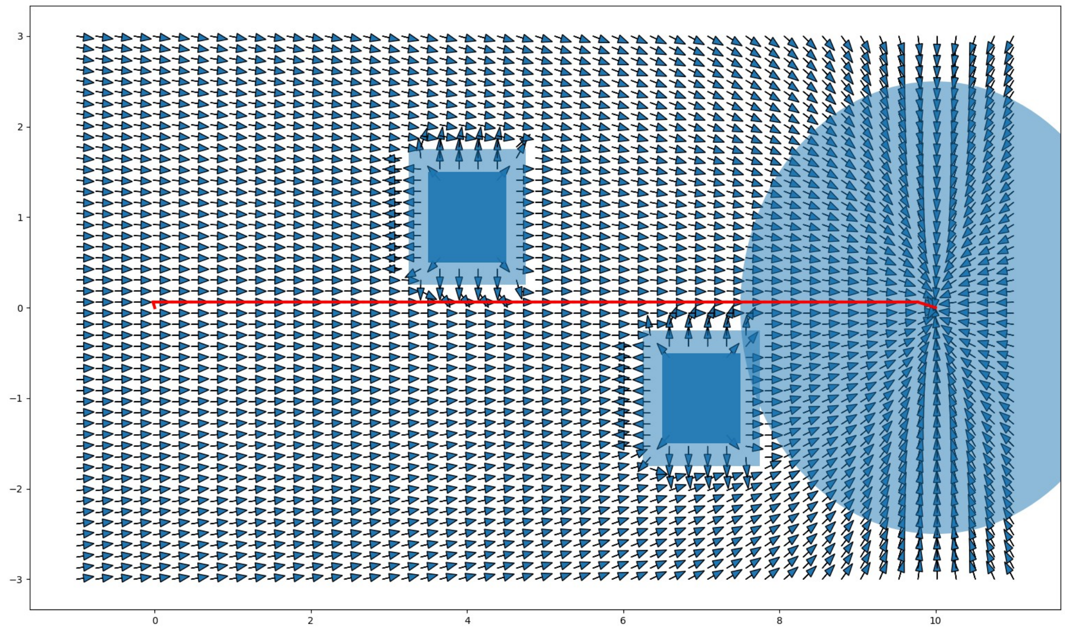
(a)

i. Vector field



ii.

iii. Path

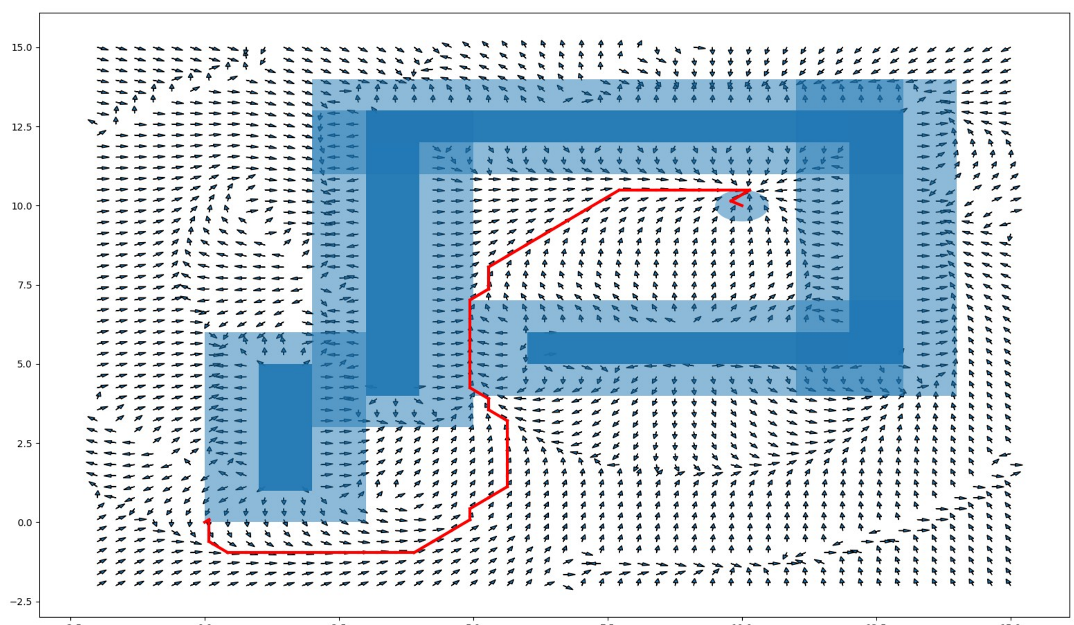


iv. Length of the path is 10.093 units.

v. No

(b) Workspace 1

i. d*=1 (scale=33.3)
Q*=[1,1,1,1,1] (scale=25)
centroid=7 (scale=1000)
ii.



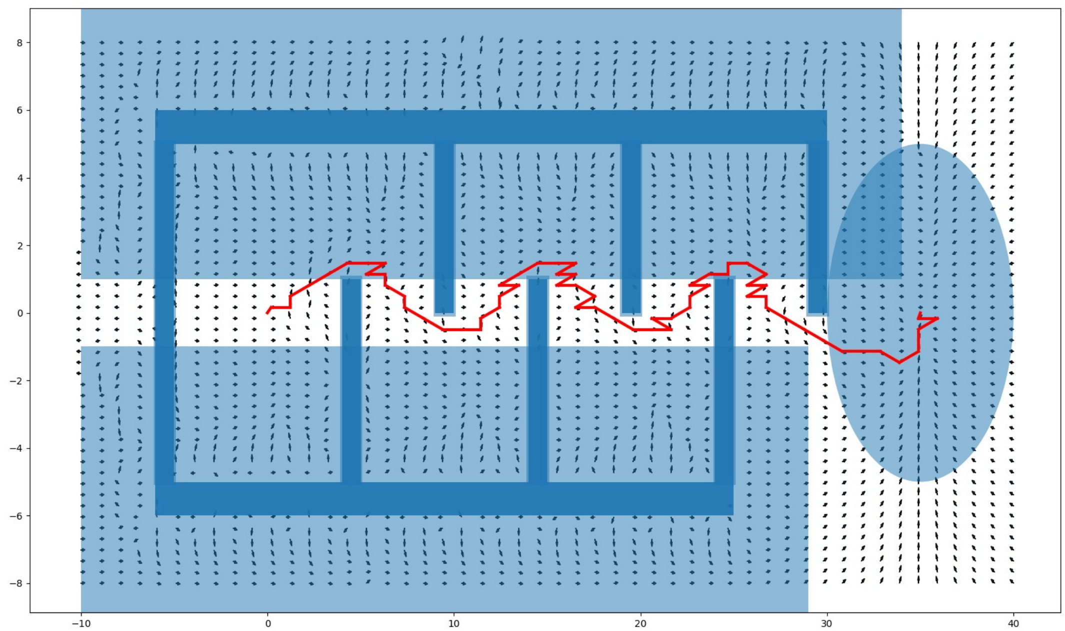
iii. Length of the path is 21.542 units

iv. No

(b) Workspace 2

i. d*=10 (scale=3)
Q*=[4,4,0.1,0.1,0.1,0.1,0.1,0.1,0.1] (scale=200)
centroid=[15,15,4,4,5,5,5,5,5] (scale=570)

ii.

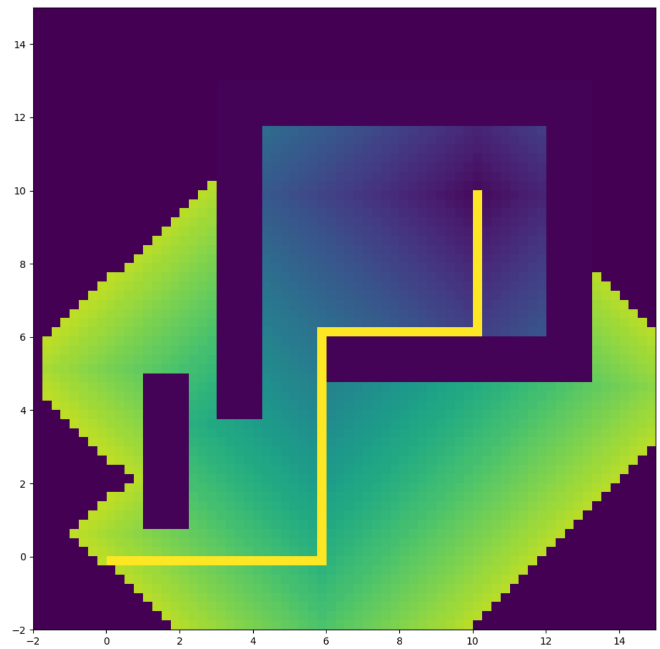


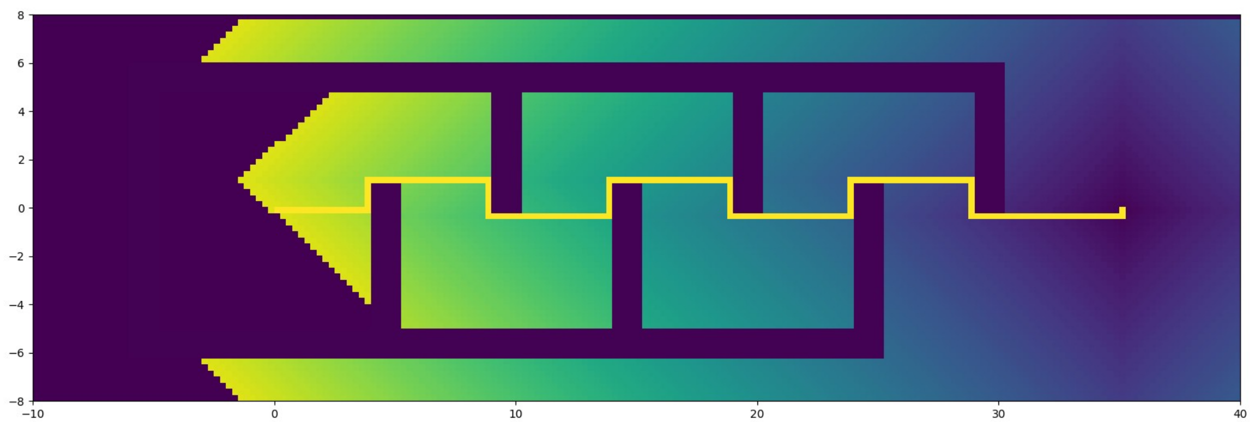
iii. Length of the path is 60.401 units

iv. No

Exercise 3.

(a) Plot the paths generated by the planner. (Assume the robot transverses the adjacent cells using a line that connects their centers.)





(b) What are the lengths of the paths?

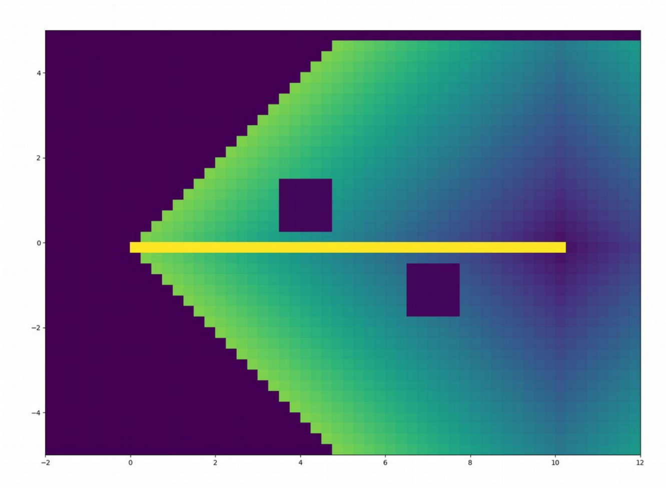
Workspace 1: 20 units

Workspace 2: 44 units

(c) Would you expect the path lengths to get smaller as the grid size gets smaller?

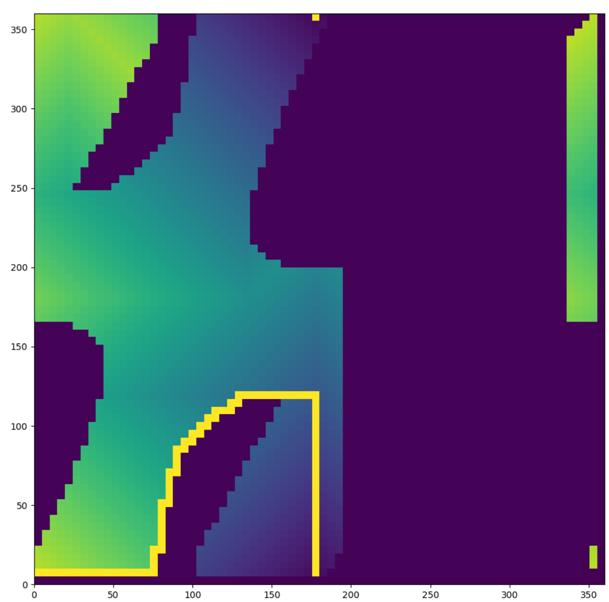
No, as the

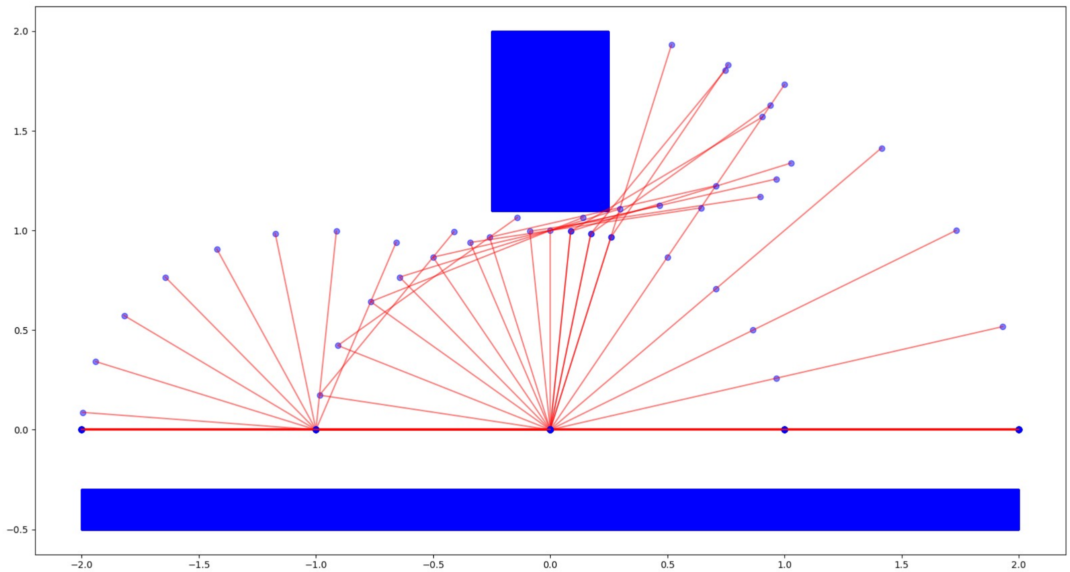
(d) How does this wave-front planner perform in comparison to the gradient descent planner in Exercise 2 part (b)?



Length of the path is 10 units.
Time taken is

Exercise 4.




2.0
1.5
1.0
0.5
0.0
−0.5
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0