

Homework 3

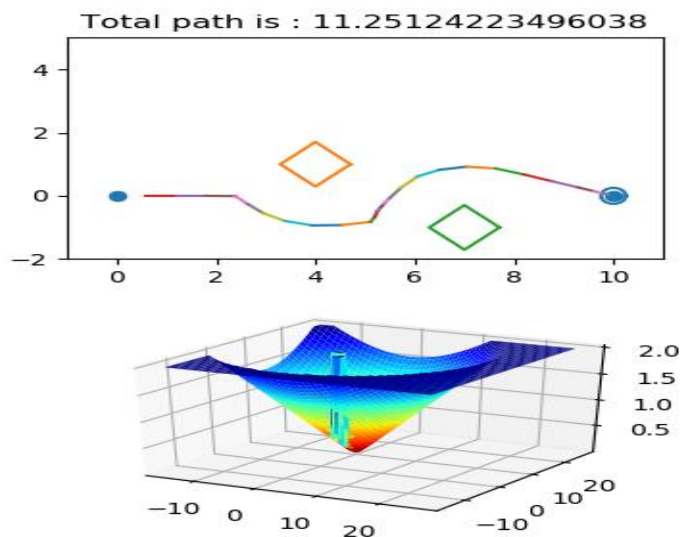
Exercise 1:

- a- A complete planning algorithm is an algorithm that can find a path to goal in a defined amount of time or notifies if there is not such a path
- b- An optimal algorithm is a planner that find the best path front start to goal among all existing paths based on set of parameters such as time variants or heuristic distances.
- c- Wavefront is an optimal panner. It is based f gradient decent which is known for optimization problem. It usual find shortest path
- It is a complete planner because the grids only have one local minimum. Thus, can detect if there is not path to goal or find one if it exists

Exercise 2:

a-

- I. Figure of path and potential field



- II. For the value of d^*_{goal} and Q^* , I iterate manually to find the best fitted. For d^*_{goal} my option was to start with $1/3$ distance away from the goal
- III. Figure above
- IV. 11.25
- V. No, the bigger the Q^* is for example, the path will be curvier from higher d away from obstacle with will make the total path longer. The smaller Q^* the closer is the path to obstacle thus tend to a straight line.

b- fig1: path + potential field workspace 1

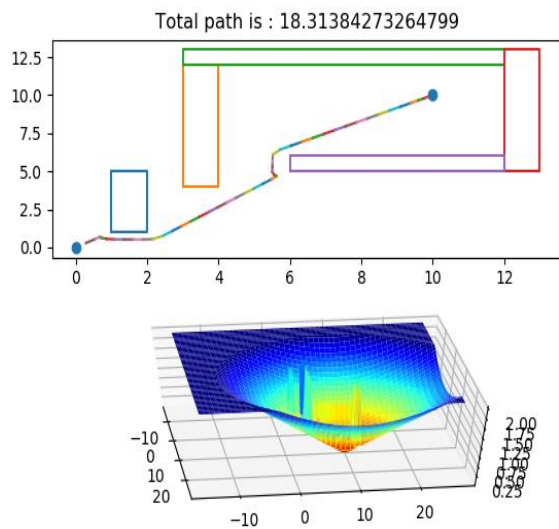
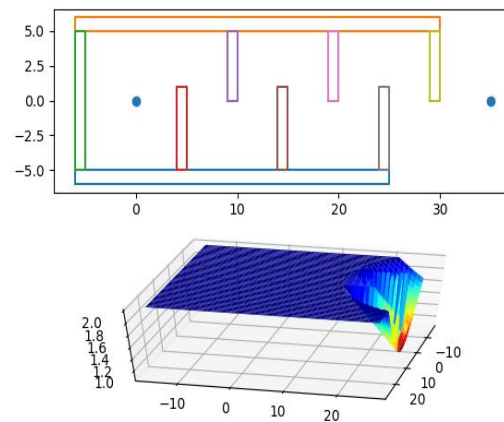


fig2: path + potential field workspace 2



The path for workspace 2 could not be found. This can be seen from the potential field as well.

- I. For the value of d^*_{goal} and Q^* , I iterate manually to find the best fitted. For d^*_{goal} my option was to start with $1/3$ distance away from the goal
- II. Figure above
- III. 18.3 for w_1
- IV. No, the bigger the Q^* is for example, the path will be curvier from higher d away from obstacle and will make the total path longer. The smaller Q^* the closer is the path to obstacle thus tends to a straight line.

Exercise 3:

- a- Figure below
- b- 20 for workspace 1 and 53 for workspace 2
- c- No, the path should change as the grid gets smaller
- d- In my case the gradient descent performs better for workspace 1 than for workspace 2. This could be due to the grid size chosen for the wavefront

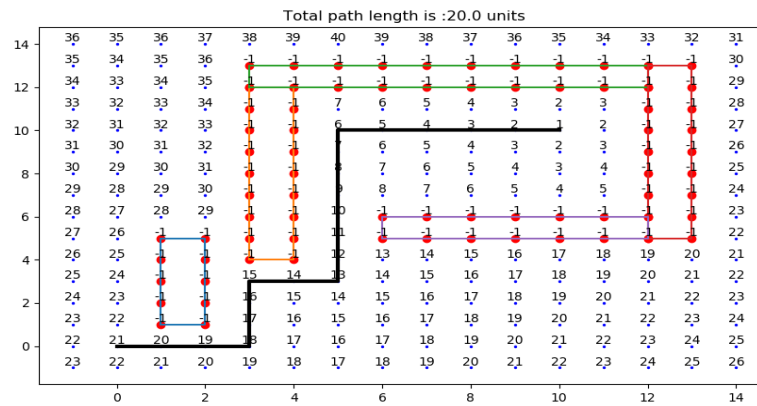


Fig1: Wavefront workspace 1

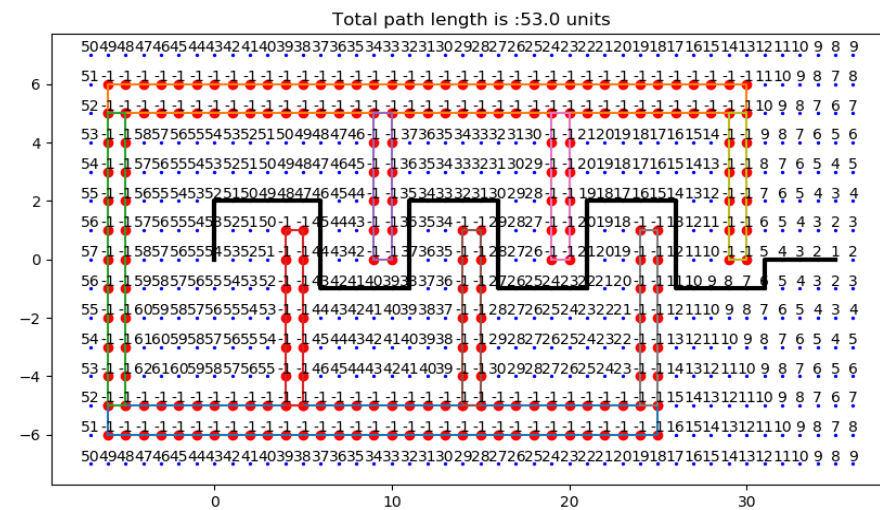


Fig2: Wavefront workspace 2

Exersuce4:

a-

Figure of notion of planner

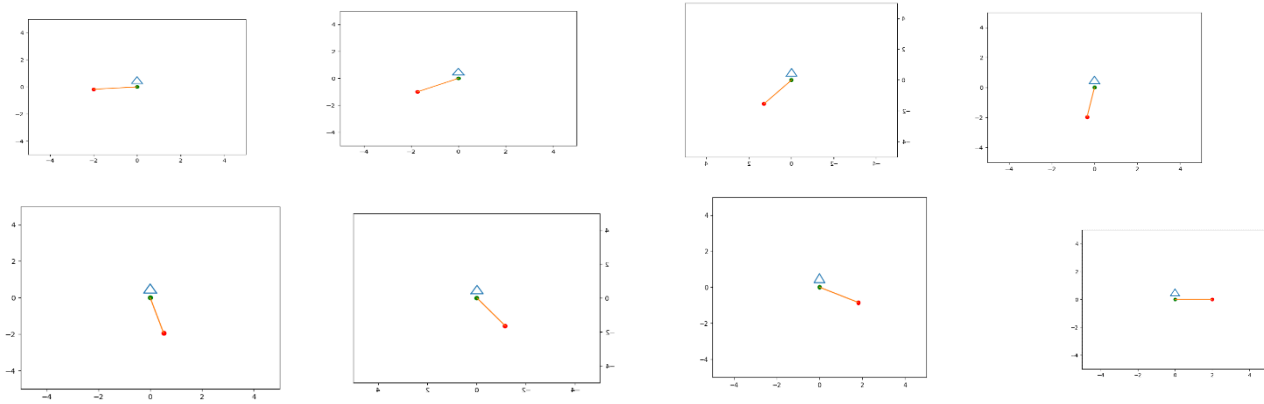


Figure of workspace obstacle with robot

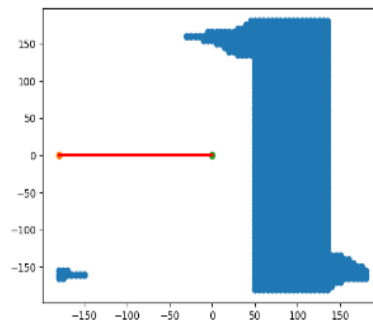


Figure motion of arm in workspace b

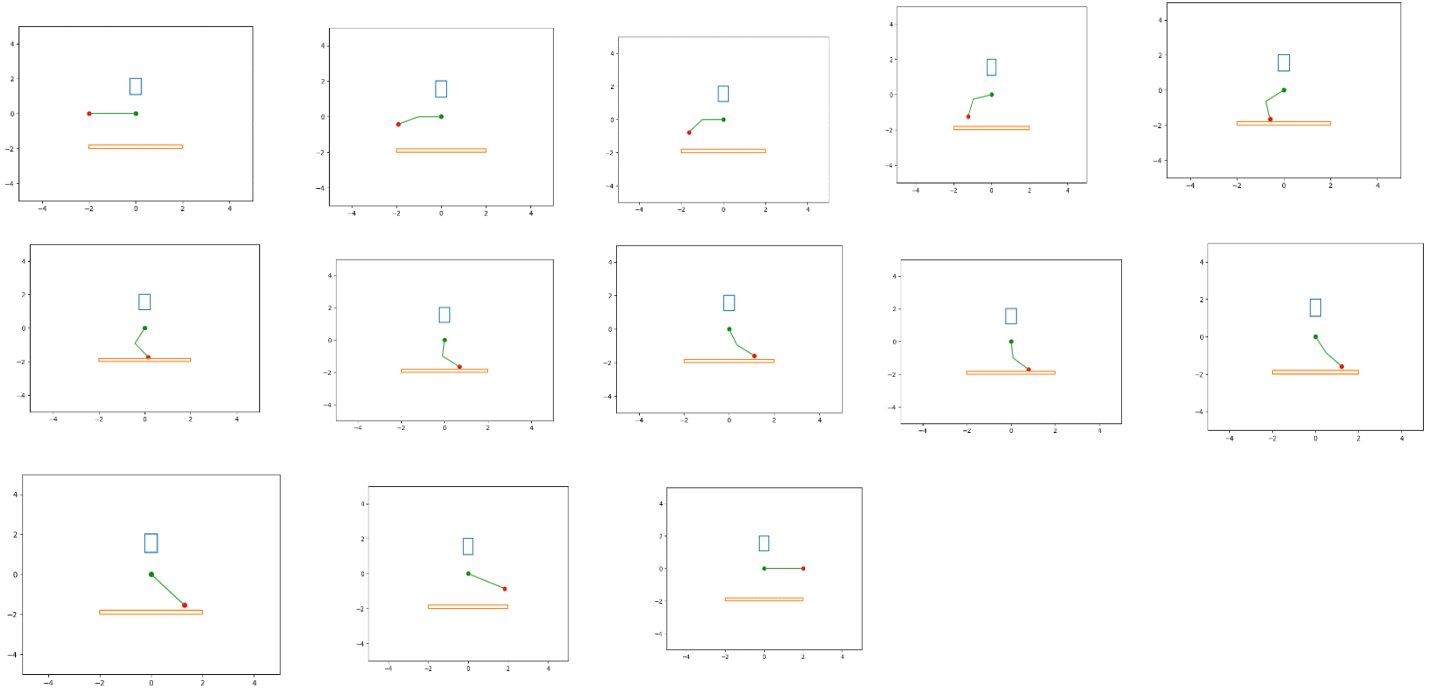


Figure c-space of the robot with obstacle

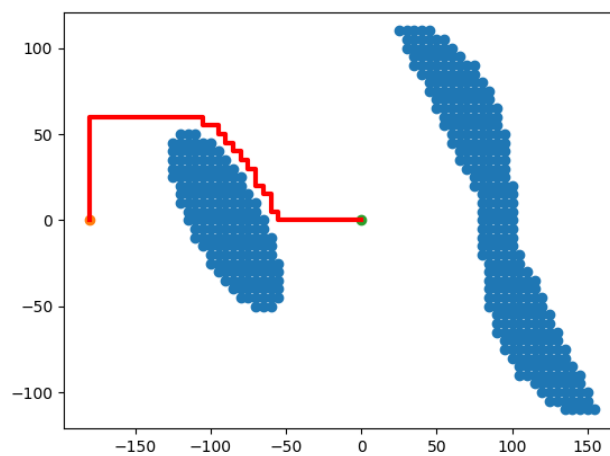


Figure motion of arm in workspace c

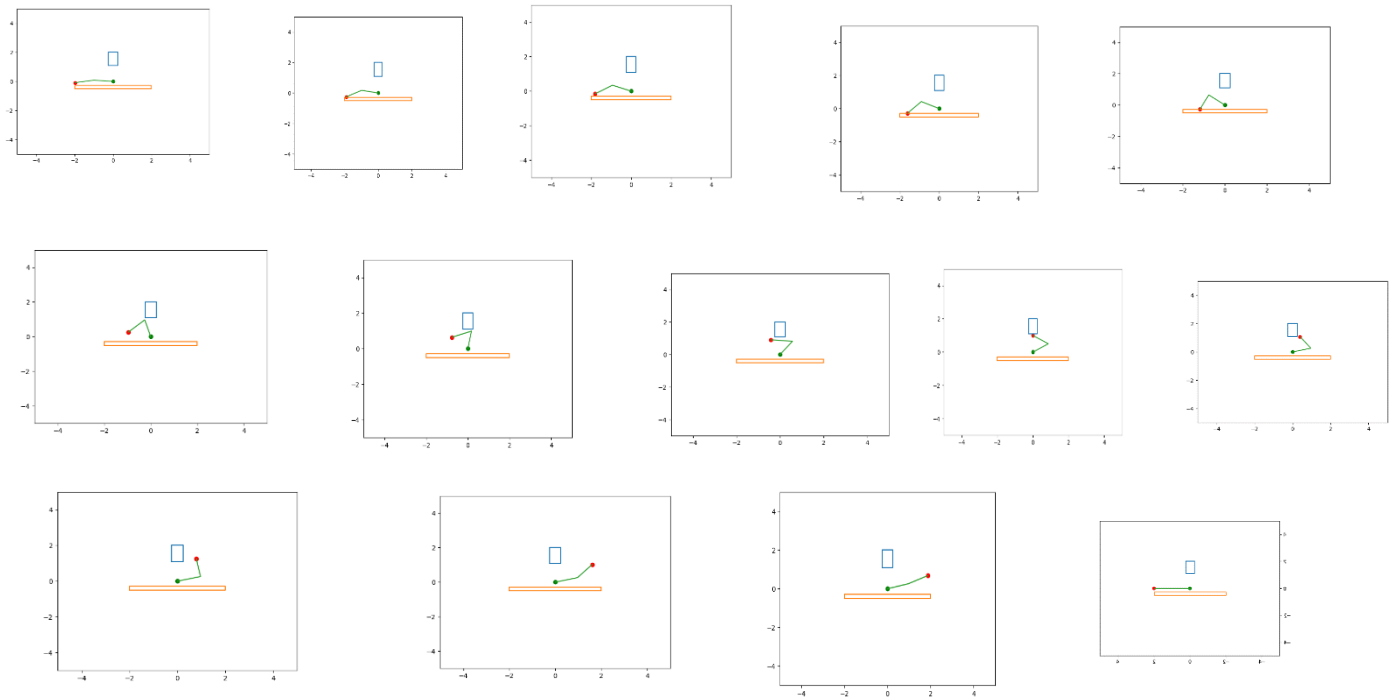


Figure c-space of the robot with obstacle

