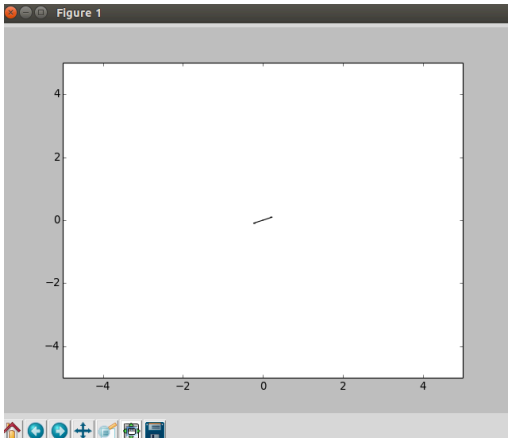
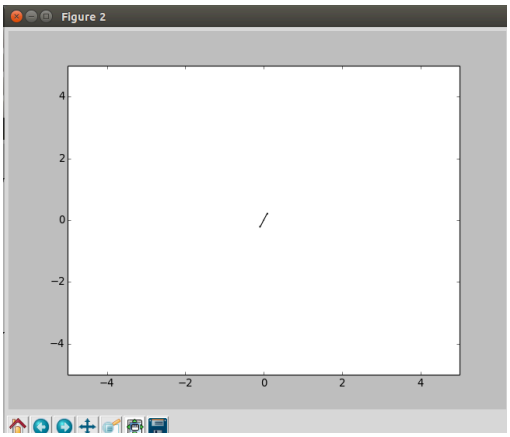
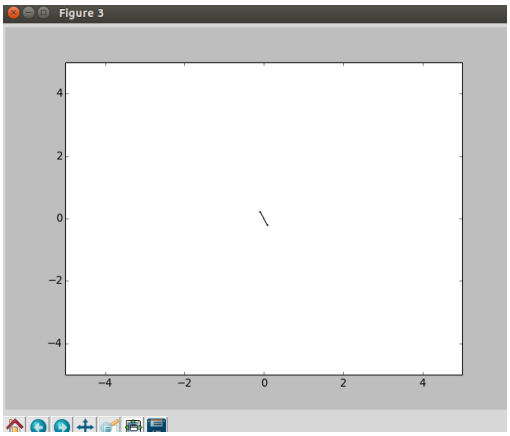
Question 1

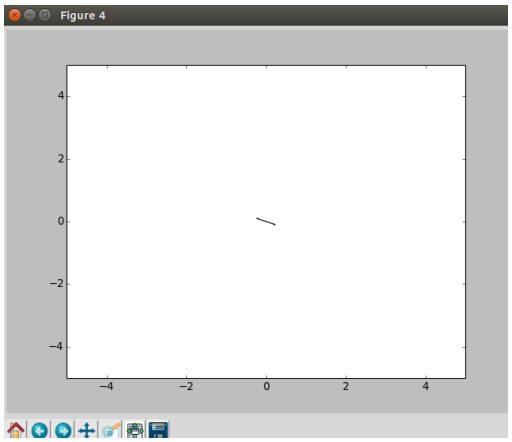
We assume the velocities of the wheels are either 1 or -1 for left wheel and right wheel, and the duration is 1 second. Therefore, there are four combinations for the left and right wheel speed, including [-1,-1], [-1,1], [1,-1], [1,1].

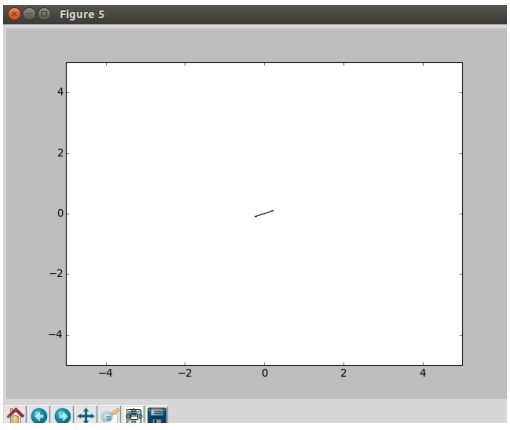
This is how we generate the control set. Then we generate a sequence of footprints given the control set and start configuration. There are 8 orientation directions given the state, for each orientation, we will generate the action set which include the footprints and the control set. The following plots are the footprints for each orientation:

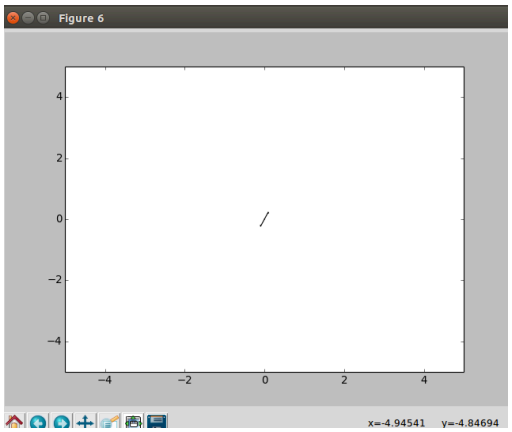


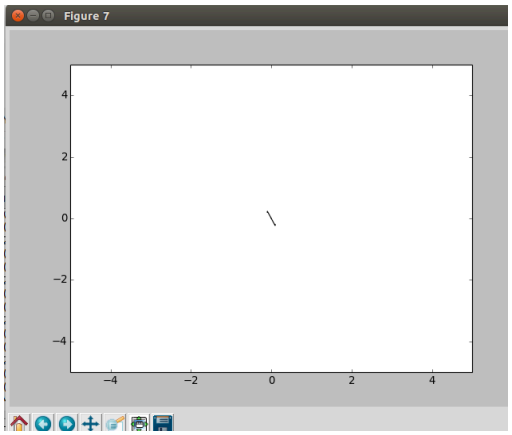


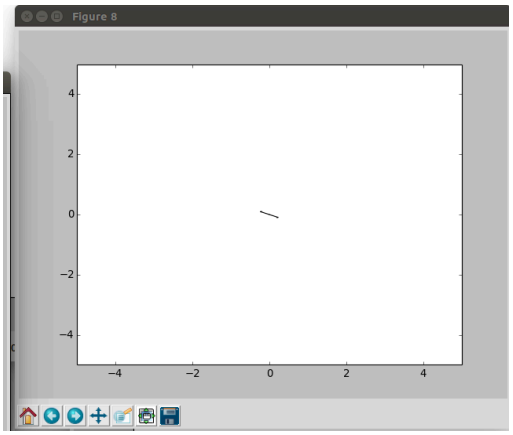












Question 2:
The videos of the base planner with 3 different start and end goal configurations are provided in this submission for you to view. The three videos for this question are called:

- writeup2-1.ogv
- writeup2-2.ogv
- writeup2-3.ogv

They can be viewed together at the following Google drive address:
https://drive.google.com/drive/folders/1v3XCzFiiPwJt6bGUov2CquzbXrwyR352?usp=sharing

The heuristic we used in our planner is simply the Euclidean distance.

Question 3:
The method we chose for selecting the base pose comes from the inversereachability module from Openrave. Simply put it works as follows:

1. Pre-load the irmodel and the grasping model
2. Use Openrave's computeBaseDistribution to calculate the joint state of the arm and the destination of the base
3. Select the best 5 valid grasp and use inverse kinematic to solve the trajectory and the path

This is how we select the base pose.

The videos of the full grasp planner for each of the three placements of the bottle are provided in this submission for you to view. The three videos for this question are called:

- new_writeup3-1.ogv
- new_writeup3-2.ogv
- new_writeup3-3.ogv

They can be viewed together at the following Google drive address:
https://drive.google.com/drive/folders/1v3XCzFiiPwJt6bGUov2CquzbXrwyR352?usp=sharing