Project 1
Due: July 7th in Class

Question 1 (15 points)

A robot moves in one-dimension discrete that is 100 meters long. At each time step the robot position is discrete and can change only by 1 meter. The robot moves 1 meter at each time step. Because of slip and friction 5% of the time it moves 2 meters; 5% it does not move and 90% it moves 1 meter.

It has a GPS that gives the location. The sensor measures the correct location for 90% of the time and 10% of the time it gives the wrong location.

The robot starts at the very left (the robot does not know this) and then travels one 1m at each time step for 50 time steps. Calculate the belief for the robot after 1, 2, 3, 4 timesteps

Extra Points (5 points)

Write a program in the programming language of your choice to calculate the robot position after 50 timesteps.

If you have MATLAB, the following examples will be helpful to understand bayes filtering (Note that these are not needed for the assignment)

https://www.mathworks.com/help/nav/ug/monte-carlo-localization-algorithm.html
https://www.mathworks.com/help/nav/ug/localize-turtlebot-using-monte-carlo-localization.html

Question 2 (15 points)

A vehicle has a 3D LIDAR sensor and is moving on a road (shown below). The LIDAR sensor gives output in cartesian co-ordinates (x, y, z). You are tasked with finding the road using the LIDAR sensor. Write down the equations and determine the road.

Equation of a plane in 3D:

$$z = a + bx + cy$$
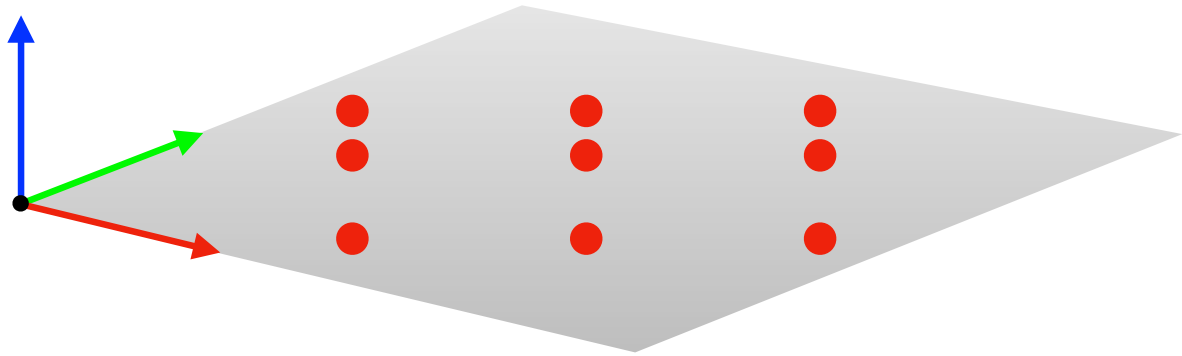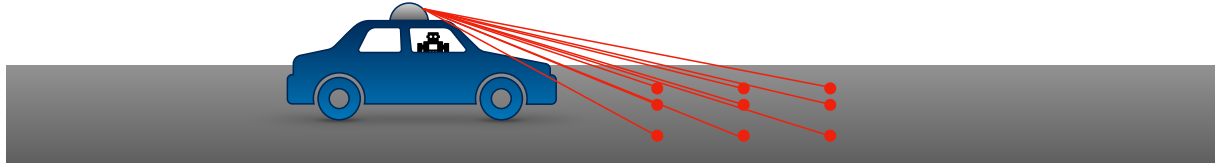
Hint: Think of the road as a plane and use least squares.

Extra Points (5 points) : Describe where the above will fail and how you can make it better (with equations)

$= 1...n$