

Section _____ Student Signature _____
Instructions: Attempt all questions

Question No 1: Histogram Filtering.

A robot moves on a 1D grid with 5 cells (1–5) and uses a histogram filtering to track itself on the grid. Initially the robot has no information about its position and orientation (Left/Right) on this grid.

Represent this fact as a probability distribution representing the belief of robot.

Using the following belief as the starting point about the position and orientation of robot on this grid,

Position $\text{bel}(x_0)=[0, 0, 0.5, 0.5, 0]$, Orientation belief $\text{bel}(x_0) = \{\text{Left} = 0, \text{right} = 1\}$.

- i. Compute the updated belief of robot after a single move using the following motion model
 - a. $p(\text{moved correctly}) = 0.8$, $p(\text{stayed in the same cell}) = 0.1$ and $p(\text{overshooting by one cell}) = 0.1$
 - b. Repeat Part i) and compute updated belief in case the initial orientation of robot is not known

Question No 2: Particle Filtering.

Assume that the robot uses three particles to track itself on the grid and weights of the following particles have been assigned using the sensor readings.

$$\{(x_1, w_1) = (2, 1), (x_2, w_2) = (3, 3), (x_3, w_3) = (5, 6)\}$$

Create the next set of particles using these weights and assuming that we use the 0.1, 0.5 and 0.9 as uniformly generated random numbers to select the particles