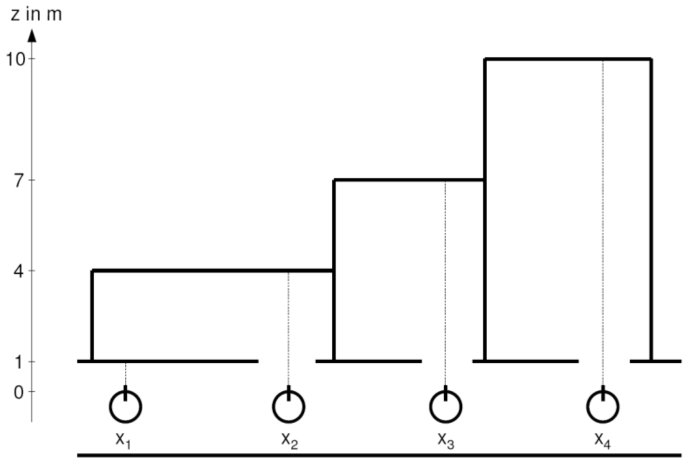
Cognitive Robotics

Assignment 2

2.1)



A robot moves along the middle of a corridor with a given accurate map, as depicted in the figure. At some of the given locations x_i it takes measurements z_k of the distance to one side, using one laser beam. Every measurement is corrupted only with additive Gaussian noise $N(\mu, \sigma^2)$ with μ = 1m and σ = 2m. The scanner range is assumed to be unlimited. The measured distances are:
z_1 = 2.5m, z_2 = 8m, z_3 = 6m, z_4 = 9m. The mapping between z_k and x_i is unknown.

(a) For each measurement, determine the most likely robot pose by calculating the probabilities for each position given the measurement using the Bayes rule. Assume an equally distributed prior. The evidence term (denominator) can be neglected, but the probabilities should be scaled such that $\sum_{i=1}^{4} P(x_i|z) = 1$.

4 points

(b) The robot believes that taking measurements at the positions x_2 and x_3 is in general two times as likely as doing so at x_1 and x_4. Use this prior information to recalculate the probabilities of (a).

4 points

(c) Suppose the laser scanner is not as ideal as above, and reports a faulty measurement of z = 30m in 10% of all cases, no matter the actual distance. How does this change the results of (a) and (b)?

4 points

2.2) List the components needed to specify an Extended Kalman Filter and briefly explain what they represent and why they are needed.

4 points

2.3) Compare the Extended Kalman Filter (EKF) to the Unscented Kalman Filter (UKF). What are commonalities and differences?

4 points