

Autonomous Robotics Fall 2011: Assignment 1

The assignments must be received by email before Thursday, Sept 22, 10am. Send you answers to prof6905@cs.dal.ca with subject line A1.

1. Write and submit a Matlab function that takes a character string and prints out the character string in reverse order.
2. Write and submit Matlab program that uses 3-dimensional plotting routines to plot a two dimensional Gaussian function.
3. Explain if the random variables X and Y are independent if their marginal distribution is $p(x) = 3x^2 + \log(x)$ and $p(y) = 3y^2 + \log(y)$ and the joined distributions is $p(x, y) = 3x^2y^2 + \log(xy)$.
4. Write and submit a Matlab program that produces and bimodal distributed (pseudo-)random variable. Plot a normalized histogram together with an indication of the mean, the median, and the variance. Plot the cumulative distribution for this random variable.
5. (From Thrun, Burgard and Fox, Probabilistic Robotics) A robot uses a sensor that can measure ranges from $0m$ to $3m$. For simplicity, assume that the actual ranges are distributed uniformly in this interval. Unfortunately, the sensors can be faulty. When the sensor is faulty it constantly outputs a range below $1m$, regardless of the actual range in the sensor's measurement cone. We know that the prior probability for a sensor to be faulty is $p = 0.01$. Suppose the robot queries its sensors N times, and every single time the measurement value is below $1m$. What is the posterior probability of a sensor fault, for $N = 1, 2, \dots, 10$. Formulate the corresponding probabilistic model. Use Matlab to plot the believe that the sensor is faulty against the number of measurements. Submit your explanation and plot as text document (preferably pdf).