1. Find the stationary point of the curve $f(x,y)=xy$ subject to the constraint $x+y=1$ using the method of Lagrange multipliers.

2. The goal of this problem is to find position estimates for a missile moving in 3D. The measurements of the position of the missile are performed by a radar that provides noisy measurements x1, x2 and x3 of its actual position in a 3D coordinate system. The state of the missile is defined by 6 components, the coordinates of its actual position, a1, a2 and a3, and its 3 velocity components a4, a5 and a6. The velocity of the missile is assumed constant in the motion modeling of the missile. The measurements of the progress of the missile for 240 time steps are listed in the file
`http://www.umiacs.umd.edu/~ramani/cmsc828d/KF_meas.dat`
The sampling of these measurements was performed at 100 Hz (i.e., the time step is 0.01 second).
   a.) Plot the 3 coordinates of the missile position in space as a function of time on a single figure.
   b.) Write the state equation, assuming Gaussian noise with standard deviation equal to 0.1 for all 6 components (cf. slide 17 on lecture about Tracking and Kalman filtering).
   c.) Write the state equation, assuming Gaussian noise with a standard deviation equal to 0.1 for each of the 6 state components.
   d.) Write the measurement equation, assuming Gaussian noise with standard deviation equal to 2 for each of the 3 measurement components.
   e.) Write a Matlab Kalman filter function to compute a position estimate of the missile (defined by 3 components) at each time step.
   f.) Run the Kalman filter (you can use an initial position estimate of (0, 0, 0), an initial velocity estimate of (0, 0, 0), and an initial covariance matrix for the prediction error equal to an identity matrix). Plot the estimates for the missile coordinates on the same figure as the measurements used in (a).

3. Read Chapter 19.4 of the book by Forsyth and Ponce on the condensation or particle filter (It is available on the web at http://www.cs.berkeley.edu/~daf/book3draft/tracking.pdf)
4. After you finish reading the chapter You will find an algorithm for representing probability distribution functions (pdfs) by sample points and weights (Algorithm 19.4).
   a.) Write a matlab function to evaluate the weights of the normal (Gaussian) pdf
   b.) Create a random set of 50 sampling points in the interval [-10,10]. Calculate the weights at these points for the normal pdf with the following parameters (0,2), (1,4), (-3,0.1). Plot the weights against the sampling points.