STATISTICAL PATTERN RECOGNITION & LEARNING
FALL 2016
PRACTICE EXERCISE 3: GAUSSIAN DISTRIBUTION

Question 1
Given the following information for a two class problem:
$\mu_1=2$, $\sigma_1= 2$,
$\mu_2=10$, $\sigma_2= 2$
(note the above σ are standard deviations NOT variances)

Find the decision boundary of the Gaussian distribution based classifier when the two classes have equal priors. Note: from the above the dimensions of the input data should be clear.

Question 2
Find the decision boundary if in question 1 when $P(C_1)$ is changed to 0.8.

Question 3
Find the decision boundary if in question 1 σ_1 is changed to 4 and $P(C_1) = P(C_2)$

Question 4
Find the decision boundary if in question 3 if $P(C_2)$ is changed to 0.3. Note how it affects the separation between the two classes

Question 5
Given the following information for a two class problem:
$\mu_1=(0,0), \mu_2=(1,1)$
$\sigma_1^2= 2, \sigma_2^2= 4, \sigma_{12}^2=0$
Find the decision boundary of the Gaussian distribution based classifier when the two classes have equal priors and same covariance matrices

Question 6
Change in question 5 the value of covariance and solve when $\sigma_{12}^2=2$

Question 7
Change in question 5 so that the covariance matrix derived from question 1 is that for class 1. For class 2 covariance matrix is twice the covariance matrix for class 1.

Question 8
Suppose you have a Gaussian distribution based classifier for a two class problem, where the two classes have equal priors and the covariance matrix is unit matrix. Prove that the line defining the decision boundary is perpendicular to the line joining the two means. HINT: find the slope of the decision boundary. The product of this slope and the line joining the two means should be equal to -1.