Problem Set: Linear Discriminant Analysis

1. Suppose we have a set of data $(x_1, y_1), \ldots, (x_6, y_6)$ as follows:

   $x_1 = (1,2), x_2 = (2,1), x_3 = (2,2), x_4 = (3,3), x_5 = (3,4), x_6 = (4,3)$ with

   $y_1 = y_2 = y_3 = k_1 = 1$ and $y_4 = y_5 = y_6 = k_2 = 2$.

   Apply linear discriminant analysis by doing the following:

   a) Find estimates for the linear discriminant functions $\delta_1(x)$ and $\delta_2(x)$.

   b) Find the line that decides between the two classes.

   c) Classify the new point $x = (4,5)$.

2. Suppose we have a set of data $(x_1, y_1), \ldots, (x_6, y_6)$ as follows:

   $x_1 = (0,0), x_2 = (1,1), x_3 = (2,3), x_4 = (2,4), x_5 = (3,2), x_6 = (4,2)$ with

   $y_1 = y_2 = k_1 = 1, y_3 = y_4 = k_2 = 2$ and $y_5 = y_6 = k_3 = 3$.

   Apply linear discriminant analysis by doing the following:

   d) Find estimates for the linear discriminant functions $\delta_1(x)$, $\delta_2(x)$ and $\delta_3(x)$.

   e) Find the lines that decide between each pair of classes.

   f) Classify the new point $x = (3,0)$.