Find an example that has three classes and two quantitative variables. You may use a subset of any data set we have analyzed. Of course you can use any data set that interests you. Randomly select 10 observations for testing and the rest for training.

1. [140/240] Use R to draw the three separation lines. Do the three lines intersect at a single point? Reference: “LinearDiscriminantClassification.R” and slides 28-32.

2. [240 only] Prove that the three lines do intersect at a single point. Hint: it is sufficient to show that the \( x \) that satisfies \( a_{12}^T x = m_{12} \) and \( a_{13}^T x = m_{13} \) also satisfies \( a_{23}^T x = m_{23} \). (why?) Reference: slides 28-31.

3. [140/240] Use the rule of minimum (Mahalanobis) distance to make predictions for the testing data. Reference: slides 27 and 29.

4. [140/240] Find the two linear discriminants and use them to make predictions for the testing data. Reference: “LinearDiscriminantClassification_MultiClass.R” and slides 34-44. You may obtain the two linear discriminants using the “lda” function in R.

5. [140/240] Do methods 3 and 4 give you the same predictions?