## Exercise 6.3

A team of medical doctors has been working on finding an easier way of diagnosing two similar but different diseases A and B.

Presently the team is working on the hypothesis that it is possible to distinguish A from B based on 2 relatively simple measurements on a patient. The measures are called $x_1$ and $x_2$.

Based on an old but difficult diagnosis technique the team has sure knowledge of 106 patients with the disease A and 81 with the disease B. Measurements of $x_1$ and $x_2$ on all these patients gave the following empirical means for $x_1$ and $x_2$:

| | Disease | |
|---|---|---|
| | A | B |
| | $n_1 = 106$ | $n_2 = 81$ |
| $\bar{x}_1$ | 380 | 400 |
| $\bar{x}_2$ | 120 | 90 |

and the following empirical variance-covariance matrix common for A and B:

| | $x_1$ | $x_2$ |
|---|---|---|
| $x_1$ | 25 | 40 |
| $x_2$ | 40 | 100 |

($x_1$ and $x_2$ are assumed normal).

1) Test if there is a difference between the means of the two frequency distributions $f_1(x_1, x_2 \mid A)$ and $f_2(x_1, x_2 \mid B)$.
2) Determine an optimal decision rule with respect to discriminating between A and B when the maximal probability of misclassification must be minimised.
3) Determine if a patient with measurements $x_1 = 390$ and $x_2 = 100$ is classified as having disease A or B.