

# MAT331 Project 1

Due March 9 2004

## Part A

The first part of the project is a version of the least squares method for ellipses. Assume that you have given some data  $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$ , that appears to describe some points in an ellipse. In the class, we did interpolation, using least squares, for data that seem to be in a circle. Using the same approach, and assuming that the ellipse is given by the equation

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$

do an interpolation for the ellipse that 'fits' the best the given data. That is, you need to *define* an error function  $E$  and solve (for the variables  $a, b, h, k$ ) a system of equations that minimizes the error. In class we did not explain completely why the points where the error attains the minimum are related with the points where the partial derivatives of  $E$  vanish. You need to explain carefully this step. You need to use some multivariable calculus for that. I will post in the web page data for each one of you. It will be in a file named `yourname.data`, with an array of points ready to be used.

## Part B

This part has to do with *splines*. Using the second array of data in the file `yourname.data`, do an interpolation via splines of degree two (check your book). You need to do this 'by hand' and step by step (there will be only five points in the data, so it will not be a lot of typing) and not by using a Maple command. You have to write what is the propose of this interpolation. Why degree two is better than degree one and of course you need to explain the mathematics behind it.