

MATH 420, HW 3, SPRING 2015

Due: February 17, 2015

1) Download the data file `simepidemic.txt` from the course web page. This data was generated with the stochastic model described in the lecture notes on modeling epidemics, using $N = 1000$ and a value of p that will remain a mystery for now. The first column gives a day number t_j and the second column gives the number I_j of infectious people on that day. Your objective is to find values of the parameters p and $I(0)$ so that the solution of model (3) in the lecture notes fits the data as well as you can make it. Start by determining the parameters by linear least squares in the two ways described in the lecture notes. Discuss why the approaches give different results. Then, by using any modification to those methods that seems appropriate from looking at the data, or any other method that seems appropriate, see if you can find a better fit. Judge the fit by graphing the function $I(t)$ determined by your values of p and $I(0)$ on the same graph as the data.

2) Generate a random collection X of 100 vectors $x = (x_1, x_2, x_3)$ all contained in a cube $[-1, 1] \times [-0.1, 0.1] \times [-0.01, 0.01] \subset \mathbb{R}^3$ using matlab. Rotate this set X by 45 degrees counterclockwise in the $x_1 - x_2$ plane, and then rotate by 45 degrees counterclockwise in the $x_2 - x_3$ plane. Compute the principal components of the resulting dataset. Compare them to the basis obtained by rotating the standard $0 - 1$ eigenbasis of \mathbb{R}^3 first by 45 degrees counterclockwise in the $x_1 - x_2$ plane, and then by 45 degrees counterclockwise in the $x_2 - x_3$ plane.