CS - MTH 237
QUIZ 1

You have \$5000 to invest for the next 20 months. After examining possible investment opportunities, you narrow your choice to two options.

- Option 1 is to put the money into a bank account that pays 5% annual (simple) interest. That is, the value of your investment I after m months is $I(1 + \frac{0.05}{12}m)$.
- Option 2 is to put the money into a mutual fund. Over the past 400 days, the rate-of-return from the mutual fund is given in the datafile `~pitman/rate.dat`. That is, the value of your investment I after d days is I times the dth rate-of-return. You assume that future mutual fund earnings can be approximated by the rate-of-return in the past. Unfortunately, brokerage fees and commissions amount to 10% of your deposit. That is, your net investment would only be \$4500.

Your task is to determine which option earns you the most money over the next 20 months.

1. Write a FORTRAN program that takes as input the datafile and produces as output the monthly averages of the mutual fund rate-of-return. Your program should also multiply this rate-of-return by your net investment to determine the value of a mutual fund investment. For purposes here, a month is defined as four weeks of five working days, i.e., 20 consecutive days. Also determine the value of the bank account investment, option 1.
2. Use MATLAB to determine whether or not there is a crossover time, and, if so, estimate that time to within 1 week. A crossover time is that time when the mutual fund and the bank account are of equal value.
3. Consider the line segment through the first and last monthly average of the mutual fund rate-of-return. If you assume that this line accurately represents the fund return over the entire period, determine the crossover time. Explain the quality of your answer.
4. Use a least squares fit to a line, based on the monthly averages of the fund investment, and determine the crossover time. Again, explain the quality of your answer. Is this time consistent with your answer to problem 3? Here, a least squares fit to a line is that line through a set of data that minimizes the sum of the squares of the distance from the data point to the line. The formulas for a least squares fit are as follows:

The best-fit line through N data points (x_i, y_i) is given by

$$L(x) = a_1 + a_2 x$$

where

$$a_1 = \frac{\sum_{i=1}^{N} y_i \sum_{i=1}^{N} x_i{}^2 - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} y_i x_i}{N \sum_{i=1}^{N} x_i{}^2 - (\sum_{i=1}^{N} x_i)^2}$$

$$a_2 = \frac{N \sum_{i=1}^{N} y_i x_i - \sum_{i=1}^{N} x_i \sum_{i=1}^{N} y_i}{N \sum_{i=1}^{N} x_i{}^2 - (\sum_{i=1}^{N} x_i)^2}$$

You should submit

- your FORTRAN code for problem 1;
- MATLAB files (including postscript files with plots) for problem 2;
- your conclusions for problem 3 along with all work leading to those conclusions;
- your conclusions for problem 4 along with all work leading to those conclusions.