Math 420, Spring 2014
Second Solo Homework:
Introduction to the Threads

Due Friday, 7 February, 2014

Exercise 1a. Compute m_i, v_{ij}, and c_{ij} for each of the following groups of assets based on daily and weekly closing price data with uniform weights:

(i) Apple, Google, Microsoft, Intel, Exxon-Mobil, UPS, GE, and Ford stock in 2009;
(ii) Apple, Google, Microsoft, Intel, Exxon-Mobil, UPS, GE, and Ford stock in 2013;
(iii) Vanguard Total Bond, Vanguard 500, and Russell 1000 and 2000 index funds in 2009;
(iv) Vanguard Total Bond, Vanguard 500, and Russell 1000 and 2000 index funds in 2013.

Display v_{ij}, and c_{ij} as 8×8 matrices for (i) and (ii), and as 4×4 matrices for (iii) and (iv). How do these matrices compare when computed using daily or weekly closing price data? Give explanations for the values of c_{ij} you computed.

Exercise 1b. Compute m_i, v_{ij}, and c_{ij} for the assets listed in the previous exercise based on daily data and weekly data with uniform weights, but only from the last quarter of the year indicated. Based on a comparison of these answers with those of the previous problem, in which numbers might you have the most confidence, the m_i, v_{ij}, or c_{ij}?

Exercise 2. 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.