MATH 420, HW 4, SPRING 2015

Due: February 24, 2015

1) Monthly data on AIDS diagnoses in various metropolitan areas, and for the entire U.S., is available at `http://wonder.cdc.gov/aids-v2002.html`. To download data for the entire U.S., select "Month Diagnosed" in Section 1 next to "Group Results By", and select the city name in Section 2. Then click any of the "Send" buttons. Once the data appears, you can save the data to a file with the "Export" button. The web site has instructions for importing this file into various programs, e.g. Excel; you can import it into MATLAB by clicking on Import Data. Or you can copy-and-paste from the web site, if you prefer.

From the number of cases diagnosed each month, compute the cumulative number of diagnosed cases as a function of time at the beginning of each month from January 1982 to December 2001 (for example, 440 cases had been diagnosed by the beginning of January 1982). The cumulative data is comparable to the cumulative number of infections $\mathcal{I}(t)$ in the model we discussed in the February 10 lecture. By whichever method you found worked best in fitting last week's simulated data, see how well you can get a solution of the continuous-time model (3) from the lecture slides to fit the real data. Please use units of months (not days) for time in the model. Notice that the value of N to use for the real data is not obvious; you will have to choose an appropriate value. Please be clear in your write-up how you chose N and what method you used to determine p and $I(0)$ from there. Graph the resulting model solution on the same graph as the cumulative data. Discuss briefly what are the main feature(s) of the real data that the model is unable to fit.

2) Use again the dataset consisting of the national total numbers of births in the US on each day in 2003 and produce two collections of vectors from this data:

a) a collection of 52 vectors in $\mathbb{R}^7$ consisting of birth numbers for each of the 52 weeks (from Wednesdays through Tuesdays, discarding the extra day on 12/31);

b) a collection of 7 vectors in $\mathbb{R}^{52}$ consisting of birth numbers for each of the days of the week (again discard 12/31).

For each of the two datasets, compute their covariance matrices and their eigendecompositions. Compare these representations with each other.

3) Write 0.5 page long report about the lecture at the FFT you saw. Please make sure your report on what you saw differs in a substantial way from the published abstracts.