

AMSC/MATH 420, Spring 2014

Second Project on Modeling Epidemics: Nonlinear Cost Functions

Oral presentation due Friday May 2

Written presentation due Wednesday May 12

Description common to all teams. This project will use an SIR-like model with the affected population divided into a low-risk group and a high-risk group. Parameters that quantify the rates of disease transmission within and between groups will be estimated from the AIDS diagnosis data at <http://wonder.cdc.gov/aids-v2002.html>; the metropolitan areas to use will be chosen after the project team is formed. On the other hand, we will regard parameters that quantify rates of removal from the susceptible and infectious population to be under our control, subject to a budget that represents resources spent by a public health organization on interventions such as awareness campaigns and disease testing programs. The budget constraint will be a maximum value for a “cost function” that expresses how much resources are required to achieve given values of the removal parameters. The central mathematical problem will be to develop a method to determine removal parameters, constrained by the budget, that minimize the number of people who contract the disease. Another goal will be to see if the optimal removal parameters can be reasonably approximated by a linear (or other simple) function of the transmission parameters and cost function parameters.

Team specialization. Whereas other teams will assume that the cost of an intervention strategy is a linear function of the removal parameters, this team will develop and use more realistic cost functions that exhibit diminishing returns – spending twice as many resources generally will not yield twice as many removals – and see how their optimal intervention strategies compare with the optimal strategies for linear cost functions.