# AMSC/MATH 420, Spring 2015
# Modeling Epidemics: Team Homework 1a

due Tuesday, March 10 (postponed from March 3)

Our next goals are to see how the modified SIR ("SIRg") model discussed in class compares to our previous SI model in two ways:

1. What are the possible outcomes as $t \to \infty$?

2. How much better can it fit your data sets?

To simplify matters due to this semester's schedule disruptions, you can let $r = \nu = 0$ and just compare the SIg model to the SI model. You can use a solution formula (if you can find one), or find an approximate solution numerically. For a numerical solution, you'll need to choose numerical values for the parameters and initial conditions, then use a differential equation solver like MATLAB's `ode45`, or approximate the model in discrete time (replacing $dS/dt$ with $S(t+1)-S(t)$, etc.)

For question 1 (outcomes), particular items to consider are what happens to each of the three quantities $S$, $\mathcal{I}$, and the rate of new infections $pS\mathcal{I} = \lambda S\mathcal{I}/N$ as $t \to \infty$; does it always go to 0, does it approach a nonzero constant, does it grow toward $\infty$, does it do something more complicated, and does the outcome depend on the parameters? For this purpose you only need to consider different values of the dimensionless parameters $\mu$ and $\alpha$, since as we discussed in class, these determine the overall "shape" of the solutions – in other words, what happens qualitatively.

For question 2 (fit), focus on the fit of rate of new infections predicted by the model to the new diagnoses per month in your data (not on the cumulative number of infections). For each of the data sets you were initially assigned and each of the two models SI and SIg: find the model parameters that minimize the sum of the squares of the residuals (called $E_y$ for the SI model in the lecture slides), report the minimum value of $E_y$ you found, and graph the fitted model solution with the data. How much smaller can you make $E_y$ with the SIg model versus the SI model?