CX 4230, Spring 2016: Project 2-A

For Project 2-A, you may work individually though you are encouraged to work in pairs. This project is due on **Sunday, February 21 at 11:59 PM AOE**. Upload your responses (as a PDF) and code for the exercises below on T-Square.

Setup: Diffusion of infection

Recall that the recommended reading for the infectious disease models we've been discussing comes from O'Leary (2008), notes for which are available on T-Square: (link) (https://t-square.gatech.edu/access/content/group/gtc-59b8-dc03-5a67-a5f4-88b8e4d5b69a/OLeary-2008-sccs--infection.pdf). Download these notes. You'll be doing two exercises, one conceptual and one involving coding, based on them.

Exercise 1: Explain the diffusion-based model.

Page 262 of the O'Leary reading (page 18 of the PDF notes) introduces a diffusion term into the S-I-R model. This new model is referred to in the text as "Model 4."

Let $I \equiv I(x, y, t)$ and $S \equiv S(x, y, t)$ denote the size of the infected and susceptible populations at position (x, y) of the "world" at time t. Model 4 suggests that the change in I with respect to time should be,

$$\frac{\partial I}{\partial t} = \tau IS - \frac{I}{k} + \delta \left(\frac{\partial^2 I}{\partial x^2} + \frac{\partial^2 I}{\partial y^2} \right) S.$$

In your own words, explain this new model. That is, what does the new term mean? What concept does it introduce? What role does δ play? Is it reasonable? Why or why not? (About 1-2 paragraphs of explanation should suffice.)

Exercise 2: Implement Model 4.

Implement Model 4. Then do both parts of "Challenge 21.5" on page 263 of O'Leary (page 19 of the PDF notes).