

School Nova Computer Science 202  
**Homework 11 (due 12/19/2020)**

PLEASE READ:

We continue working on an alternative SIR model based on numpy. This homework is generally quite a bit more difficult than our previous material and assignments. Do your best and do not be discouraged if some things do not work. If you are not able to complete a task using numpy functionality and element-wise math, feel free to use any other approach that works for you.

**Task 1**

Using classwork code. Verify that agent 0 is meeting new people each time period (print this information for each time period).

**Task 2**

Add disease transmission. Note that there are two chances when a person may get sick since each person has two meetings (as a guest and as a host). Try to complete this task without using for loops (this is NOT easy but do your best!). If not possible, use for loops, or any other approach that works for you.

**Task 3**

Add probabilistic transmission using `pr_sick`. In other words, if a Susceptible person meets an Infected person, the probability that the Susceptible person becomes Infected is `pr_sick` (for example, `pr_sick = 0.2`). Use `np.random.binomial`. If you were able to complete task 2 without using for loops, you should be able to implement probabilistic transmissions without using loops as well. Otherwise, feel free to complete this task as you want.

**Task 4**

Create an array to store the data over time (the numbers of Susceptible, Infected, and Recovered agents).

**Task 5**

Using the data array from Task 4, plot the SIR dynamics. For  $T = 100$ ,  $N = 100,000$ , `days_sick = 7`, and `pr_trans = .2`, it should look like this:

