CSOC20010

Introduction to Computational Social Science II

UCD School of Sociology

Spring, 2021-2022

Module Coordinator: Assoc Prof Taha Yasseri

Week 2 Assignment: Virus On Model Networks (Python)

In this week's assignment, we are going to simulate an SI (Susceptible-Infectious) model on *model* networks. We will be using four model networks that we covered in the class + one real-world network. We built the model networks so that they have the same number of nodes and edges as the real network so that we can compare the spread of a virus on these 5 models to see on which one the virus spreads the fastest only due to differences in topology (rather than the density of connections). For each network, we are simulating the spread *R* times and average the number of infected nodes for each time-step among the *R* realisations, this way the random factors will be averaged out.

1. Download the following two files and save them in the same folder:

SI_NetworkX.ipynb

High_School.graphml

1. Open SI_NetworkX.ipynb with JupyterLab
2. Review the code to make sure you understand what it does:

   In the first "cell" we set the number of nodes N, infection parameter L, number of realisations R, and the number of simulation time-steps T.

   In cell 3, we generate the model networks. The parameters are tuned so that all the networks have the same number of nodes and edges (the same density).

   In cell 4, we select the model we would like to use for the spreading part.

   In cell 6, we simulate the spreading dynamics on the generated network.

   In cell 7, we find and report the number of time-steps needed to get half of the population infected (half-point).

   In cell 8, we plot the number of infected nodes as a function of time steps.
3. Run the code for the 5 different networks and record the value of half-point for each.
4. **Write and submit a one-page report** which includes
   a. A table that reports the half-point value for all the networks
   b. A diagram which shows the ratio of infected nodes as a function of time-steps for all the models (to get all the 5 curves in one diagram, you need to change the code ever so slightly as the current code only plots the curve for one model at a time)
   c. A paragraph of interpretation of a and b and conclusion.