**Final Team Project**

In your final team project, you will be exploring/extending a pandemic simulator.

Teams of 2-3 students are encouraged. If you have difficulty of finding partners or your team is outside of this range, let me know early so that I can make further suggestions.

*Using the preferred programming language that your group has chosen, build a simulator as follows:*

1. *Assume there are N=1,000 people in the small place. Use an array to record the status of each person, call it “infected”. For example, infected[1]=TRUE if user 1 is infected.*
2. *Each infected individual may come into contact with ratio of all people in each round of infection.*
3. *Each contact between an infected individual and a healthy individual has a chance of that the healthy individual will be infected.*
4. *Output the number of infected individuals after each round. There are T=2,000 rounds.*
5. *Use some reasonable and , for example, =0.005 and =0.01, to generate the curve of total infection as a function of rounds.*
6. *Repeat step 5 and simulate the fact that each infected person stays infectious for rounds, after which s/he becomes non-infectious and immune forever. Note that you may want to choose a slightly larger values of and for your results to be interesting.*
7. *Repeat step 6 and simulate the fact that each immune person stays non-infectious and immune only for rounds, after which s/he may be infected again. Again, different values of and may be needed.*
8. *is defined as the total number of newly infected caused by each infected individual, on an average. Compute for step 6 and 7.*

Once the above is done, explore the following directions in your program. I expect different teams to explore different ways to approach each of the following steps. Just make sure that your approaches make sense and you can explain them as well as the results.

1. The community is not a single one. Instead, there are smaller communities, each of which people are more tightly knit and may infect each other more often. Most people stay within their communities and never interact with people outside of their communities, but there are a total number of people who unfortunately serve as the bridges among different communities and they interact with more than one communities.
2. Introduce a connection of instead of using the random connections made in each infection round. Therefore, each individual has a fixed set of connections (as in our social lives). In each infection round, each infectious individual would come into contact with a ratio of of its social connections. Simulate how infection would spread with different and .
3. Suppose an effective vaccine is introduced at round and it protects each vaccinated individual with a chance. Simulate and demonstrate how two communities would see infection spread with different vaccination rates (rate of population that will take the vaccine), e.g.,  and .
4. Extend from part c and draw the total infection as a function of vaccination rate, . Adjust other parameters so that your graph looks interesting.
5. Simulate a vaccine wear-off effect: this is a decrease of  over time. Show different curves as a function of time for different rates of decrease. That is, one decrease rate per curve.
6. Introduce some additional connections, e.g., 30% more links, to simulate a period of more active social activities. Compare the infection increase rate with those in part b without these additional connections.
7. Can your team think of anything else to simulate with your simulator? Perhaps a football or basketball game that connects more people in a short period of time? Explain and demonstrate the results.

**Final Presentation:** each team will present its results for about 8 minutes with every team member going over 1-2 slides each in its presentation. Focus on results and explanations. Presentation date is our last lecture time.

**Final Report and Presentation**: your final report should include title, team members’ names, Section I, Introduction; Section II, execution screenshots, graphs, and explanations for each parts above; Section III, Conclusion. Please include all source files, final report, and your presentation file in your submission in a zip file.