**Python assignment #7­­**

In class, we wrote the script ‘**SIR\_epidemic.py**’ to demonstrate a simple epidemic model in Python. This model has two parameters, beta and gamma, which are described in the script.Run your model for varying values of beta and gamma (I suggest from 1/1 to 1/20, but only vary one at a time!) and observe what happens to:

1. The peak val­­ue for I
   1. When varying contact time values and keeping incubation time at a constant of 20 days, the peak value of I is 0.8 of the population when contact time is 1 day (beta = 1).
   2. When varying incubation time and keeping contact time at a constant of 5 days, the peak Infectious value is 0.4 of the population when incubation time is 20 days (gamma = 1/20).
2. The ending values for S and R
   1. When contact time is varied (1-20 days) and incubation time is kept constant at 20 days, a contact time of 1-day results in a susceptible population of 0% by the end of 160 days and an infectious population of 100%. If the contact time is increased to 20 days, the susceptible population number is very high just below 100% while the infectious population value is very low just above 0%.

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* 1. When incubation time is varied (1-20 days) and contact time is kept constant at 5 days, an incubation time of 1-day results in a susceptible population of nearly 100% and an infectious population just above 0%. On the other hand if incubation time is 20 days, the ending susceptible population is nearly 0% and the ending infectious population is nearly 100%.

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1. The timing of the peak infection
   1. When varying contact time (1-20 days) and incubation time is kept constant at 20 days, at contact time of 1 day, the peak infection timing is around 10 days in at 80% of the population being infectious. At a contact time of 10 days the population reaches a peak of 10% infectious at 140 days. At a contact time of 20 days, there is no longer a peaking curve for the infectious population number and the curve has been fully “flattened” to the point where it is nonexistent.
   2. When varying incubation time (1-20 days) and contact time is kept constant at 5 days, a low incubation time of 1-day results in no peak curve in infectious population numbers. As the incubation time is raised to 20 the peak infection increases in the infectious population % and the peak infection occurs sooner.

NOTE: for some values, you may need to extend the time series out beyond 160 days. Record R0 that is reported for each run and relate your observations to how the model works. What is the interpretation of ‘flattening the curve’?

High contact times(1/beta) and low incubation times(1/gamma) both result in flattened curves with a reduced peak infectious population that occurs later, less of the population becoming removed, and more of the population remaining susceptible. Below is a graph showing the relationship between Ro and incubation time, and Ro and contact time.

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You can analyze the results in Excel, but bonus if you add code to run your simulation for different values of beta and gamma, and then plot the results.