Lab Exp. 01

As a warm-up exercise, let's create a function that samples a user-specified N values from a **Gamma** distributed random variable with parameters a and b (a distribution we did not learn about in class) and computes the mean and standard deviation of the sampled values. Store the two statistics: the mean and standard deviation, in a dictionary.

```
def gammaSampleStats(N,a,b):
    ''' Input N: The number of samples, an integer, to generate from a Gamma
                                                   distribution
              a: The 1st parameter of a Gamma distribution
              b: The 2nd parameter of a Gamma distribution
        Output : A dictionary with two pieces of information: the sample mean and
                                                        sample standard deviation.
    '''
    sampleStats = {'mean':0., 'std':0.}

    # Note: np.random.gamma() is a good function to use.

return sampleStats
```

Lab Exp. 02

Our previous recitation studied the Reed-Frost epidemic model. Let's bundle the Reed-Frost model into a single function (Hint: You can use last week's recitation notes on the website) that takes as input: the number of susceptible (S_0), infected (I_0), and recovered (R_0) individuals at the first time step, the probability a single infected individual transmits their infection to a susceptible (p), the total number of time steps to run the outbreak (T) .

With a packaged model in hand, we can study how S_0 and p interact to create an outbreak.

A

Set ($S_0 = 100, I_0 = 1, R_0 = 0$). Loop through values of p from 0.0001 to 0.02 by 0.001. For each value of p run an epidemic with ($T = 2000$) time steps 500 times. Record the total number of infected individuals at the final time step.

B

Plot the average total number of infected individuals as a function of p, the probability a single infected individual successfully infects a susceptible.

C

Set ($S_0 = 1000, I_0 = 1, R_0 = 0$). Loop through values of p from 0.0001 to 0.005 by 0.0001. For each value of p run an epidemic with ($T = 100$) time steps 1000 times. Record the total number of infected individuals at the final time step.

D

Describe how the above two simulations were setup and results of both experiments. What did you see? What is occurring? Do you see a relationship between S, p, and when an epidemic results in a positive total number of infected individuals?