BE 218 Assignment 1

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1 Implementation details

1. The constants were defined as given.
   (a) The contact rate β was found to be 0.3 after varying it from 0.1 to 0.8 in steps of 0.1.
   (b) The total number of days was taken to be 600.
2. The multidimensional array that holds the values of the population in the different compartments was initialized with given values.
3. The values in the array were updated in a main loop over the total number of days according to the given dynamical equations.
4. The answers to the questions asked were calculated and printed.
5. The results were plotted on a graph.
6. The packages *numpy* and *matplotlib.pyplot* were used.

2 Numerical results

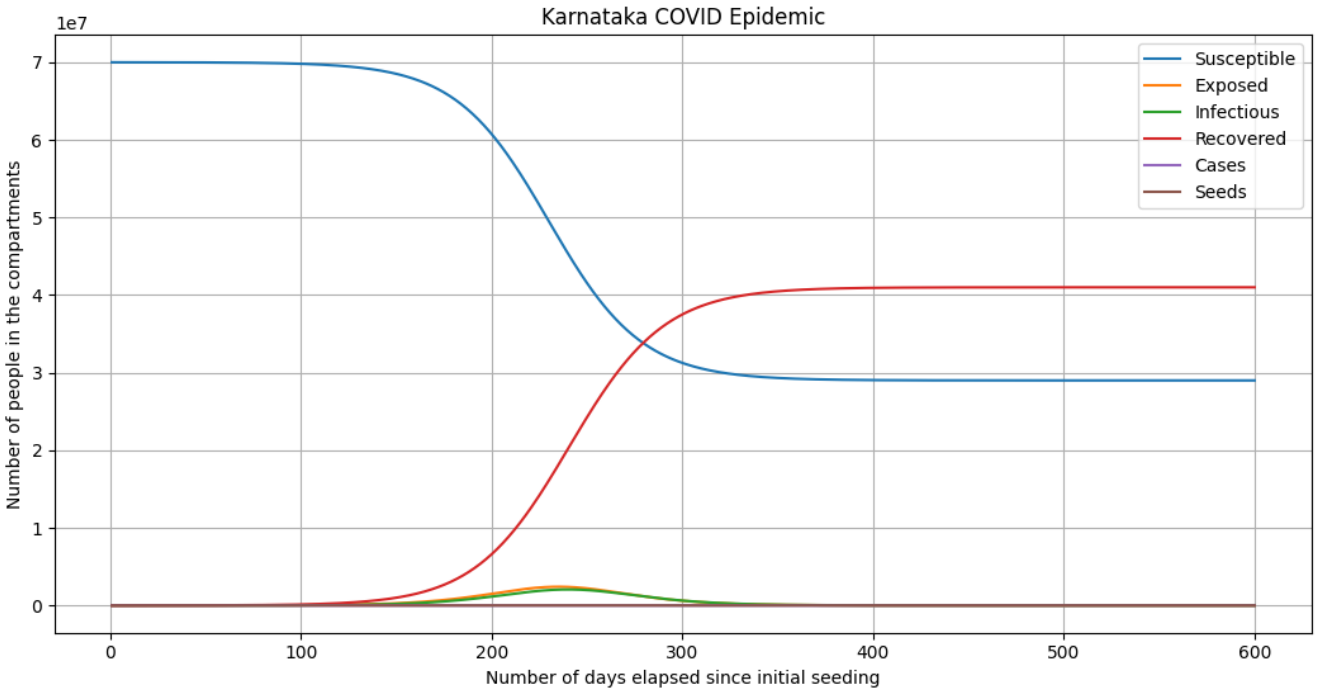

Figure 1: Linear-scale graph

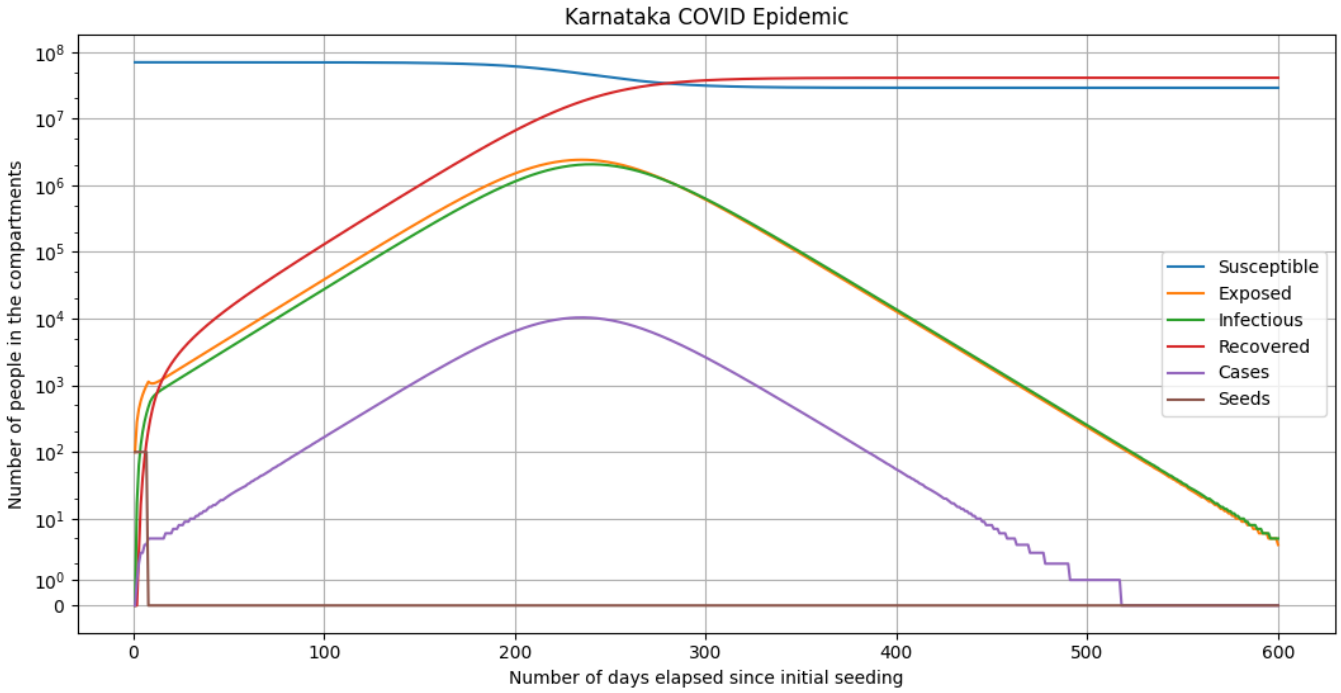

Figure 2: Asinh-scale graph

1. beta_trial_and_error: 0.3
2. num_days_to_peak: 234
3. num_days_greater_than_1000_cases: 182

3 Discussion of the results

1. Roughly 40 million people (i.e., more than half the population!) got infected and recovered. Even though there is a sizeable susceptible population, it is being protected by the herd immunity of the recovered population. The wave was dying down when the recovered population crossed the susceptible population. Meanwhile, the peak of the reported cases was merely 10,000.
2. This simple model does not take into account any measures such as lockdown etc. Still, it shows the amount of time it takes for a epidemic to spread through the population. Assuming COVID was seeded into Karnataka at around March 2020, the peak was realised on October 2020. This is around 220 days. Our peak occurred at the 234th day! This agreement might have been brought about by tuning the seeding function in lieu of lack of considering safety measures in the model (e.g., social distancing, vaccination, etc.).
3. Asinh scale was used since it behaves linearly near 0 and asymptotically as a logarithm. This avoids singularity at 0.
4. As you may be able to see on the plot, for small values it is showing step-like behaviour. This is because while plotting, only discrete integer values of the populations in each compartment were used.