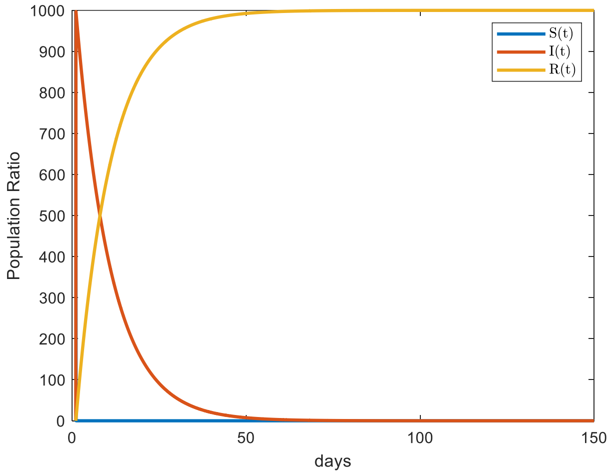
Masoud Nateghi / HW11-BMI550

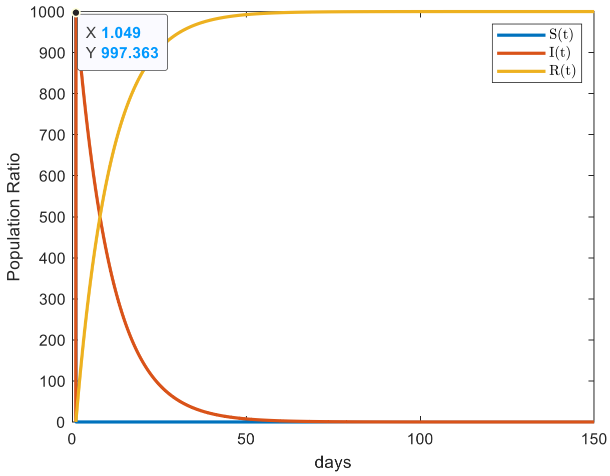
Question set 1

HW1

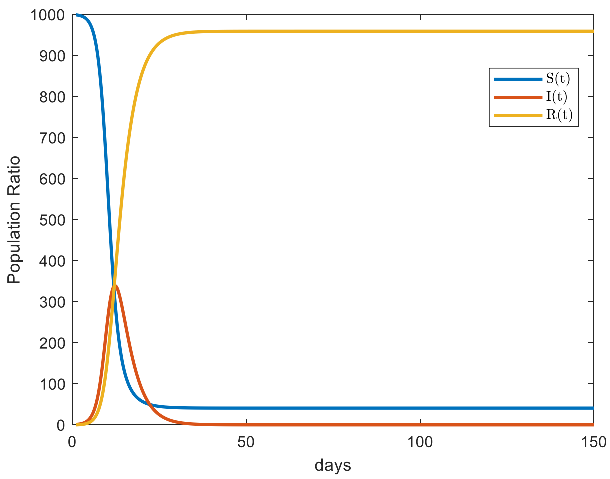
(b)



(c) From the figure below, we observe that there is a peak for the number of infected people on the first day.

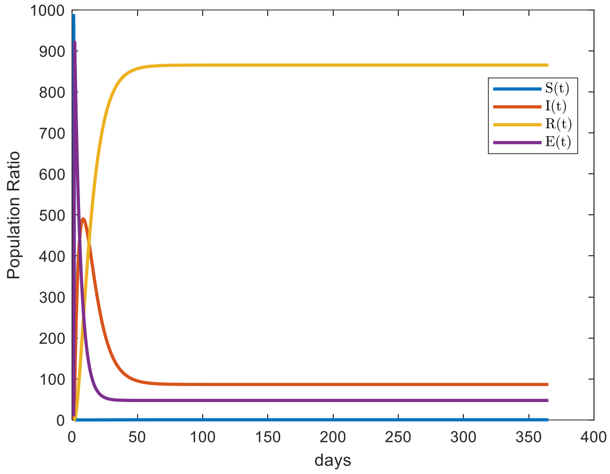


If $R_0 > 1$, the number of infected individual increases rapidly, indicating that the dynamics model a pandemic. Conversely, if $R_0 < 1$, the number of infected individuals decreases rapidly, and there will be no pandemic. The following figure displays the simulation for $\beta = 0.001$ and $\gamma = 0.3$, from which we can infer that the spread of the disease stops at a certain point, without affecting any of the remaining susceptible individuals.



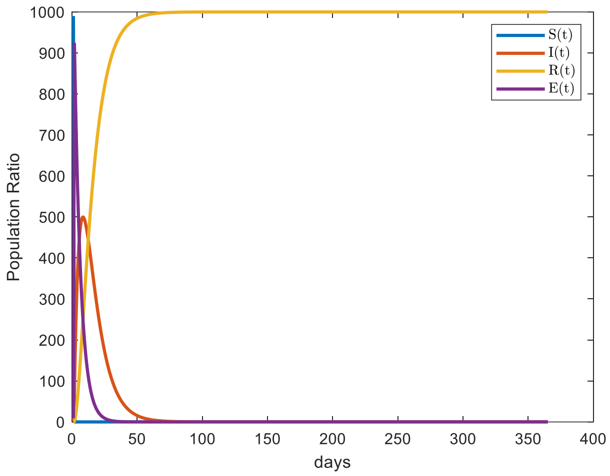
HW2

(b)



(c) The exposed compartment represents the portion of the population that has been exposed to the virus but has not yet become infected. Including this compartment allows us to more accurately model the spread of the disease by accounting for the virus's incubation period.

The figure below uses the same parameters as before, except for $\mu = 0$.



Comparing this figure with the figure in part (b), we can observe that the inclusion of birth and death rates has resulted in non-zero steady-state values for the infected and exposed compartments. Additionally, the recovered compartment no longer remains at a steady state of 1000. Individuals who die from disease, come from the infected compartment and do not return to the recovered compartment. This, in turn, reduces the steady-state value of the recovered compartment. Conversely, newborn individuals contribute to an increase in the susceptible group, eventually becoming infected or exposed. This process raises the steady-state values for the infected and exposed compartments within the population.

Code: https://github.com/MasoudNateghi/BMI500/tree/main/HW11