COSC1003 Assignment

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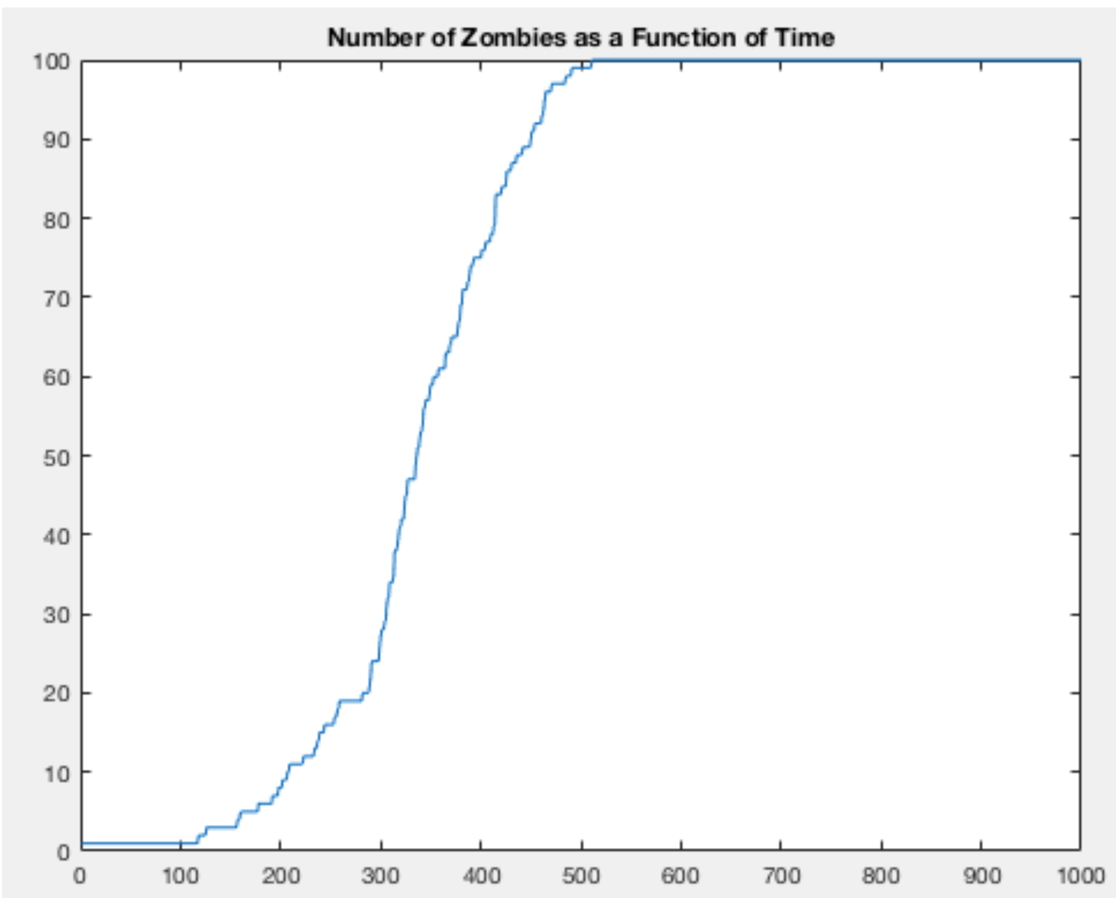
1.1

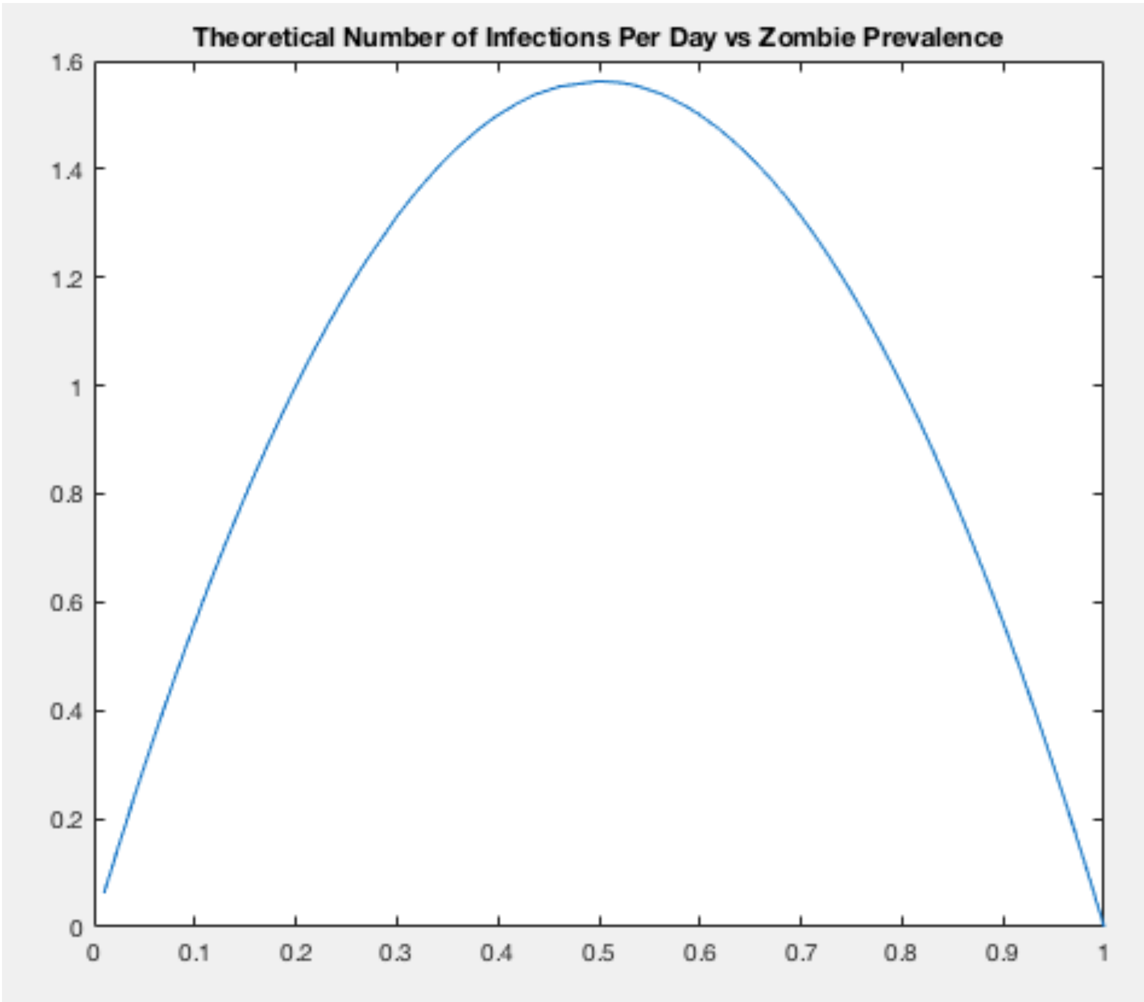
Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Run 10	**Average**
583	431	552	563	409	404	624	467	557	582	**517**

It takes around 500 to 600 days before the last person is infected, but occasionally when running the program we get much lower or much higher values.

1.2

The graphs are below:





The relationship between the two graphs is that the curve of the number of infections per day as a function of zombie prevalence is the probability density function (PDF) of the number of zombies as a function of time, which is the cumulative density function (CDF). The PDF is the derivative of the CDF so the second curve is the derivative of the first. These two curves resemble the CDF and PDF of the normal distribution.

1.3

Halving the size of the world from 40 to 20 rapidly decreased the amount of time until the last human was infected. With a size of 40 is was between 500 – 600 days typically, but at size 20 it typically only takes a little over 100 days. The real world implications are intuitive in that a disease (such as tuberculosis) spreads much faster in crowded areas or spaces that are too small relative to the population.

1.4

The dynamics of the model are different because there are now essentially two steady state points. Before when the remission rate was zero, it was inevitable that everyone would become a zombie in a matter of time. In this case, the steady state would be 100 zombies and the curve of zombies over time would approach and level off at 100. Now by introducing a remission rate, albeit a small one, it is like having two steady states. The case where everyone is a zombie is one state. Although technically a person (or even a few people) can spontaneously recover even if everyone is a zombie, the remission rate is very low and the number of surrounding zombies is very high, so they will become a zombie again very quickly. The other state is zero, since if the one zombie we start out with spontaneously recovers before infecting anyone, then nobody is a zombie and everyone is safe from the zombie apocalypse. This happens if the number of zombies is low and the world is relatively big enough.

2.1

Please see montyhall.m

2.2

If the contestant never switches, then they win roughly 33% of the time, but if they always switch, then they win roughly 66% of the time.

2.3

If the number of doors is increased to 100, then the odds of winning begin to converge no matter if you choose to switch or remain. If you stay, the odds of winning are 1%, while if you change they only increase to 1.01%. This is because the change in chance of winning from changing doors can be represented as 1/n -> 1/(n-1). As n increases, the difference in the values begins to converge and have no noticeable effect on the final outcome.