PHYS 410 - Homework 3

October 24th, 2016

The government of British Columbia wants to proceed with a vaccination campaign for a newly discovered virus. A 100% effective vaccine exists at $30 per individual dose, while treating the illness costs the government an average of $100 per infected person. Your job is to determine what is the fraction of the population that the government should vaccinate in order to minimize cost.

To proceed, modify the zombie invasion code (found on the course website) to represent the transmission of the contagious illness on a periodic lattice with 128^2 sites. Rather than dying after $T = 15$ steps (as in the original code), infected walkers should recover and become immunized for the future. Assume that the virus is quite contagious and is transmitted 66% of the time.

Determine (approximately) the minimal cost of a vaccination campaign and the ideal fraction of immunized people for:

1) Low density regions (density = 0.25);
2) Average density suburbs (density = 0.35);
3) High density metropolitan areas (density = 0.5).

In each case, your results should take the form of a plot of the average cost of the campaign versus the vaccinated fraction of the population, identifying the optimal point. They should also include a discussion of your method (number of simulations per data point, error approximation, etc.) to justify your analysis.