The Automaton of Contamination

## What it models

This automaton models the spread of disease within a population. One random person will catch the disease and the disease will contaminate people around the disease carrier. The number of disease carrier compounds in every generation. People who have stronger immune systems are less likely to be contaminated, where as people who have weaker immune systems are more likely to be contaminated. The disease has two stages. In the first stage, the disease carrier lives and is able to reproduce. If both parents carry the disease, the child will also become a disease carrier. However, if only one of the parents is a carrier, there is a chance that the child will be healthy. If both parents are healthy, the child will also be healthy right after birth. In the second stage, the virus start to harm its carrier will die soon. Over time, most people in the population will become disease carriers. However, after a few generations, some mutation will occur in a few people’s immune system and make them invulnerable to the disease. This characteristic will be passed onto their offspring, and gradually, most people in the population will be immune to the disease.

In this automaton, cells represent people. The colour of a cell represents the person’s health condition.

## States of a cell

A cell can be three shades of green, two shades of red or blue. Green cells represent healthy people who are not contaminated by the disease; the closer the green is to yellow, the weaker the person’s immune system and the more likely that person is going to be contaminated. Red cells represent contaminated people. The lighter red (pink) represents the first stage of the infection, which indicates that the carrier lives and can reproduce in the next generation. The more intense red represents the second stage of the infection, which means that the person will die in the next generation. Blue cells represent people who have mutated and who are immune to the disease.

## Evolution rules

1. If a dead cell has exactly two cells around it, it will come to life as means of reproduction.
   * If the two cells surrounding it are green it will have a random shade of green.
   * If the two cells surrounding it are pink or red, the offspring will either be pink, or have a low chance to be blue (mutate).
   * If either of the two cells surrounding it are blue, the offspring would also be blue.
2. If a healthy cell is surrounded by at least one contaminated cell beside it, it will have a chance to become contaminated in the next generation.
   * If the original healthy cell is greenish-yellow, it has a 50% chance of being contaminated; if the original cell is yellowish-green, it has a 33% chance of being contaminated; if the original cell is green, it has a 20% chance of being contaminated.
3. If the cell is light red (pink), it has a chance of becoming more intense red in the next generation.
4. If the cell is intense red, it dies in the next generation.

Exactly two green cells produce another green cell

## Sample evolution

|  |  |
| --- | --- |
| **Generation 1** | **Generation 2** |
| Mac:Users:renalu:Desktop:Screen Shot 2015-03-05 at 9.01.16 AM.png | Mac:Users:renalu:Desktop:Screen Shot 2015-03-05 at 9.14.23 AM.pngMac:Users:renalu:Desktop:Screen Shot 2015-03-05 at 9.01.21 AM.png |
|  | One green cell and one red cell produce either a green cell or a red cell |
| **Generation 3** | **Generation 4** |
| Mac:Users:renalu:Desktop:Screen Shot 2015-03-05 at 9.33.57 AM.png  The infected cell has a chance to deteriorate | Mac:Users:renalu:Desktop:Screen Shot 2015-03-05 at 9.34.09 AM.png  Deteriorated cells die in the next generation |
| A green cell that has a red cell around it has a chance to be infected | |
| **Generation N** | **Generation N+1** |
| Mac:Users:renalu:Desktop:Screen Shot 2015-03-06 at 8.47.39 AM.png | Mac:Users:renalu:Desktop:Screen Shot 2015-03-06 at 8.50.02 AM.png |
| After N generations, a random red cell turns into blue cell (mutation) |  |
| **Generation N+1** |  |
| **Mac:Users:renalu:Desktop:Screen Shot 2015-03-06 at 8.50.15 AM.png** | A dead cell becomes blue if it has exactly two cells around it and one of the cells around it is blue |