Etude 10 Epidemic – Report

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In a universe with sides of length M and N, the minimum number of sick cells required to get the whole universe sick is equal to $\frac{M}{2} + \frac{N}{2}$, given that there are no immune cells in the universe, and M and N are either both odd or both even. If one is odd and the other even, then the equation must be rounded up to the nearest whole number.

In a square universe, they can be positioned along the diagonal, or positioned in every other cell around two perpendicular edges of the universe. If either or both of the sides are of an even length, then the last sick cell must be placed in the opposite corner, as each edge row or column of the grid must have at least one sick cell in it for it to be possible for it to get sick.

An immune cell added to the corner of the grid will generally have no effect on the minimum number of sick cells required to get the rest of the universe sick, unless both side lengths are even and the immune cell is placed in the corner where the last sick cell must go, in which case one more sick cell is necessary as there is no way to have one sick cell in both of those two edges. Each single immune cell anywhere else will need another sick cell in a good position to infect the rest of the universe. Clusters of immune cells will not necessarily need one new sick cell each.

If there is a wall of immune cells that separates the grid into sections, then each of the sections can be considered its own separate universe, where the above equation applies to each section.