Risp 28: Modelling the Spread of a Disease

A population is threatened by an infectious disease.

Imagine that the population splits into two groups, the infected and the healthy.

Each year, the probability that a healthy person catches the disease is c,
and the probabilty that an infected person recovers is r.

Each of you is going to model what happens to 10 people
over a period of 10 years.

Everyone starts with 8 healthy people and 2 infected people.
Year 0 on your list is 8 Hs and 2 Is.

We are going to assume that no-one dies (of any cause) over this 10 years.
For each person roll a die, for each year.

If you roll a 1 or 2 for a healthy person,
then they become infected that year (c = 1/3).

If you roll a 1 for an infected person, then they recover that year (r = 1/6).

For everything else, there is no change.

When you have each completed 100 rolls of the dice, we can pool our data,
to arrive at the total numbers of H/I people for the population for each year.

Let x = proportion of population that are infected.
What happens if we plot a graph of x against time?
What happens as x tends to infinity?
Can we model this situation with a differential equation?
Can you solve the differential equation?
What happens to the solution if we vary c and r?

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