SEIR Modelling

Aditi

August 2024

1 Introduction

1.1 list of new stuff

- imp
  1. syntax of composition dictating how the subsystems interact
  2. semantics (logic) of composition assigning concrete mathematical models to the subsystems

1.2 –

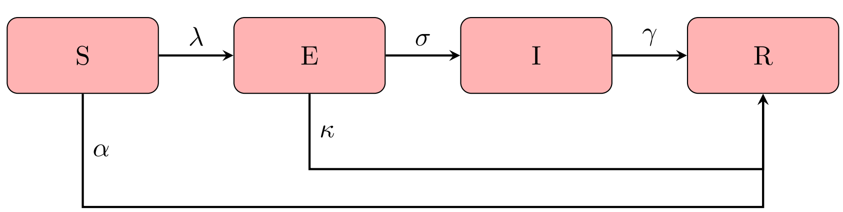
1.3 –

1.4 –

2 Implementing the model in Julia

ref

- S: susceptible
- E: exposed, Diseases (like COVID-19) often have an incubation period or a latency period and this category accommodates it. (The SIR model does not have this category.)
- I: infected
- R: recovered, also includes removed (ie, no more capable of spreading the disease



$s = \frac{S}{N}$, $e = \frac{E}{N}$, $i = \frac{I}{N}$, and $r = \frac{R}{N}$

2.1 Setting up DE's:

- S: A susceptible person can either become exposed or get removed
  $\frac{dS}{dT} = -\lambda S - \alpha S$
- E: An exposed person will get infected after the incubation period or get removed, some susceptible people will get converted to exposed as well
  $\frac{dE}{dT} = \lambda S - \kappa E - \sigma I$
- I: Infected people will get removed, exposed person may get infected
  $\frac{dI}{dT} = \sigma E - \gamma I$
- R:
  $\frac{dR}{dT} = \alpha S + \kappa E + \gamma I$

2.2 Understanding the parameters:

- α: susceptible person being removed (natural death)
- β: exposed person being removed (natural death)
- γ: infected person recovering
- λ: susceptible person getting exposed $= \frac{kI}{N}$
- σ: exposed person getting infected

The known functions $s(t)$, $e(t)$, $i(t)$, and $r(t)$, have now become:

$$s = \frac{S}{N}, \quad e = \frac{E}{N}, \quad i = \frac{I}{N}, \quad r = \frac{R}{N}.$$

$$\frac{ds}{dt} = -\beta is - \alpha s$$
$$\frac{de}{dt} = \beta is - \sigma e - \kappa e$$
$$\frac{di}{dt} = \sigma e - \gamma i,$$
$$\frac{dr}{dt} = \gamma i.$$