Modelling epidemics with Python

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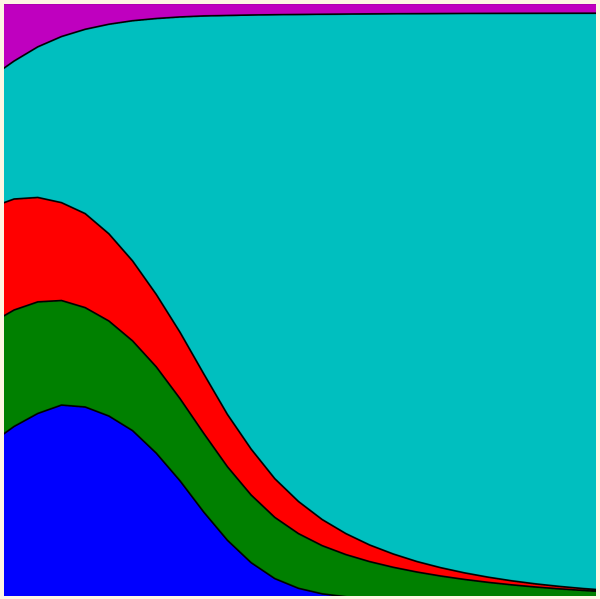
Not Me

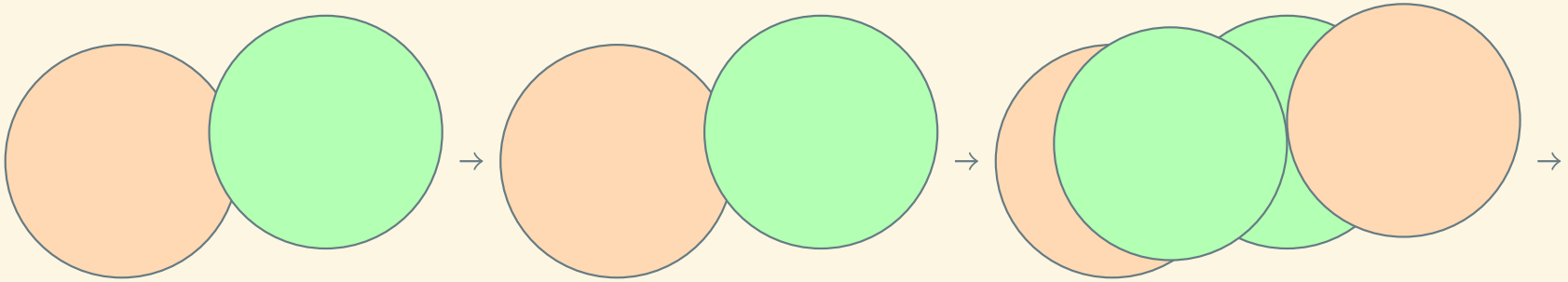
Not Me

CARDIFF UNIVERSITY

PRIFYSGOL CAERDYDD

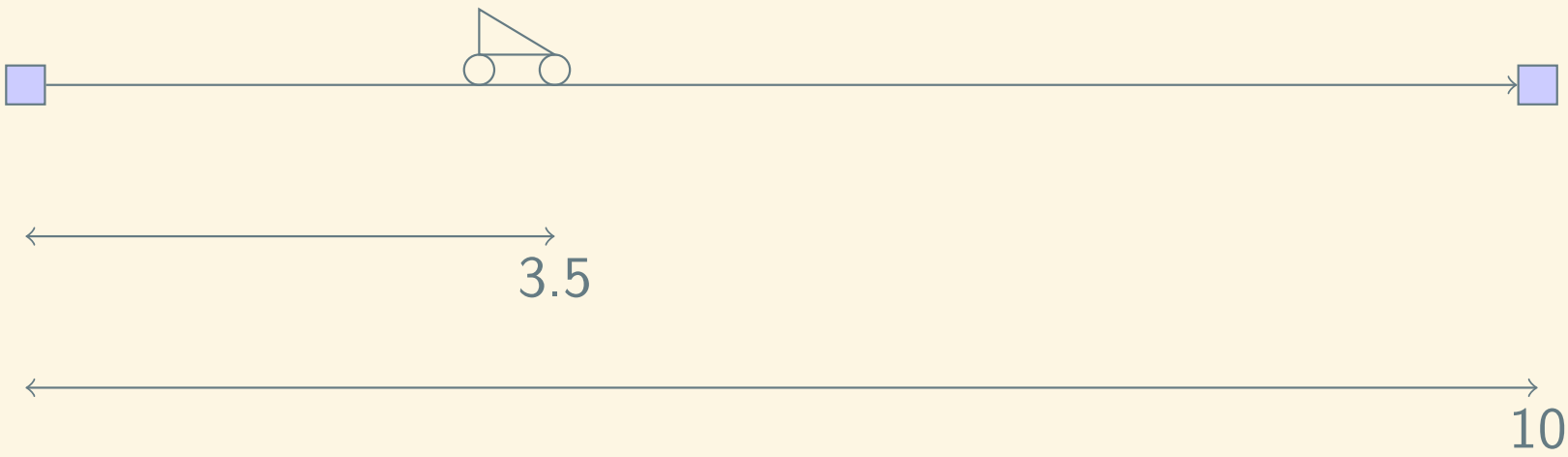


Software Sustainability Institute

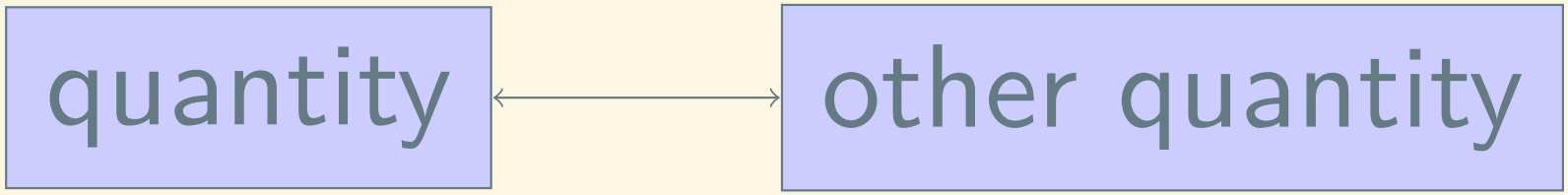


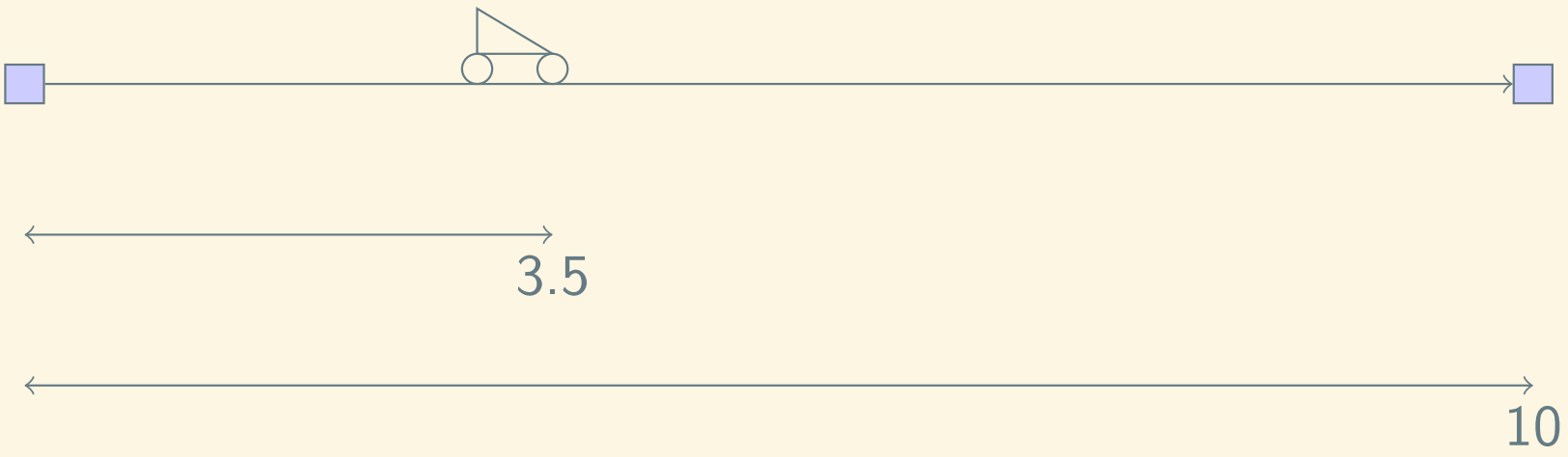
(1) (1) (2)

$$x_n = \begin{cases} 1 & \text{if } n \in \{0, 1\} \\ x_{n-1} + x_{n-2} \end{cases}$$

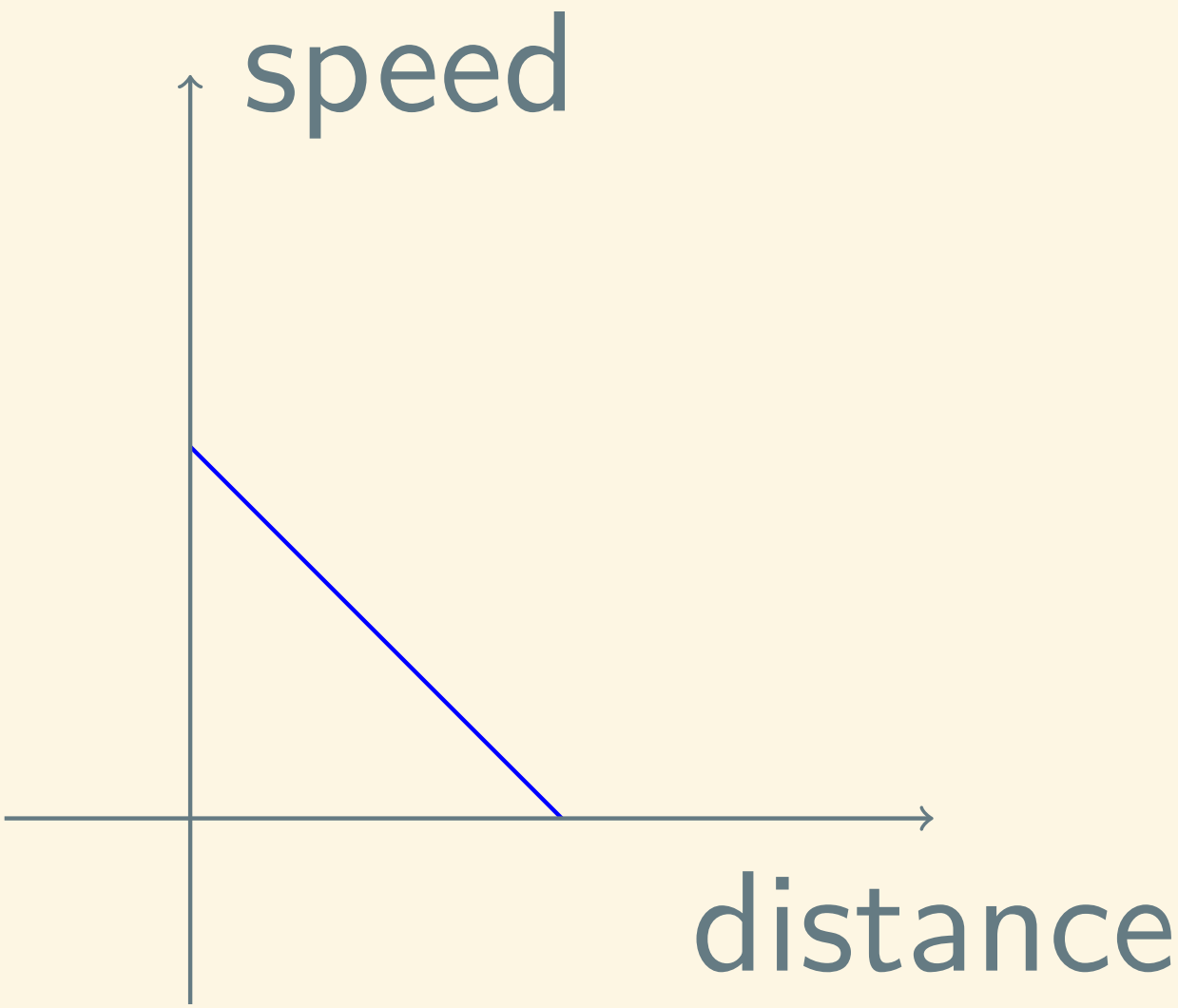


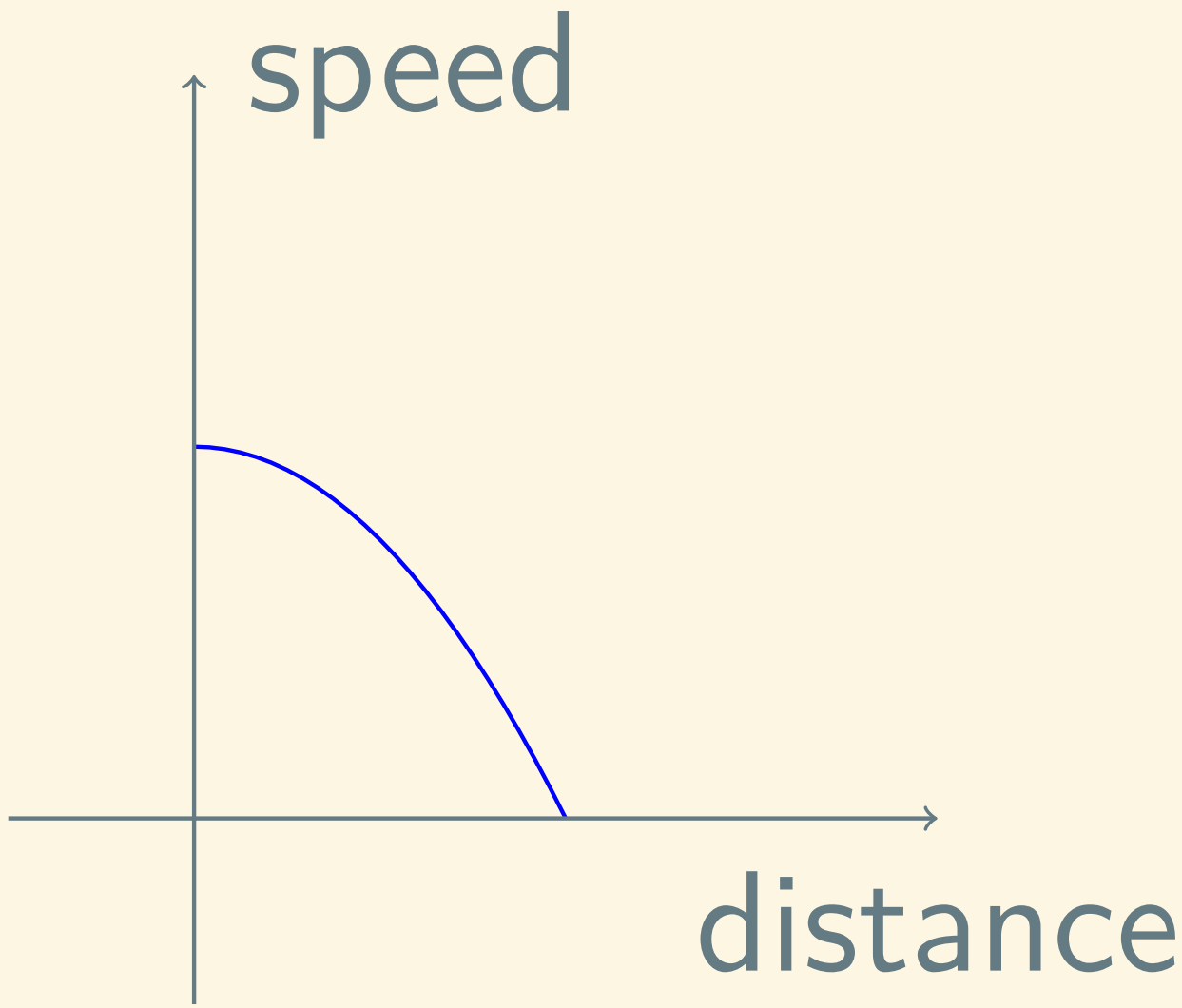
$$3.5 + x = 10$$

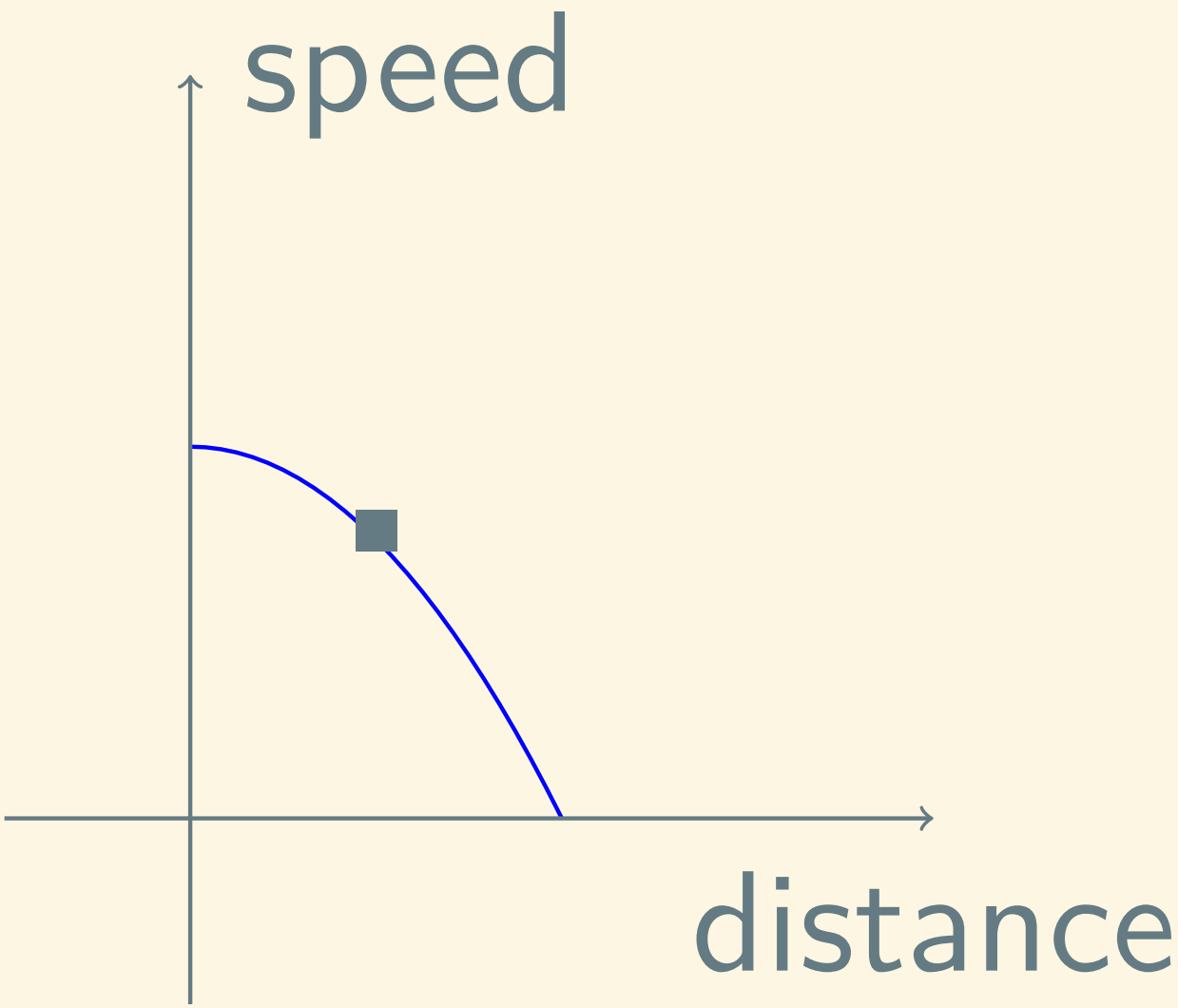

quantity
other quantity


3.5
10


quantity
speed


speed
distance

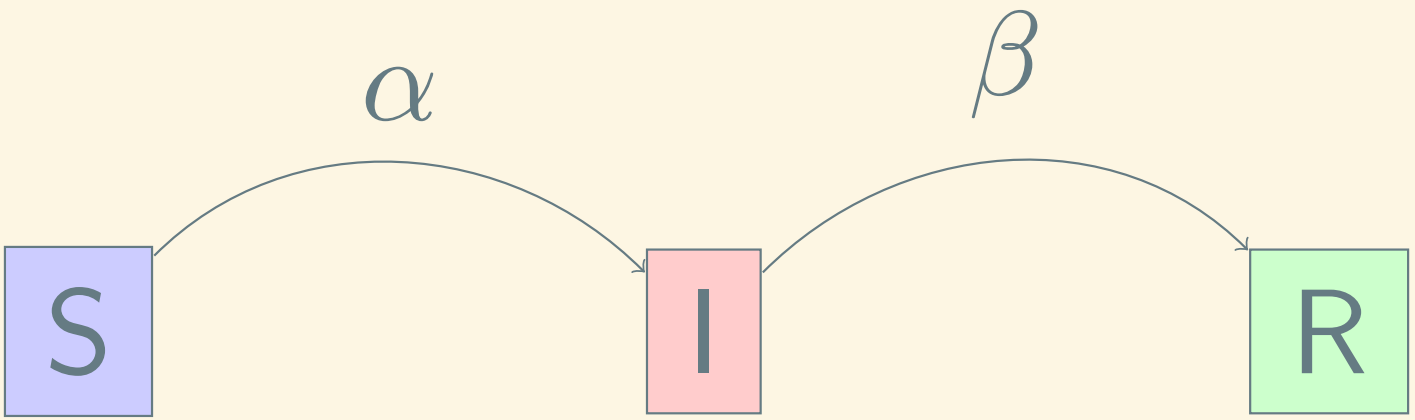

speed
distance

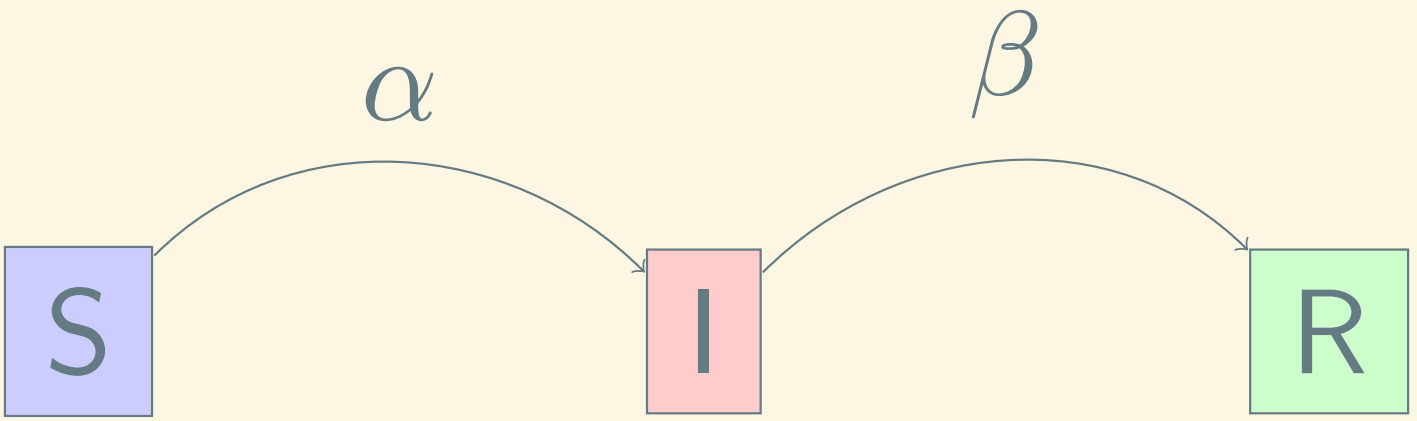

speed
distance

Coffee break.

$$\frac{dT}{dt} = K\left(T_{\text{room}} - T(t)\right)$$

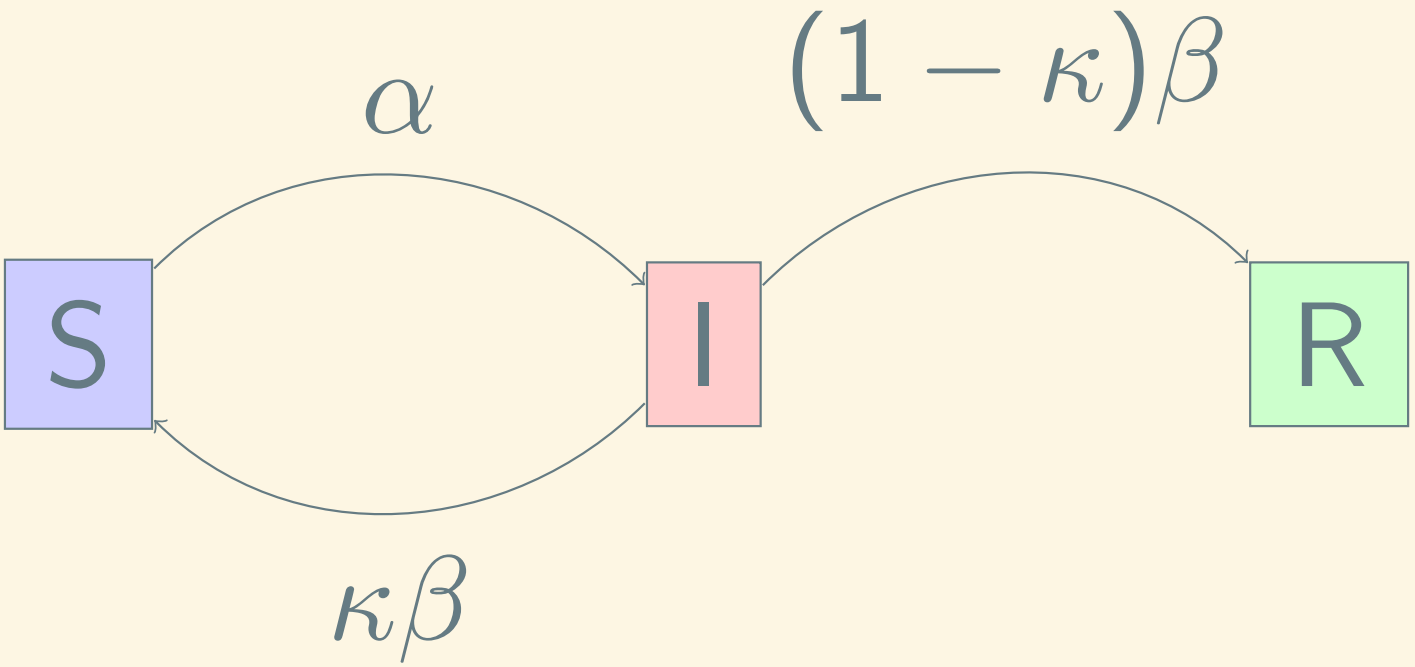
```
import sympy
```

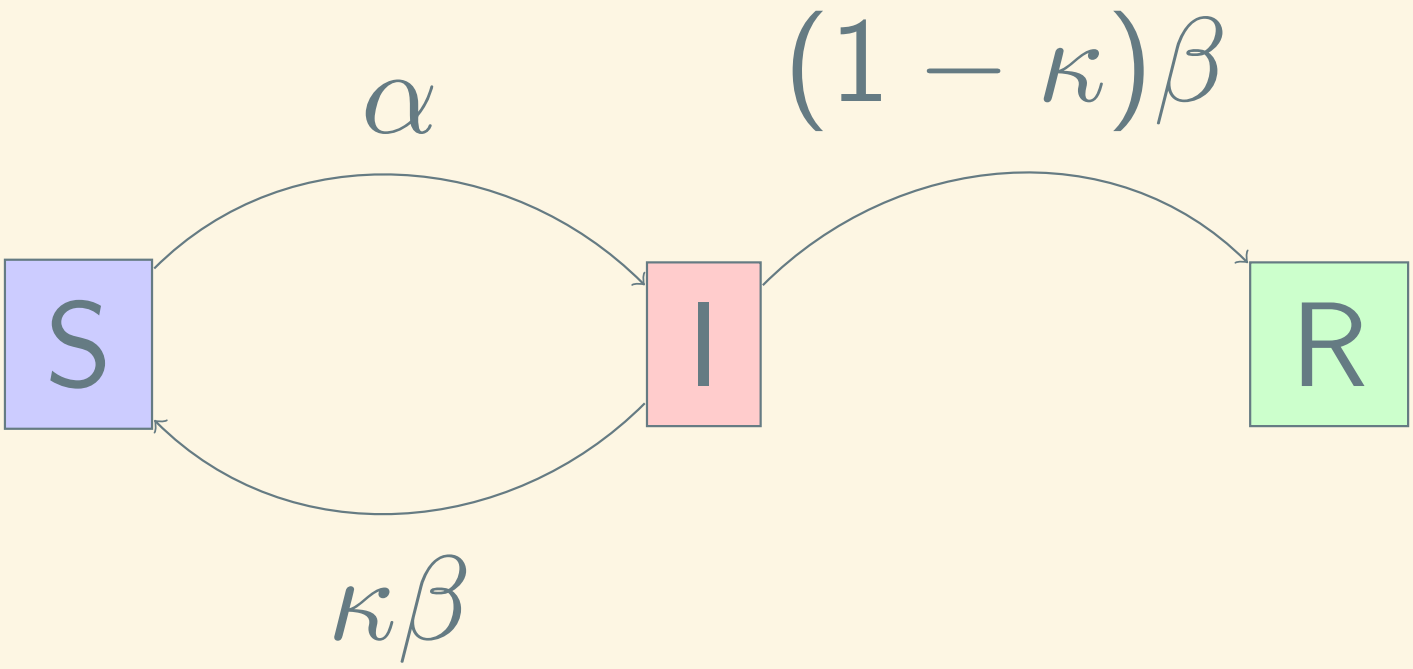

α
β
S
I
R



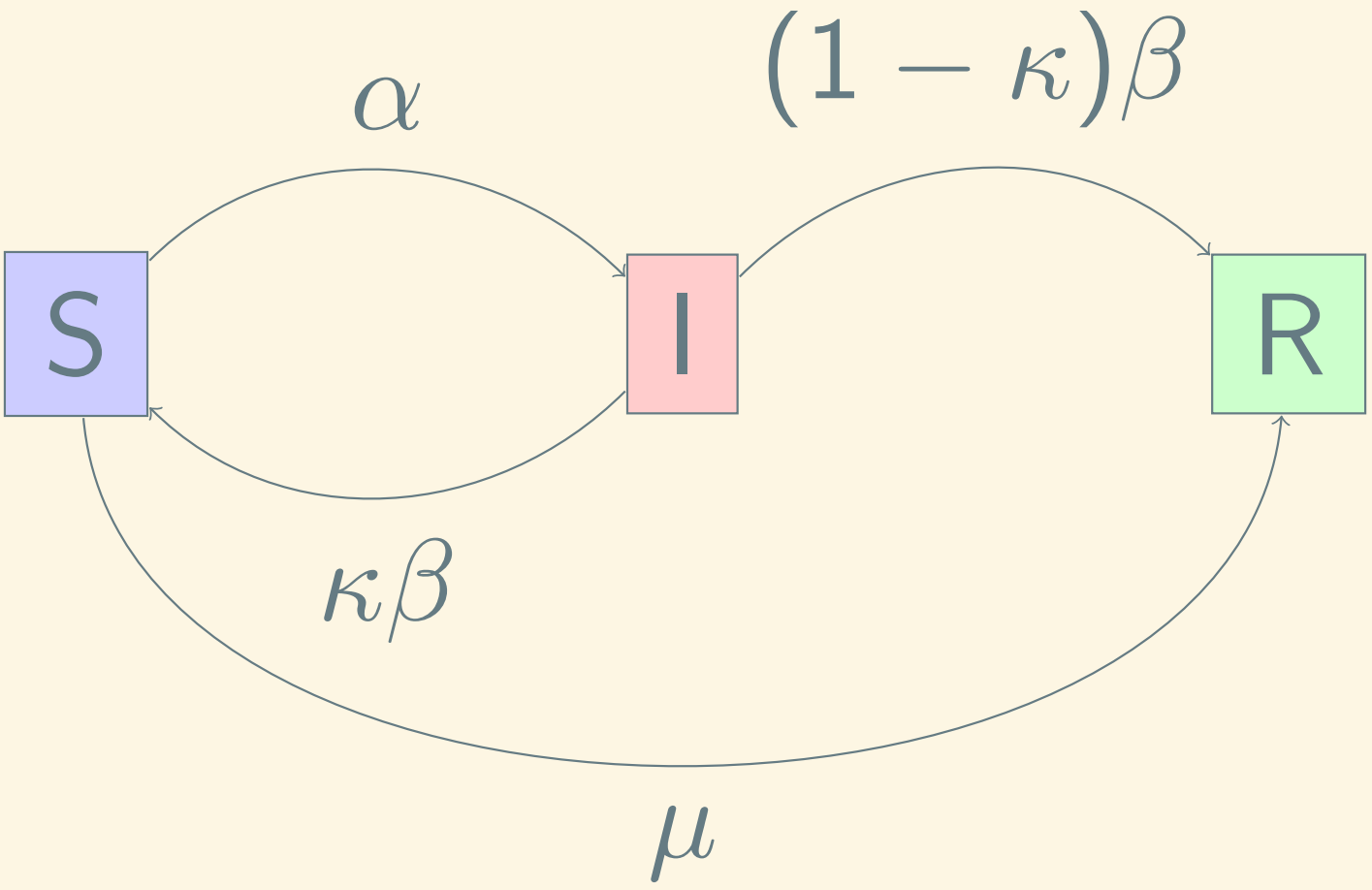
$$\frac{dS}{dt} = -\alpha IS \qquad \frac{dI}{dt} = \alpha IS - \beta I \qquad \frac{dR}{dt} = \beta I$$

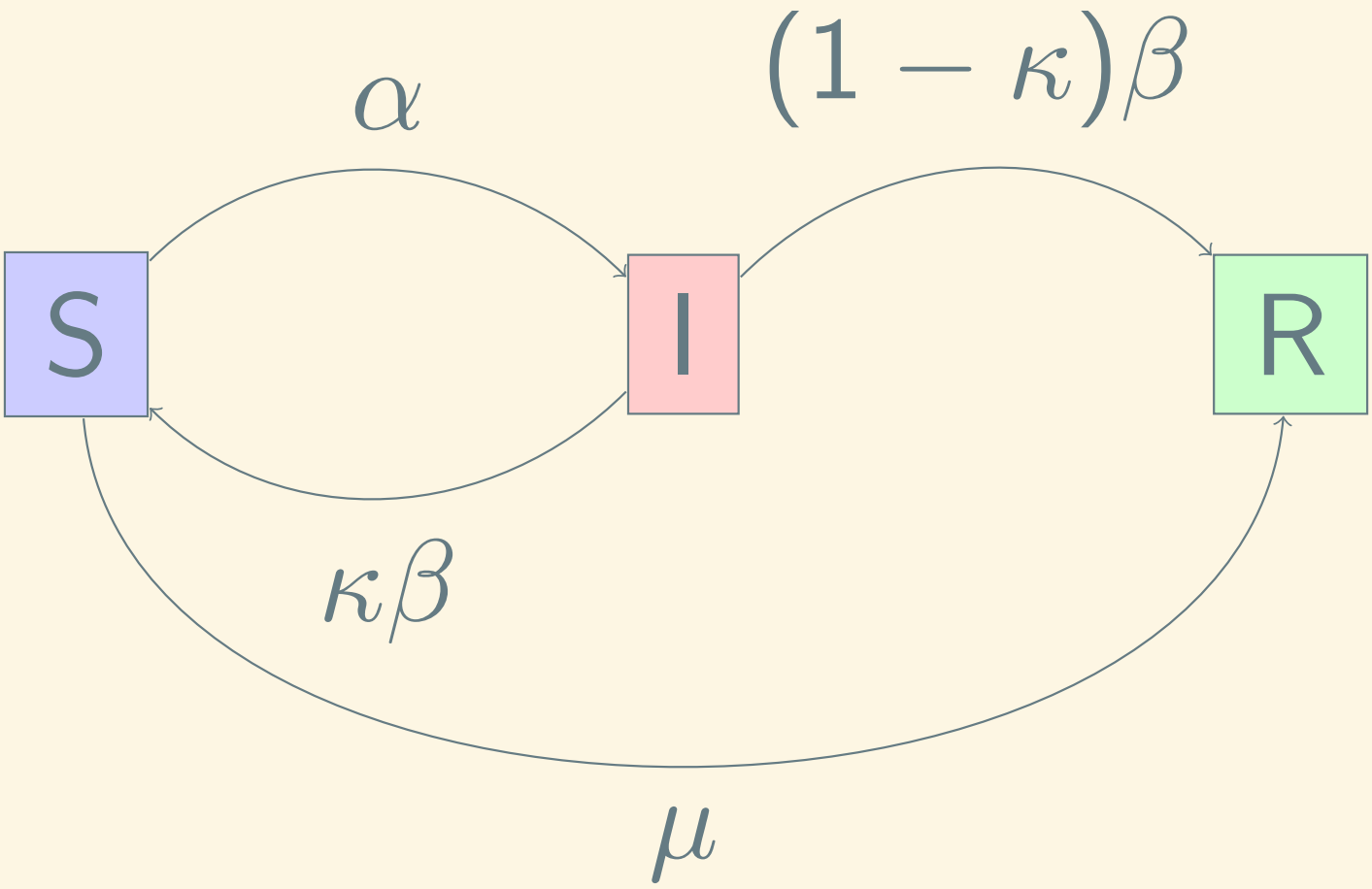
```
import scipy
```


α
$(1-\kappa)\beta$
S
I
R
$\kappa\beta$

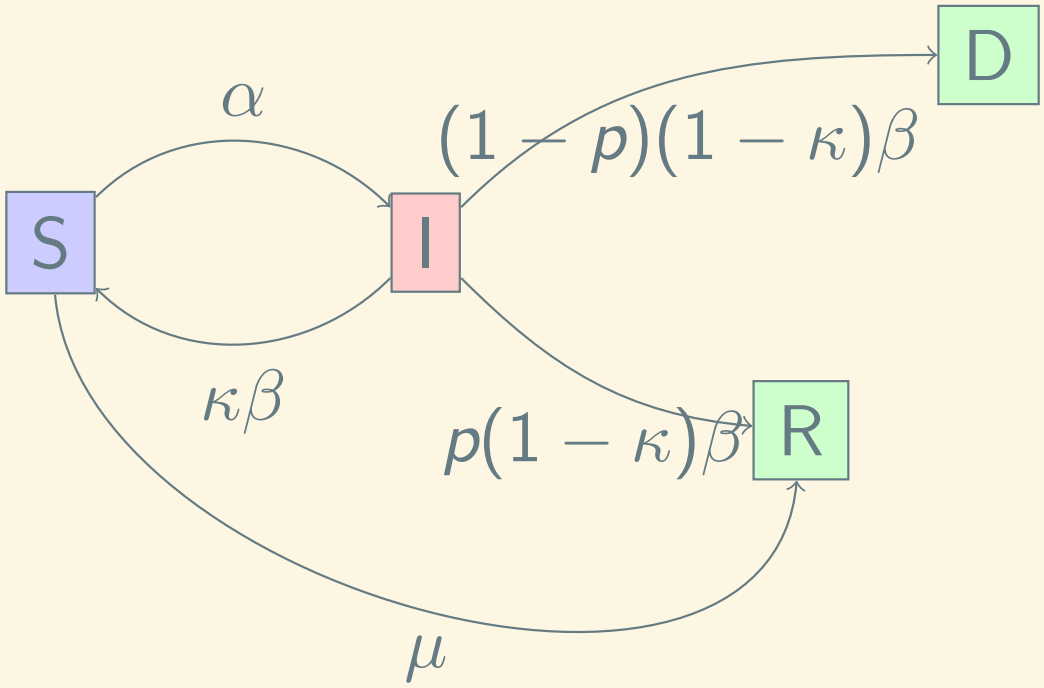


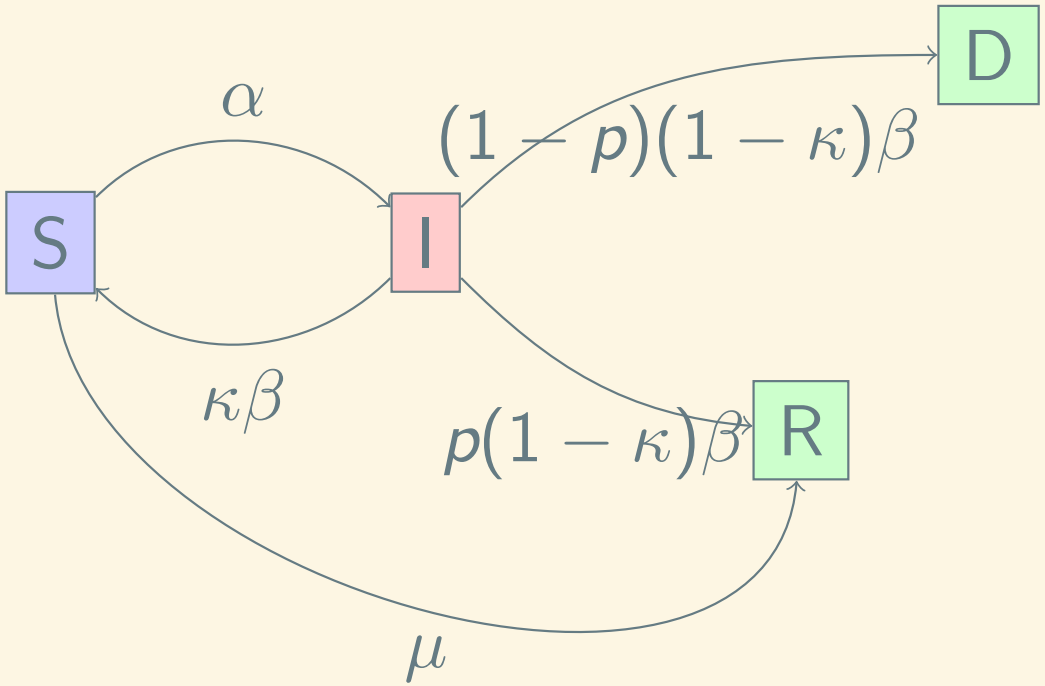
$$\frac{dS}{dt} = -\alpha IS + \kappa\beta I \qquad \frac{dI}{dt} = \alpha IS - \beta I \qquad \frac{dR}{dt} = (1-\kappa)\beta I$$


α
$(1-\kappa)\beta$
S
I
R
$\kappa\beta$
μ



$$\frac{dS}{dt} = -\alpha IS + \kappa\beta I - \mu S \qquad \frac{dI}{dt} = \alpha IS - \beta I \qquad \frac{dR}{dt} = (1-\kappa)\beta I + \mu S$$

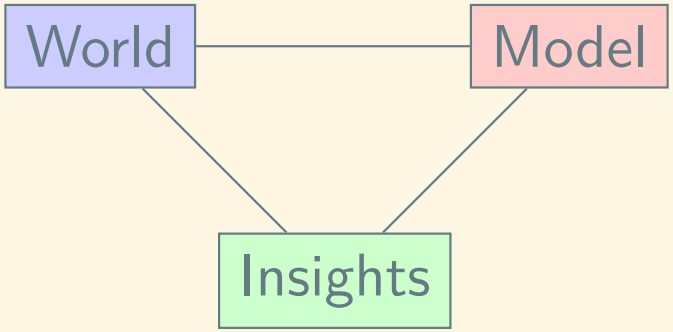

D
α
$(1-p)(1-\kappa)\beta$
S
I
$\kappa\beta$
$p(1-\kappa)\beta$
R
μ

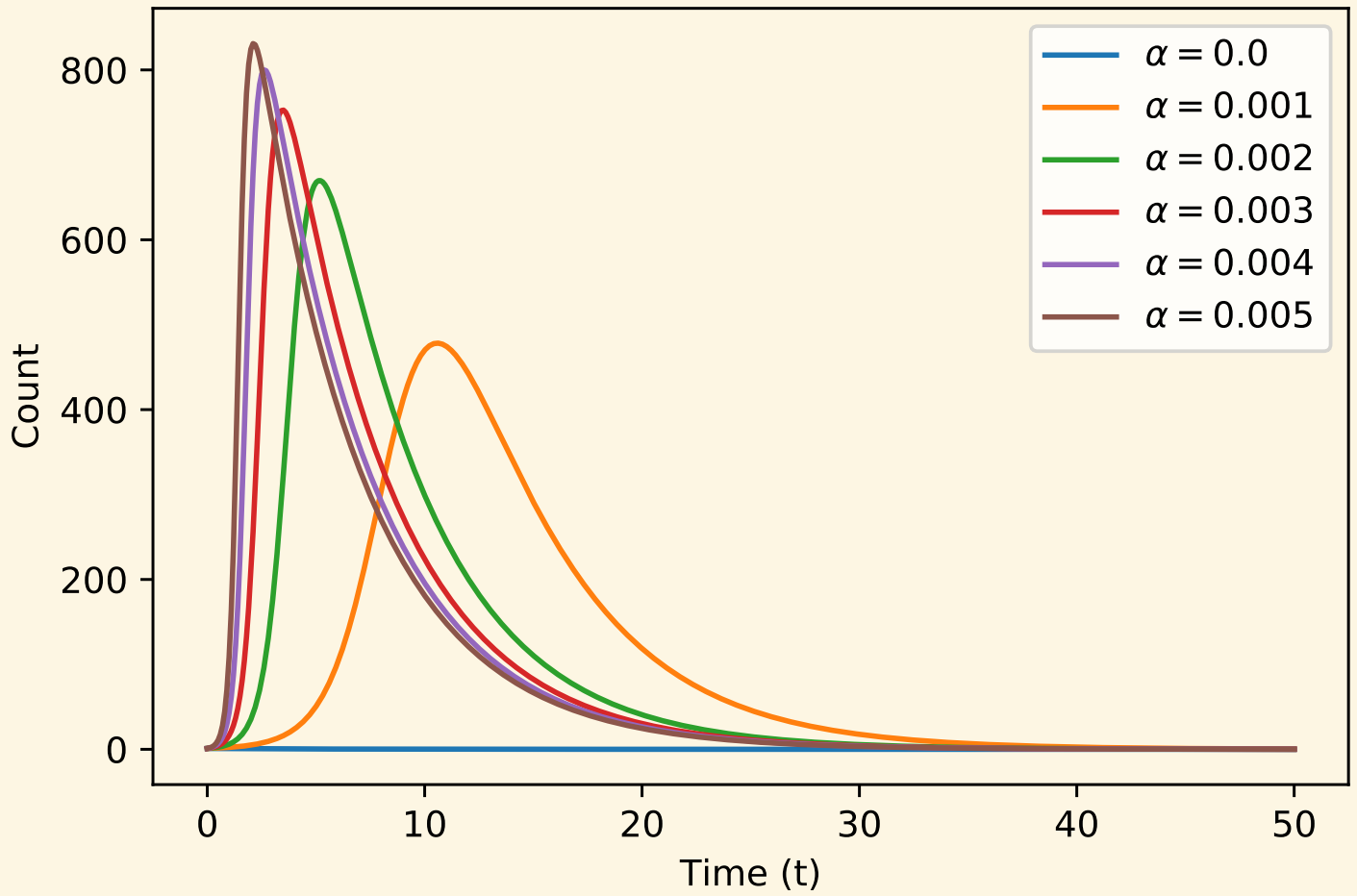


$$\frac{dS}{dt} = -\alpha IS + \kappa\beta I - \mu S \qquad \frac{dI}{dt} = \alpha IS - \beta I$$

$$\frac{dR}{dt} = p(1-\kappa)\beta I + \mu S \qquad \frac{dD}{dt} = (1-p)(1-\kappa)\beta I$$

- `sympy`: powerful python library for symbolic mathematics;
- `scipy.integrate.odeint`: numerical integration for numerical solutions of differential equations.




800
600
400
200
0
Count
0
10
20
30
40
50
Time (t)
$\alpha = 0.0$
$\alpha = 0.001$
$\alpha = 0.002$
$\alpha = 0.003$
$\alpha = 0.004$
$\alpha = 0.005$

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