

Problem Sheet 1

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All the programming task are solved using the julia programming language.
To reproduce the solution pull <https://github.com/relias96/Epidemiologie> and
following the Instructions in the README file. Then run scripts

Sheet1

T1.jl

A

$$R_0 = \frac{\text{transmissionrate}}{\text{deathrate} + \text{recoveryrate}} = \frac{\beta N_0}{\alpha + d + \theta} \quad (1)$$

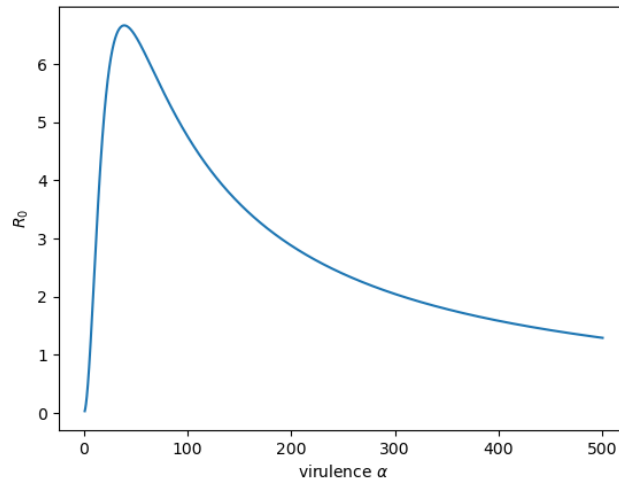


Figure 1: Optimize R_0 over virulenz α

R_0 reaches its maximum of 6.66 at $\alpha = 39.10$

B

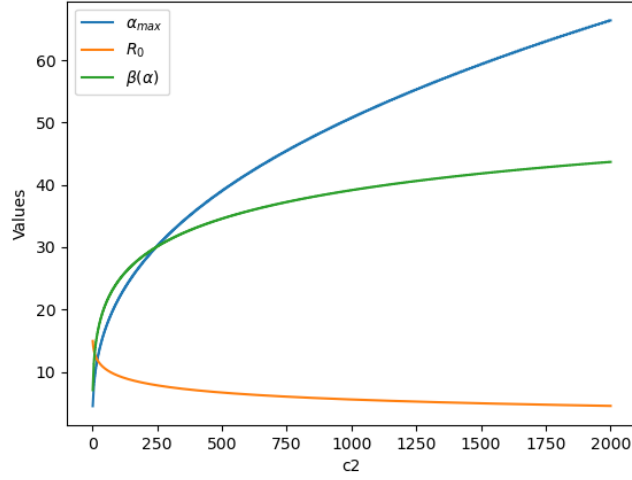


Figure 2: $R_0(\alpha_{\max})$ and α_{\max} over c_2

C

Figure 2 shows that an increase in c_2 would lead to an increase in α_{\max} and a decrease $R_0(\alpha_{\max})$. We expect a similar behavior when increasing the deathrate d .

D

We assume that a vaccination has an impact on the virulenz α .

$$\alpha(v) = \alpha_0 * (1 - v) \quad (2)$$

with the other dependencies we get:

$$\beta(\alpha(v)) = \frac{c_0 * \alpha(v)}{c_1 + \alpha(v)} = \frac{c_0 * \alpha_0 * (1 - v)}{c_1 + \alpha_0 * (1 - v)} \quad (3)$$

and

$$\theta(\alpha(v)) = \frac{c_2}{\alpha(v)} = \frac{c_2}{\alpha_0 * (1 - v)} \quad (4)$$

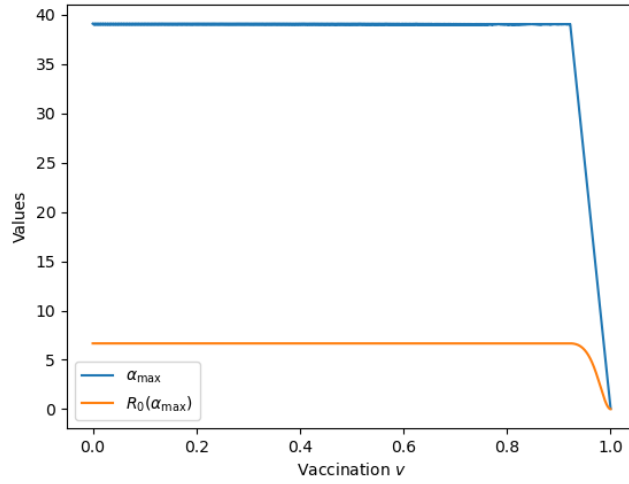


Figure 3: Vaccination