Problem Sheet 1

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All the programming task are solved using the julia programming language.
To reproduce the solution pull Github-Repository and following the Instructions in the README.md file. Then run scripts
Sheet1
T1.jl

A

$$R_0 = \frac{transmissionrate}{deathrate + recoveryrate} = \frac{\beta N_0}{\alpha + d + \theta} \tag{1}$$

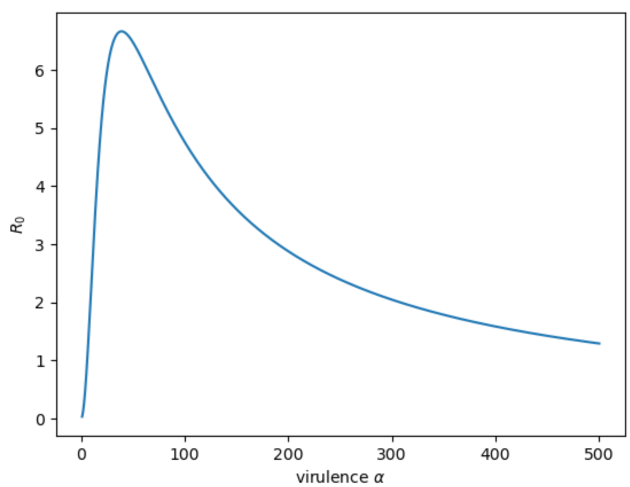

Figure 1: Optimize R_0 over virulenz α

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

B

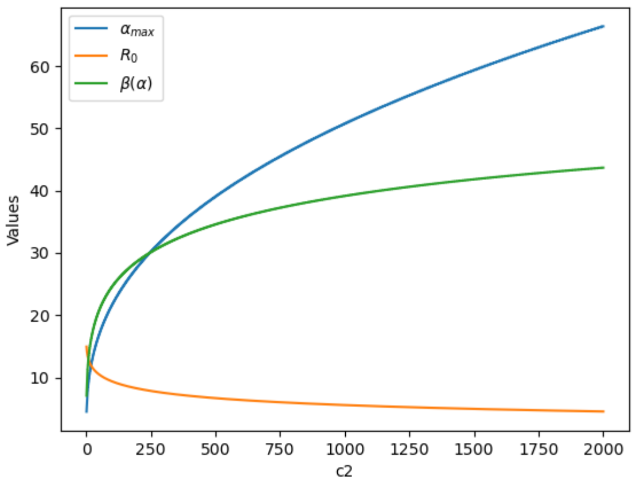

Figure 2: $R_0(\alpha_{\max})$ and $\alpha_{\max}$ over $c2$

C

Figure 2 shows that an increase in c2 would lead to an increase in $\alpha_{\max}$ and an decrease $R_0(\alpha_{\max})$. We expect a similar behavior when increasing the deathrate d.

D

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

$$\alpha(v) = \alpha_0 * (1 - v) \tag{2}$$

with the other dependencies we get:

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

and

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

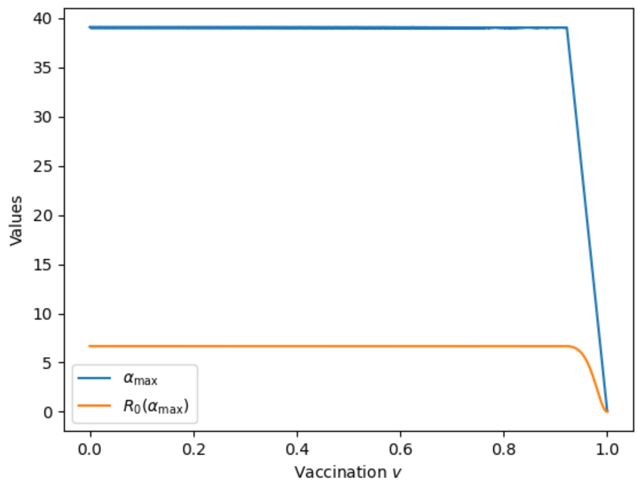

Figure 3: Vaccination