Consider the SIR model:

,

, (5.1)

.

With the following initial conditions: (5.2)

where N is the size of a population.

Summing all the equations in (5.1) yields us a single equation for N(t):

(5.3)

The initial condition for (5.3) is:

, (5.4)

Where is the initial size of the population.

**Tasks**

1. Find an analytical solution to model (5.3) with the initial condition (5.4). Estimate N(t) as .
2. Solve model (5.1) with the initial condition (5.2) numerically. Draw the graphs for S(t), I(t) and R(t). Consider the cases when the disease-free equilibrium (DFE) is stable and unstable.
3. Estimate the expected secondary infection .

**Note**: all the model coefficients have been described in Lecture 5. Select the appropriate values for the given coefficients.