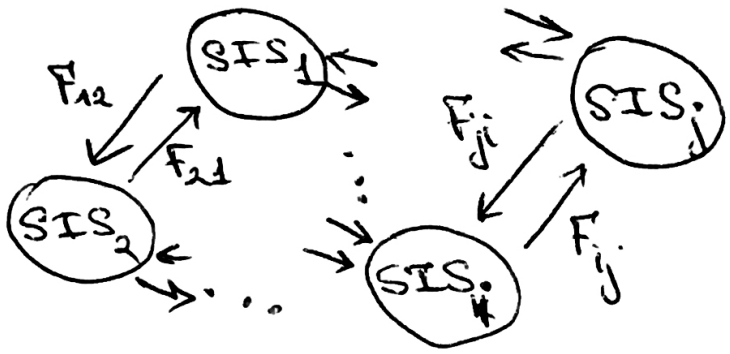
SIS - model

(Susceptible - Infected - Susceptible)

$$\begin{cases} \frac{dS}{dt} = -\alpha \cdot \frac{IS}{N} + \beta \cdot I \\ \frac{dI}{dt} = \alpha \cdot \frac{IS}{N} - \beta I \\ N = I + S \end{cases}$$

Metapopulation model:



Discrete time:

$$\begin{cases} N_j^t = N_j^{t-1} + \sum_{k \neq j} F_{kj}^{t-1} - \sum_{j \neq k} F_{jk}^{t-1} \\ I_j^t = I_j^{t-1} + \alpha \cdot \frac{S_j^{t-1}}{N_j^{t-1}} \left(I_j^{t-1} + \sum_{k \neq j} F_{kj}^{t-1} \cdot \frac{I_k^{t-1}}{N_k^{t-1}} \right) - \\ \qquad - \beta \cdot I_j^{t-1} - \left(\sum_{j \neq k} F_{jk}^{t-1} \right) \frac{I_j^{t-1}}{N_j^{t-1}} \\ S_j^t = S_j^{t-1} - \alpha \cdot \frac{S_j^{t-1}}{N_j^{t-1}} \left(I_j^{t-1} + \sum_{k \neq j} F_{kj}^{t-1} \frac{I_k^{t-1}}{N_k^{t-1}} \right) + \\ \qquad + \beta \cdot I_j^{t-1} - \sum_{j \neq k} F_{jk}^{t-1} \frac{S_k^{t-1}}{N_k^{t-1}} \end{cases}$$