

### 1. 3 COMPETITOR MODEL

The prey model that is often discussed in mathematical modelling classes is the Lotka-Volterra model with two species. In real world applications, there are likely more than two species. Other models have thus been developed, one of which is the three-competitors model proposed by Robert May and Warren Leonard. The equations governing the populations  $N_1(t)$ ,  $N_2(t)$  and  $N_3(t)$  are:

$$\begin{aligned}\frac{dN_1}{dt} &= N_1(1 - N_1 - \alpha N_2 - \beta N_3) \\ \frac{dN_2}{dt} &= N_2(1 - \beta N_1 - N_2 - \alpha N_3) \\ \frac{dN_3}{dt} &= N_3(1 - \alpha N_1 - \beta N_2 - N_3)\end{aligned}$$

In this model  $\alpha, \beta$  are positive parameters.

In this project, you investigate the three-species model above by looking at the evolution in time of the populations for a range of values of  $\alpha$  and  $\beta$ . The case  $\alpha + \beta = 2$  deserves special attention.