

## ***Introduction to Theoretical Ecology Assignment 7***

### Linear Stability Analysis of Lotka-Volterra Competition Model

Continuing on the assignment last week, in this assignment you will analyze the same Lotka-Volterra competition model using linear stability analysis:

$$\frac{dN_1}{dt} = r_1 N_1 \left(1 - \frac{N_1 + \alpha N_2}{K_1}\right)$$

$$\frac{dN_2}{dt} = r_2 N_2 \left(1 - \frac{N_2 + \beta N_1}{K_2}\right)$$

, where  $r_1$  and  $r_2$  are the intrinsic population growth rates;  $K_1$  and  $K_2$  are the carrying capacities;  $\alpha$  is the effect of  $N_2$  on the population growth of  $N_1$ ;  $\beta$  is the effect of  $N_1$  on the population growth of  $N_2$ .

1. Perform linear stability analysis for all four equilibrium points you got in the previous assignment. Your answer should include (1) the Jacobian matrix evaluated at the equilibrium point, (2) the two eigenvalues of the Jacobian matrix (in the case of two species coexistence, simply show the characteristic equation), and (3) the stability criteria. (10 pts; 2.5 pts for each equilibrium point)