

Math 172 Spring 2011 WS 7

1. Compute the equilibrium point of the discrete model system

$$\begin{aligned}u_n &= 3u_{n-1} - 2v_{n-1} + 4 \\v_n &= 5u_{n-1} - 3v_{n-1} - 28\end{aligned}$$

2. You are studying competition between red and black desert scorpions. If only a single species is present, it would grow following the logistic model, with a carrying capacity $K_1 = 100$ for the red scorpion, and $K_2 = 150$ for the black scorpion.

- Write the logistic model equations for each of the species.
- Write the Lotke-Volterra competition model equations for the two species, assuming competition coefficients of $\alpha = 2$ for the red scorpion, and $\beta = 3$ for the black scorpion.
- Find the equilibrium values for the equations in b.
- Assume the initial populations are 25 red scorpions and 50 black scorpions. Graph the state space and the isoclines for each species. Predict the short-term dynamics of the populations, and the final outcome of the competition.

3. Repeat questions c. and d. in problem 2 with $K_1 = 100$, $K_2 = 150$, $\alpha = 0.5$, $\beta = 2$. Assume the initial values to be:

- $N_1 = 90$, $N_2 = 120$
- $N_1 = 60$, $N_2 = 60$
- $N_1 = 60$, $N_2 = 20$.

4. Repeat questions c. and d. in problem 2 with $K_1 = 100$, $K_2 = 150$, $\alpha = 0.5$, $\beta = 0.75$. Assume the initial values of the population to be $N_1 = 50$, $N_2 = 70$.