

Math 361 Winter 2001/2002
Assignment 8 (Quiz on Wednesday, November 28)

1. Consider the Lotka-Volterra competition equations

$$\begin{aligned}\frac{dx_1}{dt} &= x_1(1 - x_1 - \alpha_{12}x_2) \\ \frac{dx_2}{dt} &= x_2(1 - x_2 - \alpha_{21}x_1),\end{aligned}$$

where $\alpha_{12} > 0$ and $\alpha_{21} > 0$. Perform a complete linear stability analysis of this system. (Hint: depending on the parameters α_{12} and α_{21} , this system will have 3 or 4 equilibrium states; find these equilibria, and calculate the eigenvalues of all relevant Jacobian matrices.)

2. Solve problem 6 on p. 201 in the textbook.

3. Solve problem 7 on p. 201 in the textbook.

4. Solve problem 16 on p. 261 in the textbook.

5. Solve problem 17 on p. 261 in the textbook. However, instead of using the equations given in the textbook, use the following equations:

$$\begin{aligned}\frac{dN_1}{dt} &= rN_1 \left(1 - \frac{N_1}{k_1 + \alpha N_2}\right) \\ \frac{dN_2}{dt} &= rN_2 \left(1 - \frac{N_2}{k_2 + \beta N_1}\right)\end{aligned}$$

where $r > 0$, $k_1 > 0$, $k_2 > 0$, $\alpha > 0$, $\beta > 0$ and $\alpha\beta < 1$.

6. Read section 6.6. in the textbook, and solve the pertaining problem 25 on p. 263.

7. Solve problem 12 on p. 259 in the textbook.

8. Solve problem 14 on p. 259 in the textbook.

9. Solve problem 32 on p.265 in the textbook.

10. Solve problem 1 on p. 362 in the textbook.

11. Solve problem 6a,b,c,d and f on p. 363 in the textbook.

12. Solve problem 21 on p. 368/369 in the textbook.