

ME 534 COMPUTER-BASED MODELING AND SIMULATION
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Dynamic systems occur in many fields of study. Consider, for example, the problem of modeling the population levels of a predator-prey pair of species. The following simplified model of population growth is referred to as the Lotka-Volterra system.

$$\frac{dx_1}{dt} = (b_1 - c_1 x_2)x_1$$

$$\frac{dx_2}{dt} = (-b_2 + c_2 x_1)x_2$$

where, x_1 denote the population level of the prey, and let x_2 denote the population level of the predator.

- (a) Write a C/C++ program to solve these nonlinear equations using Numerical Recipes routines for the given parameters and initial condition below from $t = 0$ to $t = 10$ sec.
- (b) Plot x_1 versus x_2 and explain in words (submit a document) why the resulting solution forms a closed trajectory (hint: consider the relation between predator and prey in ecological systems).

Parameters:

$$b_1 = b_2 = c_1 = c_2 = 1$$

Initial condition:

$$x_1(t = 0) = 0.5$$

$$x_2(t = 0) = 0.5$$