MATH 315 Fall 2024
Assignment 7
Due Friday, October 4

I. Reading

Read Sections I ("Introduction"), II ("Two real-world situations") and III ("Autonomous systems") of Chapter 4: **Ecological Models: Interacting Species** of our text; Pages 140 - 153.

II. Exercises:

Complete Exercises 6 and 20 in Chapter 4.

III: Use the eigenvalue – eigenvalue approach to find explicit solutions for the two arms race models from Part II of Assignment 3.

IV. *MATLAB*

(A) In part (f) of Exercise 20, you used the information derived from calculus considerations to analyze the behavior of the function

$$f(x) = x^m e^{-nx}$$

so that you could sketch a reasonable graph of the function.

Now use MATLAB to obtain a graph of the particular version of this function which has $m = 6$ and $n = 2$. Compare the *MATLAB* output with the graph in Figure 4.7 of the text.

(B) [**OPTIONAL, EXTRA CREDIT]** *A Simulation Approach To The Homicide Problem*

(A) Create a *MATLAB* model for the cooling murder victim $dV/dt = k\,(V - R)$ where V denotes the temperature of the object (victim) at time t,, R is the temperature of the room and k is a proportionality constant dependent on the thermal properties of the object.

For the values $R = 68$ and $k = -.04$, use *MATLAB* to estimate the time of death. You may use the other data given in the description of the homicide case.

(B) Now, let's make the problem a bit more complex. Suppose that the murder victim's body is found outside on a spring evening. The air temperature had been dropping 1° per hour since sundown and continued this rate of decline all night, with the air temperature reaching 70° at midnight. Modify your *MATLAB* model to include such a varying R. Use this *MATLAB* model to estimate time of death.