New York City College of Technology
MAT 3770/D676 - Fall 2019
Homework 3

Homework 3 consists of Problem 2, Section 2.4. It is due on **11/9 at 11:59 pm**.
Make sure to follow the instructions:

- The collection will be done on CoCalc only.
- E-mail submission will not be accepted.
- Go to the course project (not the shared project) and look for the folder named Homework 3. This is where you should upload your pdf file.
- One pdf file per submission.
- No late submission will be accepted.
- Include your name on the file.
- Name your file as "yourlastname_hw3"
- Include the coding part and a technical report (as if you were a consultant) addressing the questions in each item. One paragraph for each item.
- Before working on the problem, you should look at the solution to Homework 2 that you can find both on CoCalc and OpenLab.
- I will be talking about both problems (Homework 2 and 3) on Monday, 11/4.

Reconsider the whale problem of Homework 2, but now look at the total number of whales. We will say that the whale population levels x and y are feasible provided that both x and y are nonnegative. We will say that the population levels x and y are sustainable provided that both of the growth rates dx/dt and dy/dt are nonnegative.

(a) Determine the population levels that are feasible, sustainable, and that maximize the total whale population $x + y$. Use the five-step method, and model as a constrained optimization problem.

(b) Examine the sensitivity of the optimal population levels x and y to the intrinsic growth rates r_1 and r_2.

(c) Examine the sensitivity of the optimal population levels x and y to the environmental carrying capacities K_1 and K_2.

(d) Assuming that $\alpha_1 = \alpha_2 = \alpha$, examine the sensitivity of the optimal population levels x and y to the strength of competition α. Is it ever optimal to drive one species to extinction?