m 5740 HW assignment. Dynamics of populations

Due date: Friday, January 24

1. Using Maple, calculate and graph the growth or decline of the size P_n of a population,

$$P_{n+1} = P_n + \alpha_n P_n$$

in which the fertility-mortality rate α_n (Logistic model)

   (a) declines with the size of the population,

$$\alpha_n = .1 \left(1 - \frac{P_n}{1000} \right)$$

   if the initial population size is 500.

   (b) declines with the size of the population in the previous period,

$$\alpha_n = .1 \left(1 - \frac{P_{n-1}}{1000} \right),$$

   if initial population sizes are $P_0 = P_1 = 500$ or $P_0 = P_1 = 1500$. (Logistic model with delay)

   (c) depends the size of the population as following,

$$\alpha_n = .1 \left(\frac{P_n}{200} - 1 \right) \left(1 - \frac{P_n}{1000} \right),$$

   if initial population size is 201 or 199. (Allee model)).

2. Using Maple, calculate and graph the growth or decline of the sizes X_n and Y_n of a populations of foxes and rabbits, using Lotka-Volterra model

$$X_{n+1} = -.8X_n + .01X_nY_n, \quad Y_{n+1} = 1.3Y_n - .01X_nY_n$$

if $X_0 = 20$ and $Y_0 = 200$.

Bonus Describe a variant of the two previous models with delay and calculate the dynamics. Explain the effect of the delay