Population Models: Week 1

Question 1 Consider the population model discussed in the slides

$$P^{n+1} = P^n + (\alpha - \beta)P^n$$

Set $\alpha = 1$ and $\beta = 0.9$. If $P^0 = 100$ compute a table of P^n for $n = 1, ..., 10$. Is there something strange that the math gives as far as the interpretation of P^n as the number of individuals is concerned? (Hint: what does a population of 2.3 mean?)

Question 2 Consider the population model discussed in the slides

$$P^{n+1} = P^n + (\alpha - \beta)P^n$$

Set $\alpha = 0.9$ and $\beta = 1$. If $P^0 = 100$ compute a table of P^n for $n = 1, ..., 10$. Does the population ever die out? You may need to make a graph.

Question 3 In Question 1 you identified a flaw in the model, as far as representing the number of individuals. Use the floor function,

$$\lfloor 2.3 \rfloor = 2$$

to come up with a better model and repeat question 1 for this better model.

Question 4 Let's try to get more specific and realistic. If we measure time in months and assume all months to be equal we could try to come up with a more realistic model that accounts for harsh winters. Let's say in winter months, which we will take to be December, January, and February we have $\alpha = 0$ and $\beta = 0.25$ and during the summer months we have $\alpha = 0.5$ and $\beta = 0.1$.
i) If we start with $P^0 = 100$ again calculate the population after a year.
ii) Now do some math to try to come up with a simplified model at the end of each season.
iii) Can you find a closed form expression for the population after one year? After n years?