Assignment 9, ST2304

Problem 1 The Ricker model is a discrete time population dynamic model where population size N_t changes from one generation to the next according to the equation

$$N_{t+1} = N_t e^{r(1-N_t/K)}. \tag{1}$$

1. At which population size N_t would $N_{t+1} = N_t$ according the model? By what factor will the population size N_t change each generation when N_t is much smaller than K?

2. Make a graph showing $\Delta N_t = N_{t+1} - N_t$ as function of N_t for a suitable choice of r and K.

3. Write a function which given N_1, r, K and t_{max} computes $N_2, N_3, \ldots, N_{t_{max}}$ and returns $N_1, N_2, \ldots, N_{t_{max}}$ as a vector.

4. Make several calls to your function and plot the result for different choices of r, K and t_{max} to verify that your function works.

Problem 2 The growth rate λ of a population where a fraction l_i of individuals survives to age i and m_i is the number of offspring produced by each individual at that age, is given by the solution of the the Euler-Lotka equation

$$1 = \sum_{i=1}^{n} \lambda^{-i} l_i m_i. \tag{2}$$

Write a function which computes the growth rate λ of a population given $l_1, l_2, \ldots, l_n$ and $m_1, m_2, \ldots, m_n$ by solving (2) using Newton's method.

Your function should take two vectors containg the l_i's and m_i's as arguments and should return the growth rate λ as it's value. For example, if you name your function `eulerlotka`, the call

```
> eulerlotka(c(.9,.8,.25),c(0,0,32))
```

should return 2 since such a population would double in size each year.