Assignment 6 - Exercise 2

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Your task is, to model a simple growth curve of a plant's biomass. Starting with a small initial weight, the daily growth rate is calculated and added to the weight: $W_1 = init$; $W_n = W_{n-1} + \Delta W_{n-1}$ for $n \geq 2$.

Growth depends on external factors like temperature and radiation.

Formulas

At the beginning, growth is determined mainly by temperature. Let's denote the weight of the plant - this is the state we are interested in our model - by W and the mean temperature by MT. The daily increase ΔW for every day n is given by

$$\Delta W_n = 0.0193 \cdot MT_n \cdot W_n \quad (1)$$

It is known, that after some days of growth, the behaviour of growth changes. The daily increase rate is now driven by radiation R and the formula is:

$$\Delta W_n = 0.201 \cdot R_n \quad (2)$$

MT_n and R_n are mean temperature and radiation on day n.

Task A

Load the weatherfile `weather.txt` as a dataframe. It contains mean temperature and radiation for each day. (For simplicity reasons, don't bother, if mean temperature is negative.)

Start with an initial weight of $W_1 = 1.53$ at day 1. Calculate the weight increment ΔW_n up to day 21 with formula (1). After day 21, calculate it with formula (2). Use the mean temperature and daily radiation values from the dataframe.

Calculate the weight W_n until day 365 and plot the result.

Question B

Have a look at the figures / graph of the simulated weight.

1. Does the growth curve look linear after day 21? (Similar to the restricted rabbit growth example?)
2. If yes - why? If no - why not?

You will find the answer if you look at the formula and the input data. State your answer with maximal three lines per question.

How to submit the assignment 6 (part 1 and 2)

- Submit your answers as a single PDF document (including R code, graphs, tables etc.). Don't print the whole weatherfile in the document!
- Include the R code additionally as R source files `exercise1.R` and `exercise2.R`.
- Make sure that your R code in the two files runs in a fresh (cleared) workspace.

Hints

- It might be easier (less typing, better resemblance to the formulas), if you assign the `MeanTemp` column of the dataframe to a variable `MT` and the `Radiation` column to a variable `R`.
- Notice, that the condition involves only the days, not the weight of that days (this is different from the rabbit example, where the condition depends on the number of rabbits.)