PC1-Assignment Monday 20 April from 10:00-11:15 hours

Programming & Numerical Analysis

Consider the following sequence of infinite series of integers beginning with 2, 3, 4:

$$S_i = S_{i-2} + S_{i-3} \qquad \text{for } i \geq 4$$

where

$$S_1 = 2, S_2 = 3, S_3 = 4.$$

The matrix version looks like this:

$$x_i = Q x_{i-1} \qquad \text{for } i \geq 2$$

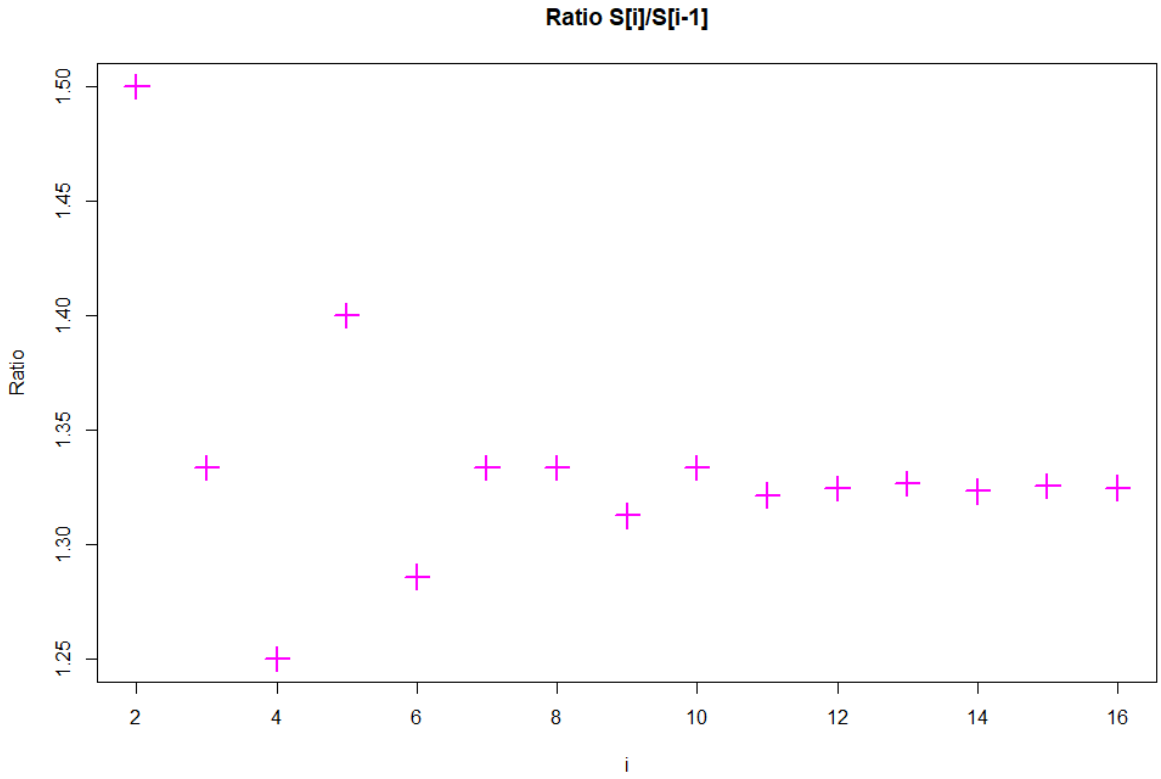
with the 3×3 matrix $Q = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ and the 3×1 vector $x_1 = \begin{bmatrix} S_1 \\ S_2 \\ S_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$.

Write *one* R-script (using RStudio) that

1. contains the function `sequence<-function(n)`, which returns an $n \times 1$ vector with elements $(S_1, S_2, S_3, \ldots, S_n)$ for $n \geq 4$ using a `while` loop; so `sequence(4)` should return `2 3 4 5`;
2. generates: `seq<-sequence(16)`;
   if you are unable to code the function `sequence`, please use `seq<-2:17` although the ratios will then be different.
3. determines the ratios of $\frac{S_i}{S_{i-1}}$ for $i = 2, \ldots, 16$ based on the vector `seq`
4. shows a table with the ratios $\frac{S_{11}}{S_{10}}, \ldots, \frac{S_{16}}{S_{15}}$ in 3 decimals (see second page)
5. creates a plot of the ratios $\frac{S_i}{S_{i-1}}$ with magenta plusses and the correct labels (see second page)
6. creates the matrix `Q`
7. generates: `seqlist<-list(matrix(c(2,3,4),3,1))`
8. the `seqlist` should be a list containing the vectors x_i for $i = 1, \ldots, 14$. Use a `for` loop to calculate $x_2, \ldots, x_{14}$ and assign x_i to the i^{th} component of `seqlist`
9. initializes `counter<-0` and increases this counter by one if the third element of the 3×1 vector x_i stored in `seqlist` equals S_{i+2} that is stored in the vector `seq`; show the final value of `counter` to the user.

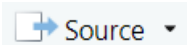
ASSIGNMENT:

1. Write an **R-script** (including the function `sequence`!)
   - put everything in ***one*** file and do ***not*** make use of user-defined functions outside the script
   - *for full credits*, your output needs to be the same as the second page
2. Download the template from Canvas and enter your name and student number at the first line
   - # NAME: name student (student number)
3. When finished, upload your file (`PC1.R`) to canvas. In case of emergency (Canvas not available), so can also email the file to uvapna@gmail.com
4. Output (see other side):




```
     11       12       13       14       15       16
  1.321    1.324    1.327    1.323    1.326    1.325
Counter=14
```

Explanation:

The user executes the R-script (for instance by clicking on the 

button), which shows the graph and blue text on the screen.

Use vectors as much as possible!
GOOD LUCK!