Tutorial 1 STQD6214

To start our tutorial, we require to install R. You can download the latest version of R from here: https://cran.r-project.org/. After that, you might want to consider installing RStudio from here: https://posit.co/. This step is not necessary but personally, using RStudio is much easier and it has nicer interface compared to the basic R.

For this tutorial, our aim is to familiarize ourselves with using R for basic mathematical computations.

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1. Evaluate the following expressions.

   a) $12.3 + 232.2$

   b) $\log(e^2 + 3)$

   c) $\sin(\frac{\pi}{4} + 3)$

   d) $\tan^{-1}(1.3^2)$

2. Let $x = 2.3$ and $y = 3.1$. Evaluate the following expressions.

   a) $\sqrt{x^4 - 5y}$

   b) $e^x - 3x + y^x$

   c) $\cos^{-1}\left(\frac{x}{y}\right)$

   d) $\log\left(z + \frac{3}{z}\right)$ where $z = x^2 - \log(10y)$

3. Let $x = 2.3$ and $y = 3.1$. Determine whether the following expressions are true or false.

   a) $3x > 2y$

   b) $x^y \leq y^x$ AND $3^x > y^{2.2}$

   c) $\cos(x) = 0$ OR $\sin(y) > 0$

4. Let $\boldsymbol{x}$ and $\boldsymbol{y}$ be vectors where $\boldsymbol{x} = (6,4,3,20)$ and $\boldsymbol{y} = (12,46,2,1)$. Evaluate the following expressions.

   a) $\boldsymbol{x} + 2\boldsymbol{y}$

   b) $\sum_{i=1}^{4} x_i y_i$

c) $\max(z)$ where the ith component of $z_i = x_i^2 - 10y_i$. Which component gives this maximum value of z?

d) How would you code to get the components of y that is bigger than 10?

e) Run this following code: `c(x, y)`. What do you think happen here?

f) Run this following code: `sum(x[x>5])`. What do you think happen here?

g) Run this following code: `sum(x>5)`. What do you think happen here?

5. Without using only the `c()` function, create the following:

a) A vector containing integers from -10 to 10.

b) A sequence of numbers from 0 to 100 where the length of sequence is 1000.

c) A vector of 0's with length 10.

d) The vector ("A", "B", "C", "A", "B", "C", "A", "B", "C").

e) The vector ("A", "A", "A", "B", "B", "B", "C", "C", "C").

6. Let $A = \begin{bmatrix} 21 & 3 \\ 2 & 14 \end{bmatrix}$ and $B = \begin{bmatrix} 12 & 5 \\ 45 & 1 \end{bmatrix}$. Answer the following questions.

a) Assign the variables `A` and `B` as the matrix above. Run this following code: `class(A)`. What do you get here?

b) Evaluate $A + B$.

c) Evaluate AB.

d) Evaluate A^{-1}.

e) Evaluate $\left(A^T B\right)^{-1}$.

7. Let $D = \begin{bmatrix} 3 & 52 & 7 \\ 2 & 10 & 1 \end{bmatrix}$ and $x = \begin{bmatrix} 75 \\ 2 \end{bmatrix}$. Assign the variables `D` and `x` as given. Answer the following questions.

a) Let E be a 2×4 matrix where the first 3 columns of E is the same as D and the fourth column of E is the same as x. How would you code the matrix E in R?

b) Let F be a 2×2 matrix where F is the first two columns of D. How would you get matrix F using R?