

Due Mon. 09/24 (submit to ICON before 9:30 a.m.)

Submit your solutions as an .Rnw file and accompanying .pdf file.

1. Use the `system.time` function in R to time the performance of the same task in two different ways:
  - (a) Generate a vector of 500,000 random variates from a Normal(0,1) density and use the `sum` function to calculate their sum.
  - (b) Create a variable called `answer` and initialize it to 0. Then, using a `for` loop, do the following steps 500,000 times: generate a single Normal(0,1) value and add it to the sum contained in `answer`.

Besides including the R code and output, add a sentence in which you compare the relevant timings for both methods and state which one is more efficient.

2. Use R to do the following:
  - (a) create a matrix called  $M$  with the following entries:

$$\begin{pmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{pmatrix}$$

- (b) create a vector called  $v$  with the following entries:  
17 46 181
  - (c) compute and display the product  $Mv$  produced by matrix multiplication
  - (d) compute and display the transpose of  $M$
  - (e) display only those elements of  $v$  that have values less than 50
3. Generate a sample of 500 values from a Gamma density with shape parameter 3 and rate parameter 0.5. Produce and display a histogram of your sample.
  4. (a) Do any `help.search` operations outside of your .Rnw file. Then just include a sentence in your .Rnw file saying what you found.  
In R, use the `help.search` function to locate a package that contains a function to compute the skewness of a vector of numbers. Make sure that it uses the standard definition of skewness. What is the name of the function, and which package is it in?

- (b) Locate an R function that computes the five-number summary of a vector of numbers. What is the name of the function, and which package is it in?
- (c) Write an R function that does the following:
  - i. Accepts one argument: a vector
  - ii. Checks whether the vector is numeric
  - iii. If not, displays the message "Vector must be numeric" and exits. Note: do not use the `stop` function in your function, as that will prevent your .Rnw file from continuing compilation.
  - iv. If yes, computes the skewness of the values (after removing any missing values)
    - A. if the absolute value of skewness is less than 1, returns a list containing two objects: skewness in an object named "skewness" ; a vector consisting of the mean and standard deviation in an object named "descstats"
    - B. otherwise, returns a list containing two objects: skewness in an object named "skewness" ; a vector consisting of the five-number summary in an object named "descstats"
- (d) Run your function in R three times, using the following vectors as arguments:
  - i. `c("Arthur", "Mary", "Rover")`
  - ii. `rnorm( 100 )`
  - iii. `rexp( 100, 5)`
- (e) In the document that you submit for homework, include the text of your function as well as the R code and output for the 3 calls to it.

The output from your own function ought to look something like the following (with different numeric values):

```
> mydesc( rnorm(100) )
$skewness
[1] 0.1931722

$descstats
[1] -0.03160733 0.94527957

> mydesc( rexp(100,5) )
$skewness
[1] 1.462030

$descstats
[1] 0.000019662 0.057816812 0.105732124 0.265288314 0.806777159
```