STAT:5400 Fall 2016
Instructor: Cowles
Homework 3b

Due Mon. 09/26 (submit to ICON before 4:30 p.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 form 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
```