CHAPMAN University

Department of Computational and Data Sciences
CS501 Introductory Computation for Scientists
Fall 2019
Homework#10

Date Given: Oct 23, 2019 Due Date: Oct 26, 2019

==========

Download R software from CRAN (www.r-project.org) and install it on your computer.
Download RStudio software (www.rstudio.com) and install it on your computer.

There are 6 problems in this homework assignment. Solve these problems using R software. Make sure that the answer computed by your R-code matches with the given answers.

==========

1. Read a file 'blowfly.txt: Compute the total number of records in this file. How many of them are unique? (Lesson 9.13 Slide#3 + #13)

   Answer: Out of 361 records, there are 353 unique numbers.

==========

2. Use a loop in R to determine how long it will take to accumulate $1,000,000 in a bank account if you deposit $10,000 initially and $10,000 at the end of each year; the account pays 6% annual interest. (Lesson 9.21 Slide#5 - 9)

   Answer = 33 years

==========

3. Read the 'worldfloras.txt' file in R. Display the countries names that have a character 'c' as the 4th character in their name. Use 'R 'grep' command and regular expressions.
   (Lesson 9.21 Slide#16 - 31)

   ```
   Answer:  "Czechoslovakia" "Liechtenstein"  "Seychelles"
   ```

==========

4. The volume ‘V’ and paper surface area ‘A’ of a conical paper cup are given by the following 2 equations.

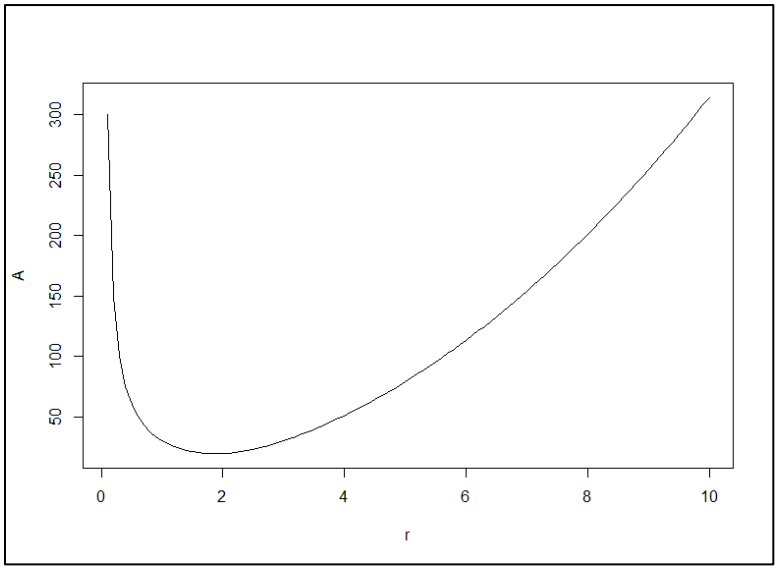
$$V = \frac{1}{3}\pi r^2 h$$

$$A = \pi r\sqrt{r^2 + h^2}$$

Where ‘r’ is the radius of the base of the cone and ‘h’ is the height of the cone. By eliminating ‘h’, obtain the expression for ‘A’ as a function of ‘r’ and ‘V’.

Create a user-defined function that accepts ‘r’ and ‘V’ as arguments and computes ‘A’ for a given value of ‘V’ (assume ‘V’ = 10 in^3). Plot a graph between ‘A’ and ‘r’ where ‘r’ varies from 0.1 to 10 inches. For which value of ‘r’, ‘A’ value is minimum? (Lesson 9.13 Slide #5)

Answer: When r=1.9, A is minimum



==========

5. The recursive definition of Factorial function is as follows.
   Factorial(x) = x * Factorial(x-1)

   Write a recursive function R that computes the factorial of a number. Test that function for all the numbers from 1 to 10. (Lesson 9.21 Slide #6 - #8)

```
Answer: [1]       1       2       6      24     120     720    5040
40320  362880 3628800
```

==========

6. Read 'cells.txt' and 'multivariate.txt' files into R using 'read.table' command.
   a) Using R functions identify the data type of each column for both files.
   b) Read both files again. This time omit the column headers and assign column names of your own choice.
   c) Save the two datasets to both ASCII text using 'write.table' command and binary dataframe files using 'save' command.

   The first 10 lines of both files are displayed here. (Lesson 9.23 Slide#8 + #14 + #17)

   ==========

cells	smoker	age	sex	weight
1	T	young	male	normal
0	T	young	male	normal
1	T	young	male	normal
1	T	young	male	normal
0	T	young	male	normal
2	T	young	male	normal
1	T	young	male	normal
0	T	young	male	normal
5	T	young	male	normal
1	T	young	male	normal

   ==========

Temp	Industry	Population	Wind	Rain	Wet.days
61.5	368	497	9.1	48.34	115
55.6	291	593	8.3	43.11	123
55.9	775	622	9.5	35.89	105
51	137	176	8.7	15.17	89
68.4	136	529	8.8	54.47	116
47.6	44	116	8.8	33.36	135
66.2	641	844	10.9	35.94	78
49.9	1064	1513	10.1	30.96	129
57.8	197	299	7.6	42.59	115
50.4	347	520	9.4	36.22	147