

HW01 - Markdown Syntax and Histograms

Stat 131A, Spring 2019

General Instructions

- This assignment assumes that you have read the first four tutorials available in the course's github repository: <https://github.com/ucb-introstat/introstat-spring-2019/tree/master/tutorials>
- Write your narrative and code in an `Rmd` (R markdown) file.
- Name this file as `hw01-first-last.Rmd`, where `first` and `last` are your first and last names (e.g. `hw01-gaston-sanchez.Rmd`).
- Please do not use code chunk options such as: `echo = FALSE`, `eval = FALSE`, `results = 'hide'`. All chunks must be visible and evaluated.
- Submit your `Rmd` and `html` files to bCourses.
- If you have questions/problems, don't hesitate to ask us for help in OH. Also, make use of piazza and seek advice from your peers.

Introduction

The purpose of this assignment is to work with an `Rmd` file, practice writing content using markdown syntax, and plotting histograms with `hist()`.

You will be using R markdown files, aka `Rmd` files, throughout the rest of the course. So the sooner you get familiar with the markdown syntax, the better.

Here are some useful resources that you can consult to complete this assignment:

- RStudio has a very comprehensive R Markdown tutorial: [Rstudio markdown tutorial](#)
- Markdown tutorial by CommonMark: <http://commonmark.org/help/tutorial/>
- www.markdowntutorial.com
- Mastering Markdown: <https://guides.github.com/features/mastering-markdown/>
- Markdown reference: <http://commonmark.org/help/>
- Adam Pritchard's [Markdown Cheatsheet](#)
- RStudio cheat sheet: <https://www.rstudio.com/wp-content/uploads/2016/01/rstudio-IDE-cheatsheet.pdf>

Cooking Recipe

Visit *Smitten Kitchen* (<https://smittenkitchen.com>) and choose one recipe (e.g. [root vegetable gratin](#)). Write about the recipe using Markdown syntax:

- Use an **unordered** list (of bullets) to list the ingredients.
- Use another unordered list to list any “special” kitchen tools that are needed.
- Describe the steps of the recipe.
- Try to include an image to show the appearance of the meal.
- Is there a special season of the year for it?
- Are there variations of the recipe? Using other ingredients?

Quadratic Equation

Visit the wikipedia page for the quadratic equation:

https://en.wikipedia.org/wiki/Quadratic_equation

Write the general form of a quadratic equation, and provide a brief description for it:

$$ax^2 + bx + c = 0$$

Write the formula for the roots of the general quadratic equation:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Also, write the derivation of the solution:

$$\begin{aligned} ax^2 + bx + c &= 0 \\ 4a^2x^2 + 4abx + 4ac &= 0 \\ 4a^2x^2 + 4abx &= -4ac \\ 4a^2x^2 + 4abx + b^2 &= b^2 - 4ac \\ (2ax + b)^2 &= b^2 - 4ac \\ 2ax + b &= \pm\sqrt{b^2 - 4ac} \\ 2ax &= -b \pm \sqrt{b^2 - 4ac} \\ x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \end{aligned}$$

To write all the above equations you will have to use latex syntax. Here are a couple of resources about writing math symbols with Latex notation:

- https://www.sharelatex.com/learn/Mathematical_expressions
- <https://en.wikibooks.org/wiki/LaTeX/Mathematics>
- <https://rmarkdown.rstudio.com/lesson-8.html>

If you feel the quadratic is not enough, feel free to find other math equations and formulas to play with.

Histograms

This problem involves working with R, and it assumes that you have read the tutorial `04-histograms.pdf` available in the course's github repository.

Consider the following vector `x` with 1000 random numbers.

```
# run this code to generate the vector x  
set.seed(9875)  
size = 1000  
x = runif(n = size, min = 0, max = 10)
```

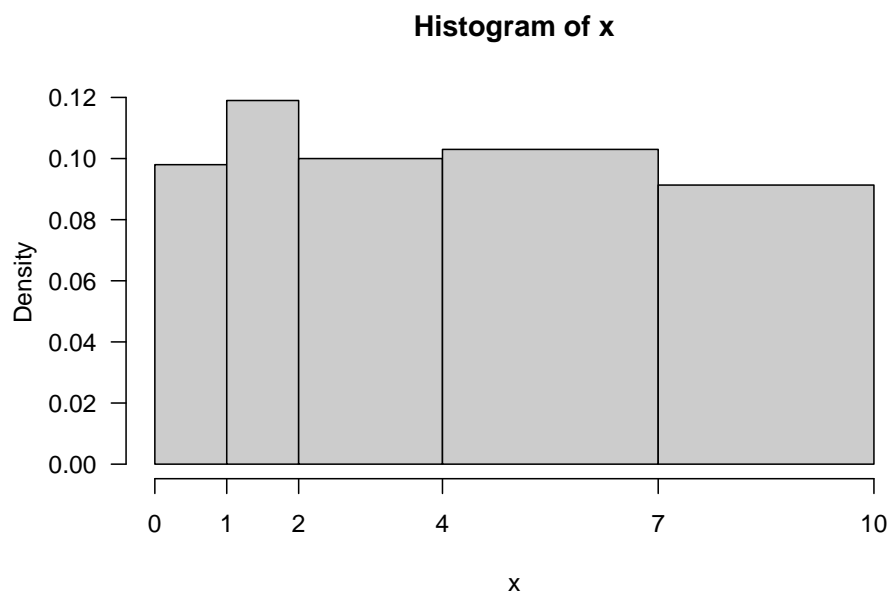
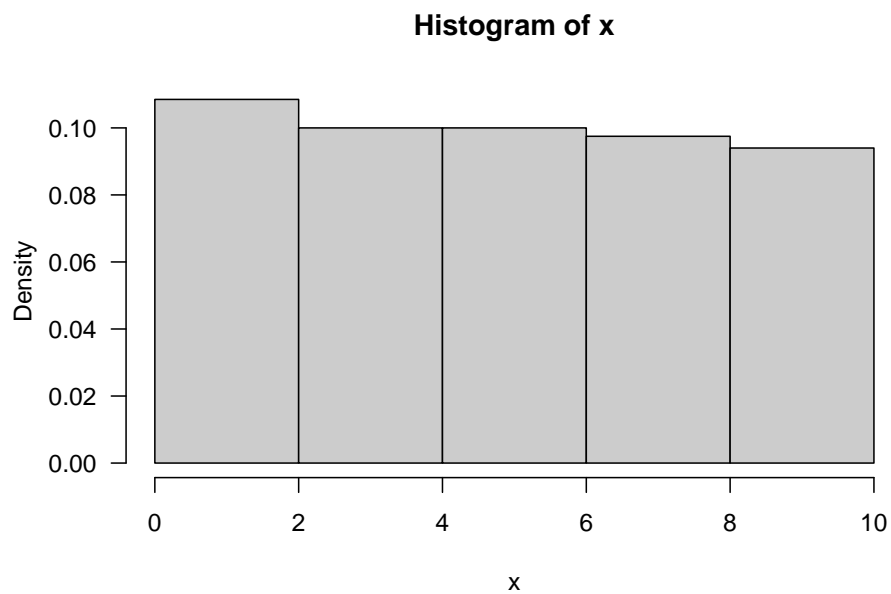
Use R to make two density histograms. The first histogram should have the following interval classes (left endpoint included)

- $[0, 2)$
- $[2, 4)$
- $[4, 6)$
- $[6, 8)$
- $[8, 10)$

The second histogram should have the following interval classes (right endpoint included):

- $(0, 1]$
- $(1, 2]$
- $(2, 4]$
- $(4, 7]$
- $(7, 10]$

Your histograms should look like these:



More Histograms

Create vectors `y`, `z`, and `w` by running the code below:

```
set.seed(4782)
y <- rbeta(1000, .8, .5)
z <- rnorm(1000, 10, 3)
w <- rpois(1000, 2)
```

For each vector: plot default histograms, and add a density curve. Likewise, describe the shape of the distribution.

IQ Scores

The following vector `iqs` contains the IQ scores of 60 fifth-grade students chosen at random from one school.

```
iqs <- c(145, 139, 126, 122, 125, 130, 96, 110, 118, 118,
        101, 142, 134, 124, 112, 109, 134, 113, 81, 113,
        123, 94, 100, 136, 109, 131, 117, 110, 127, 124,
        106, 124, 115, 133, 116, 102, 127, 117, 109, 137,
        117, 90, 103, 114, 139, 101, 122, 105, 97, 89,
        102, 108, 110, 128, 114, 112, 114, 102, 82, 101)

iqs

## [1] 145 139 126 122 125 130 96 110 118 118 101 142 134 124 112 109 134
## [18] 113 81 113 123 94 100 136 109 131 117 110 127 124 106 124 115 133
## [35] 116 102 127 117 109 137 117 90 103 114 139 101 122 105 97 89 102
## [52] 108 110 128 114 112 114 102 82 101
```

Use R to:

- make a frequency table: function `table()` is your friend
- use `hist()` to plot a (default) histogram, comment on its shape, spread, and center
- plot another histogram by dividing the range of the data into the following classes:
 - 75 to 84
 - 85 to 94
 - 95 to 104
 - 105 to 114
 - 115 to 124
 - 125 to 134
 - 135 to 144
 - 145 to 154