

# Lab 1 – MATH 240 – Computational Statistics

Will Perry  
Affiliation  
Department  
wperry@colgate.edu

## Abstract

This document provides a basic template for the 2-page labs we will complete each week. Here, you should provide a succinct summary about what you did and why it might be helpful.

**Keywords:** What topics does the lab cover with respect to class?

## 1 Introduction

For this lab, you will

1. Install R and RStudio
2. Install tinytex (if necessary):  
`install.packages("tinytex")`
3. Create a GitHub account [here](#), and email me your username.
4. Install [GitHub desktop](#).
5. Accept the LAB 1 assignment [here](#).
6. Recreate this document (except put your name/info at the top) to get used to writing in L<sup>A</sup>T<sub>E</sub>X and to see the types of things we can do when creating a document to convey statistical information. Make sure to commit and push your work using GitHub desktop as you finish each section.

**Remark:** You will find the class Sweave cheatsheet to be *incredibly* (`\emph{incredibly}`) helpful.

## 2 Word Processing Tasks

### 2.1 Centering Text

We can center text in Sweave.

### 2.2 Bold, Italics, and Underlining

We can **bold**, *italicize*, underline, and *emphasize* text in Sweave.

Note, I did a column break here so that the list wasn't broken across columns.

### 2.3 Lists, and Numbered Lists

We can write an unordered list in Sweave.

- first item
- second item
- third item

We can write a numbered list in Sweave.

1. first item
2. second item
3. third item

We can write a lettered list in Sweave.

- a. first item
- b. second item
- c. third item

### 2.4 Submissions

This part of the midterm is due Sunday November 14 by 5p. I will not accept late submissions. Note that you may use this template to help build your introduction and methods sections, and you can use the work you did as a group during the datathon. Still, I expect this submission to be your own summary and extension of that work without collaboration.

### 2.5 Typing Mathematical Equations

We can write a one line equation that is centered like this

$$\hat{y}_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{2i} + \epsilon_i.$$

This can be written in the text as,  $\hat{y}_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{2i} + \epsilon_i$ , using as well.

When we need to show multiple steps, we can create a multi-line equation that is centered like this:

$$\begin{aligned} 8(x-5) + x &= 9(x-5) + 5 \\ 8x - 40 + x &= 9x - 45 + 5 && \text{(Distributing)} \\ 9x - 40 &= 9x - 40 && \text{(Combining like terms)} \\ 9x &= 9x && \text{(Adding 40 to both sides)} \\ x &= x && \text{(Dividing both sides by 9)} \end{aligned}$$

The equality holds for any x.

Note, I did a page break here so that the next section started on a clean page.

## 2.6 Runing R Code

Code chunks can be entered into Sweave; e.g., here are some comments.

```
# R code goes here
# Output is automatically printed in the pdf
```

Below, you can see that we can do algebra with R.

```
8*(9-5) + 9 # 8(x-5) + x for x=9
## [1] 41
```

Below, we show we can produced the code without evaluating it.

```
8*(9-5) + 9 # 8(x-5) + x for x=9
```

Alternatively, we can produced the output without the code.

```
## [1] 41
```

We can also call object values from R directly.

```
result <- 8*(9-5) + 9 # 8(x-5) + x for x=9
result.with.error <- result + rnorm(1, mean = 0, sd = 0.1)
result.with.error
## [1] 41.15654
```

The result is 41.1565402. Note that I did not type the result, but I used the `\Sexpr{}` command.

## 2.7 Plotting

We can also plot with R.

```
# Plot a histogram of random exponential data
hist(rexp(100))
```

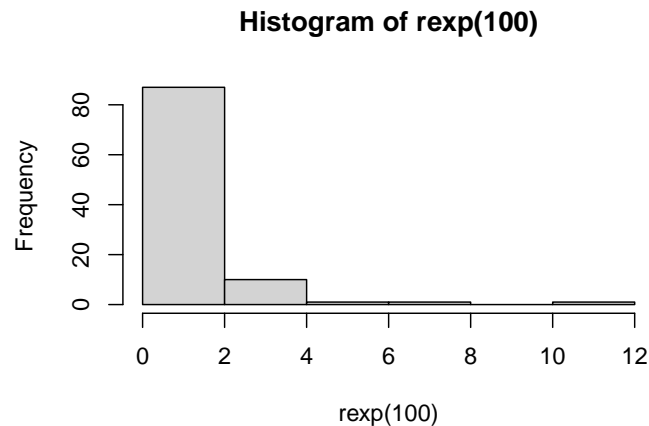


Figure 1: A histogram of random normally distributed data,  $n = 100$ .

## 2.8 Tables

Below, we load and take a peek at some data about the death rates per 1000 in Virginia in 1940 (Molyneaux et al., 1947).

```
data(VADeaths)
head(VADeaths) # Take a peek of the data
```

	Rural Male	Rural Female	Urban Male	Urban Female
## 50-54	11.7	8.7	15.4	8.4
## 55-59	18.1	11.7	24.3	13.6
## 60-64	26.9	20.3	37.0	19.3
## 65-69	41.0	30.9	54.6	35.1
## 70-74	66.0	54.3	71.1	50.0

If we want to print this nicely, we can do so using the `xtable` package (Dahl et al., 2019), which we can reference using the label (Table 1).

```
library(xtable)
sleep.table<-xtable(VADeaths ,
                    label = "VADeaths.tab",
                    caption = "Death Rates per 1000 in Virginia (1940).")
```

Rural Male	Rural Female	Urban Male	Urban Female
11.70	8.70	15.40	8.40
18.10	11.70	24.30	13.60
26.90	20.30	37.00	19.30
41.00	30.90	54.60	35.10
66.00	54.30	71.10	50.00

Table 1: Death Rates per 1000 in Virginia (1940).

## 3 Discussion

You should objectively evaluate the evidence you found in the data. Do not embellish or wish-terpet (my made-up phrase for making an interpretation you, or the researcher, wants to be true without the data *actually* supporting it). Connect your findings to the existing information you provided in the Introduction.

Finally, provide some concluding remarks that tie together the entire paper. Think of the last part of the results as abstract-like. Tell the reader what they just consumed – what’s the takeaway message?

**Bibliography:** Note that when you add citations to your `bib.bib` file *and* you cite them in your document, the bibliography section will automatically populate here.

## 4 Appendix

If you have anything extra, you can add it here in the appendix. This can include images or tables that don't work well in the two-page setup, code snippets you might want to share, etc.