Lab 1 – MATH 240 – Computational Statistics

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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 Instructions

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 LaTeX 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}`) helfpul.

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 clumn 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

$$\widehat{y_i} = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_1 i x_2 i + \epsilon_i.$$

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

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

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

This equality holds for any x.

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

2.6 Running R Code

Code chunks can be entered into Sweave; eg., 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] 41.0479
```

The result is 41.0479005. 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))
```

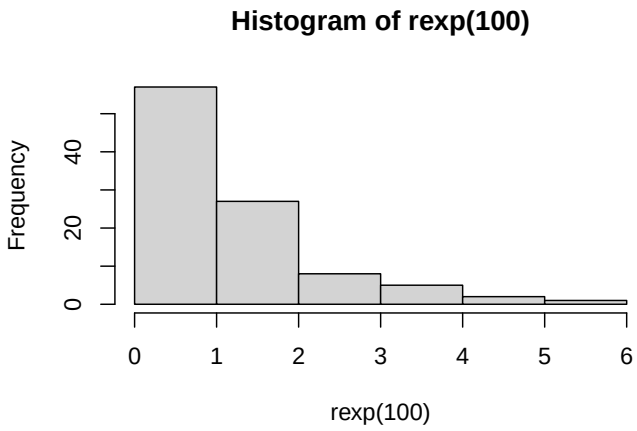

Figure 1: A histogram of random expotentially distributed data, $n = 100$

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 peak 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 1.

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

References

Dahl, D. B., Scott, D., Roosen, C., Magnusson, A., and Swinton, J. (2019). *xtable: Export Tables to LaTeX or HTML*. R package version 1.8-4.

Horst, A. M., Hill, A. P., and Gorman, K. B. (2020). *palmerpenguins: Palmer Archipelago (Antarctica) penguin data*. R package version 0.1.0.

Molyneaux, L., Gilliam, S. K., and Florant, L. C. (1947). Differences in virginia death rates by color, sex, age and rural or urban residence. *American Sociological Review*, 12(5):525–535.

3 Appendix

Below is a table from a paper I'm currently working on. Without the analysis object in `R`, I have to create this table myself.

The `palmerpenguins` package for `R` (Horst et al., 2020) provides data on adult foraging penguins near Palmer Station, Antarctica. **??** is too big to fit nicely in our column-based-template above, so I've placed it here in the abstract by saving it and presenting it scaled to 0.75.

```
pdf("figure/penguins.pdf", width = 8, height = 5)
plot(penguins)
dev.off()

## pdf
##   2
```

	species	island	bill_length_mm	bill_depth_mm	flipper_length_mm	body_mass_g	sex	year
1	Adelie	Torgersen	39.10	18.70	181	3750	male	2007
2	Adelie	Torgersen	39.50	17.40	186	3800	female	2007
3	Adelie	Torgersen	40.30	18.00	195	3250	female	2007
4	Adelie	Torgersen						2007
5	Adelie	Torgersen	36.70	19.30	193	3450	female	2007
6	Adelie	Torgersen	39.30	20.60	190	3650	male	2007
7	Adelie	Torgersen	38.90	17.80	181	3625	female	2007
8	Adelie	Torgersen	39.20	19.60	195	4675	male	2007
9	Adelie	Torgersen	34.10	18.10	193	3475		2007
10	Adelie	Torgersen	42.00	20.20	190	4250		2007
11	Adelie	Torgersen	37.80	17.10	186	3300		2007
12	Adelie	Torgersen	37.80	17.30	180	3700		2007
13	Adelie	Torgersen	41.10	17.60	182	3200	female	2007
14	Adelie	Torgersen	38.60	21.20	191	3800	male	2007
15	Adelie	Torgersen	34.60	21.10	198	4400	male	2007
16	Adelie	Torgersen	36.60	17.80	185	3700	female	2007
17	Adelie	Torgersen	38.70	19.00	195	3450	female	2007
18	Adelie	Torgersen	42.50	20.70	197	4500	male	2007
19	Adelie	Torgersen	34.40	18.40	184	3325	female	2007
20	Adelie	Torgersen	46.00	21.50	194	4200	male	2007
21	Adelie	Biscoe	37.80	18.30	174	3400	female	2007
22	Adelie	Biscoe	37.70	18.70	180	3600	male	2007
23	Adelie	Biscoe	35.90	19.20	189	3800	female	2007
24	Adelie	Biscoe	38.20	18.10	185	3950	male	2007
25	Adelie	Biscoe	38.80	17.20	180	3800	male	2007
26	Adelie	Biscoe	35.30	18.90	187	3800	female	2007
27	Adelie	Biscoe	40.60	18.60	183	3550	male	2007
28	Adelie	Biscoe	40.50	17.90	187	3200	female	2007
29	Adelie	Biscoe	37.90	18.60	172	3150	female	2007
30	Adelie	Biscoe	40.50	18.90	180	3950	male	2007
31	Adelie	Dream	39.50	16.70	178	3250	female	2007
32	Adelie	Dream	37.20	18.10	178	3900	male	2007
33	Adelie	Dream	39.50	17.80	188	3300	female	2007
34	Adelie	Dream	40.90	18.90	184	3900	male	2007
35	Adelie	Dream	36.40	17.00	195	3325	female	2007
36	Adelie	Dream	39.20	21.10	196	4150	male	2007
37	Adelie	Dream	38.80	20.00	190	3950	male	2007
38	Adelie	Dream	42.20	18.50	180	3550	female	2007
39	Adelie	Dream	37.60	19.30	181	3300	female	2007
40	Adelie	Dream	39.80	19.10	184	4650	male	2007
41	Adelie	Dream	36.50	18.00	182	3150	female	2007
42	Adelie	Dream	40.80	18.40	195	3900	male	2007
43	Adelie	Dream	36.00	18.50	186	3100	female	2007
44	Adelie	Dream	44.10	19.70	196	4400	male	2007
45	Adelie	Dream	37.00	16.90	185	3000	female	2007
46	Adelie	Dream	39.60	18.80	190	4600	male	2007
47	Adelie	Dream	41.10	19.00	182	3425	male	2007
48	Adelie	Dream	37.50	18.90	179	2975		2007
49	Adelie	Dream	36.00	17.90	190	3450	female	2007
50	Adelie	Dream	42.30	21.20	191	4150	male	2007
51	Adelie	Biscoe	39.60	17.70	186	3500	female	2008
52	Adelie	Biscoe	40.10	18.90	188	4300	male	2008
53	Adelie	Biscoe	35.00	17.90	190	3450	female	2008
54	Adelie	Biscoe	42.00	19.50	200	4050	male	2008
55	Adelie	Biscoe	34.50	18.10	187	2900	female	2008
56	Adelie	Biscoe	41.40	18.60	191	3700	male	2008
57	Adelie	Biscoe	39.00	17.50	186	3550	female	2008
58	Adelie	Biscoe	40.60	18.80	193	3800	male	2008
59	Adelie	Biscoe	36.50	16.60	181	2850	female	2008
60	Adelie	Biscoe	37.60	19.10	194	3750	male	2008
61	Adelie	Biscoe	35.70	16.90	185	3150	female	2008
62	Adelie	Biscoe	41.30	21.10	195	4400	male	2008