RMarkdown basics

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This example will show you how to format some basic math and R code to get you started on the first homework. If you ever can't remember how to do something, click on the "Help" menu in RStudio and you'll find a "Markdown Quick Reference" and also an "R Markdown Cheat Sheet" under "Help -> Cheatsheets". If you're still stuck, email a question to `teach-cs3130@list.eng.utah.edu` or post on the Canvas discussion board.

Math Notation

First, let's do some math! Math notation in R Markdown is denoted by placing it between two dollar signs (`$`). This can happen in the middle of a sentence. For example: The probability of an event A is denoted $P(A)$. It can also be used on a line all by itself. For example, the set difference between two sets A and B is written:

$$A - B$$

Here when we want math on its own line (and centered), we use double dollar signs (`$$`). Note how this looks different from "regular" text:

A - B

If you are writing math, always use the dollar signs to format it nicely! Don't use "regular" text for math notation.

Next, there are lots of math symbols that we can use. These are always indicated by a backslash (\). For example, Greek letters are easy: α, β, π, ϕ. Here are some notations that will be useful for Homework 1:

- Sets: A, B, C, etc.
- Sample space: Ω
- Set operations:

  $A \cup B$

  $A \cap B$

  $A - B$

  A^c

Final math formatting trick, there are often problems where you need to show multiple steps to get to your answer. You can do this inside `\begin{align} ... \end{align}`. Let's solve an example problem:

Problem: Two difference between two events A and B has probability $P(A - B) = 0.1$. What is the probability $P(A^c \cup B)$?

Answer:

What follows is LaTeX code.

$$
\begin{aligned}
P(A^c \cup B) &= P((A \cap B^c)^c) && \text{DeMorgan's Law} && (1)\\
&= P((A - B)^c) && \text{Definition of set difference} && (2)\\
&= 1 - P(A - B) && \text{Complement rule for probability} && (3)\\
&= 1 - 0.1 && \text{Given in the problem} && (4)\\
&= 0.9 && \text{Answer!} && (5)\\
& && && (6)
\end{aligned}
$$

In this `align` environment, we use ampersands (`&`) to denote points we want to align (they are kind of like tab stops). Each line should have the same number of `&`. A line must end in a double backslash (`\\`). Finally, the right-hand side should contain an explanation of what you are doing in this step. We need the `\text{...}` command because we are inside math mode and don't want these letters formatted as math symbols. Feel free to cut-and-paste this example to get you started on a problem (just replace my math and text with what you need to answer the problem).

R Code

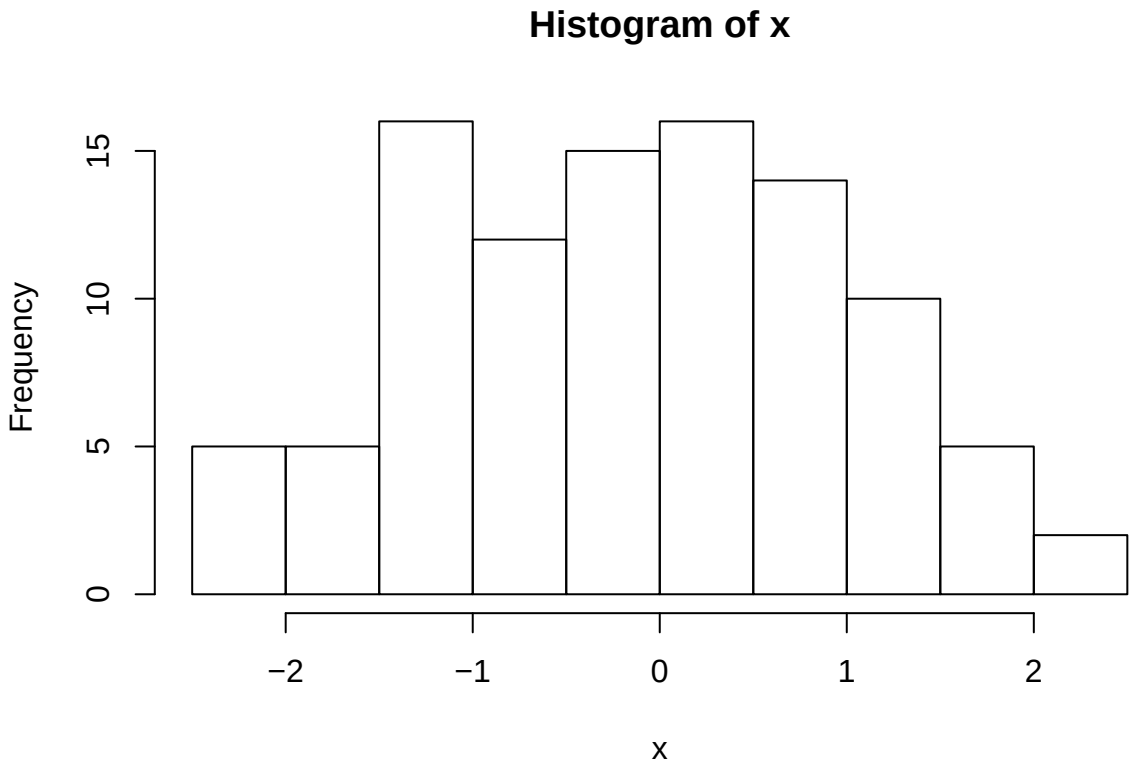
R code can be inserted into your document with what is called a "chunk". There is a button in RStudio on the top-right of the editor window that is a quick way to insert a new chunk, or run the code in one or more chunks. This is what an R code chunk looks like:

```
1 + 1
```

```
[1] 2
```

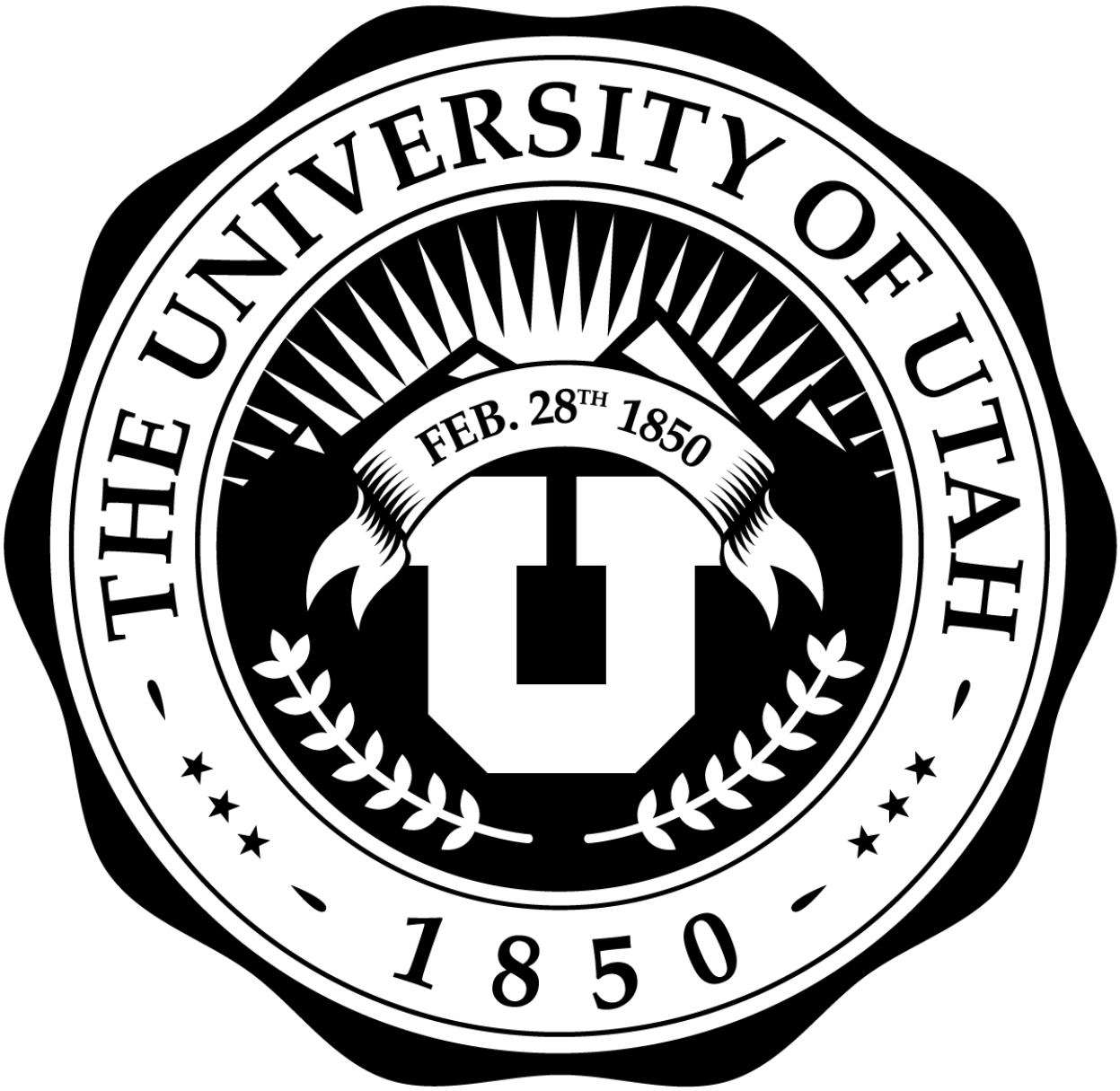
Notice when you knit your document, the R code you wrote is executed, and both the original code and the result are printed in the document. If the result of an R command is to make a plot, then that shows up as a figure in the document. Here is a simple plot example:

```
x = rnorm(100)
hist(x)
```



Inserting Figures

If you need to draw a diagram to answer a question, you can do that in your favorite drawing software program and then insert it in your R markdown. Always save the image in the same directory as your .Rmd file. (In other words, don't include a file path that is specific to your machine!) Now you can include that image in your document as follows:



Note, inside the square braces, you can put an optional caption, like so:

Figure 1: Go Utah!