Problem set 1 sample solutions

2024-09-11

After finishing the homework, you are to turn in all the code to GitHub using git.

1. Start an RStudio project. Pick a good name following a naming convention. Start a Quarto document called `beginning.qmd`.
2. Create a directory called `img` and save a screen shot of your RStudio session for the project. Include your screenshot in the Quarto document.
3. Next, in your Quarto document, define variables $a = 1, b = -1, c = -2$ and print out the solutions to $f(x) = ax^2 + bx + c = 0$. Do not report complex solutions, only real numbers.

```
# Sample answer
a <- 1
b <- -1
c <- -2

d <- b^2 - 4*a*c

if (d >= 0) {
  x1 <- (-b + sqrt(d)) / (2*a)
  x2 <- (-b - sqrt(d)) / (2*a)
  print(paste("The real roots are ", x1, "and ", x2))
  } else {
    print("There are no real roots")
  }
```

```
[1] "The real roots are  2 and  -1"
```

4. Include a graph of $f(x)$ versus x for $x \in (-5, 5)$.

```
# Sample answer
x <- seq(-5, 5, length = 100)
# Hint: Use the plot function

f_x <- a*x^2 + b*x + c

plot(x, f_x, type = "l", col = "red", lwd = 2, xlab = "x", ylab = "f_x")
```

5. Create a directory called `docs`. Use the command `quarto render` to create a PDF and save it to the `docs` directory. Show us the command you typed:

```
# Sample answer
mkdir docs
quarto render beginning.qmd
mv beginning.pdf docs
```

6. Use Unix to create a directory called `data` in the project home directory. Include the Unix command you used to create the directory.

```
# Sample answer
mkdir data
```

7. Use a terminal-based text editor to create a file `coefs.txt` in the `data` directory and save three coefficients, `1 -1 -2` for example. Show us the Unix commands you used to achieve this:

```
# Sample answer
cd data
touch coefs.txt
vim coefs.txt
# enter in "1 -1 -2"
# :wq to write to file and quit Vim
```

8. Make a directory called `code`. Use Unix to copy the file `beginning.qmd` to a file called `quadratic.qmd` in the code directory. Show us the Unix commands you used.

```
# Sample answer
mkdir code
cp beginning.qmd code/quadratic.qmd
```

9. Edit the `quadratic.qmd` file to read in `a`, `b`, and `c` from the file `coefs.txt`. Make sure to use a relative path when reading the file. As before, print out the solutions to $f(x) = ax^2 + bx + c = 0$. Do not report complex solutions, only real numbers.

```r
# Sample answer
# coefs <- scan("../data/coefs.txt")
coefs <- scan("./pset-01-data/coefs.txt")

a <- coefs[1]
b <- coefs[2]
c <- coefs[3]

d <- b^2 - 4*a*c

if (d >= 0) {
  x1 <- (-b + sqrt(d)) / (2*a)
  x2 <- (-b - sqrt(d)) / (2*a)
  print(paste("The real roots are ", x1, "and ", x2))
} else {
  print("There are no real roots")
}
```

```
[1] "The real roots are  2 and  -1"
```

10. Change the path of the file you are reading to the full path you get when you type `file.path(getwd(), "data/coefs.txt")`. Confirm that the file still renders. Then move the entire `pset-01-rmarkdown` project to a directory called `RtmpyDknq4`. Does the file render? Change the path back to a relative path and see if it renders.

```r
# Sample answer
The file does render when first using the absolute path with
 ↪  `file.path(getwd(), "data/coefs.txt")`.
After moving the entire project to the `RtmpyDknq4` directory, the absolute
 ↪  path no longer works because the path itself is now invalid. After
 ↪  changing the path back to a relative path, the file renders again.
```