Discussion 1

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BIFX 553 Discussion 1: January 19, 2017

Pretest

1) What is a p-value?

2) Write a short R script to add all numbers from 1 to 100 using a for loop.

```
s <- 0
for(i in 1:100)
  s <- s + i
```

3) Repeat problem 2 using only one line of code (i.e. without using a for loop).

```
sum(1:100)
```

```
## [1] 5050
```

4) Given the data.frame, *dat*, with the variables {*x1*, *x2*, *x3*, *y*}, write the R command to create a linear model for *y* using *x1*, *x2* and *x3* as predictors.

```
lm(y ~ x1 + x2 + x3, data = dat)
```

5) Write an R command to plot the relationship between *x1* and *y*.

```
plot(x1, y, bty = 'l')
```

6) Given the relationship between *x1* and *y* in this figure, update the R command in question 4 with a more appropriate model.

```
dat$x1sqr <- dat$x1^2 lm(y ~ x1 + x1sqr + x2 + x3)
```

7) A collaborator presents a data analysis to you. The p-value they give you is p = 0.012. Is this statistically significant?

Yes

8) After discussing the results further, you discover that this p-value represents just one of 20 tests performed in the analysis. What is the Bonferroni threshold for significance if you want the family-wise error rate to be $\alpha = 0.05$? Is the result statistically significant?

```
(thresh <- 0.05 / 20)
```

```
## [1] 0.0025
```

No

9) What assumptions are made in a simple linear regression? What R command(s) can you use to get a quick look at whether those assumptions have been violated?

- Linear relationship
- Multivariate Normality
- No/little multicollinearity
- No autocorrelation
- Homoscedasticity

- General lm diagnostics
  - plot()
  - broom package
  - car package
  - gvlma package

10) Explain the relationship between confidence intervals and p-values. Why are confidence intervals more useful than p-values?

Discussion of R programming basics

- What data types does R have?
  - numeric
  - integer
  - double
  - character
  - factor
- What are the standard data structures in R? How are they indexed?
  - scalar
  - vector
  - matrix
  - array
  - lists
  - data.frames
  - (tibble)

Lecture notes are located in the course repository

- Examples of vector calculations

```
x <- 1:10
y <- rnorm(10)
x + y
```

```
##  [1] 1.714201 2.473387 3.287186 3.739490 4.599493 5.885009 7.878700
##  [8] 8.414016 9.447221 9.516530
```

```
mat <- cbind(x, y)
apply(mat, 1, sum)
```

```
##  [1] 1.714201 2.473387 3.287186 3.739490 4.599493 5.885009 7.878700
##  [8] 8.414016 9.447221 9.516530
```

```
lst <- list(rnorm(100),
            rnorm(100, 5),
            rnorm(100, 5, 10))
sapply(lst, mean)
```

```
## [1] 0.197392 4.993251 5.322037
```

```
lapply(lst, mean)
```

```
## [[1]]
## [1] 0.197392
##
## [[2]]
```

```
## [1] 4.993251
##
## [[3]]
## [1] 5.322037
```

```
ifelse(y > 0, 1, -1)
```

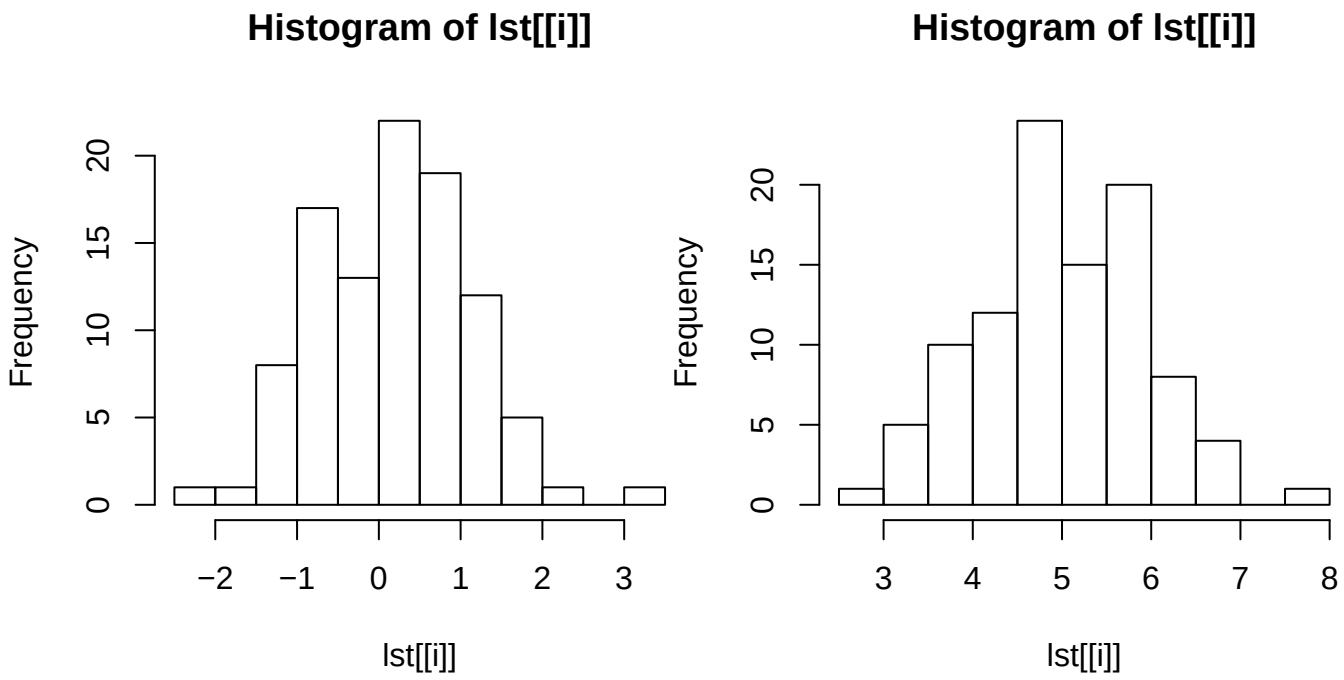
```
##  [1]  1  1  1 -1 -1 -1  1  1  1 -1
```

- Examples of control structures

```
test <- TRUE
if(test)
{
  print("This is executed when test is true.")
}else{
  print("This is executed when test is false.")
}
```

```
## [1] "This is executed when test is true."
```

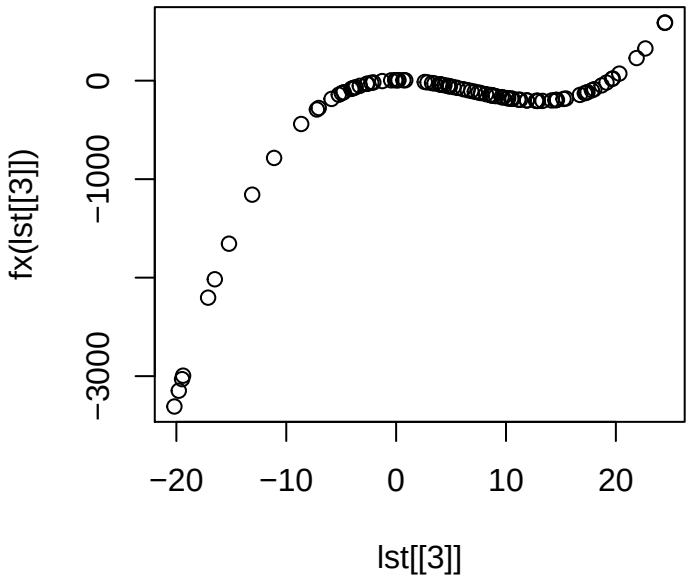
```
for(i in 1:2)
{
  hist(lst[[i]])
}
```



- There are other control structures, but you shouldn't need them very often (if ever).
- Functions

```
fx <- function(x)
{
  # do something here and return a value
  return(5 + 2*x - 4*x^2 + x^3/5)
}
```

```
plot(lst[[3]], fx(lst[[3]]))
```



Questions?