Problem Set 3

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For this assignment, you will be measuring your participants’ happiness level. It is on a scale from 1-10. Give me the following information. In addition to that, you’ll fit a “model” with your own prediction of what would happen at your own choosing of happiness. For example, if you are interested in how the model fits with 10 on the happiness scale, you would include 10 to calculate the sum of squares/sum of squared errors. **If working with R/RStudio, make sure to copy everything below from the word data to the word data.**

data <- data.frame(happiness = c(10, 9, 9, 7, 5,  
 2, 3, 1, 6, 7),  
 mean = c('', '', '', '', '',  
 '', '', '', '', ''),  
 deviance = c('', '', '', '', '',  
 '', '', '', '', ''),  
 dev\_squared = c('', '', '', '', '',  
 '', '', '', '', ''),  
 first\_predict = c(3, 3, 3, 3, 3,  
 3, 3, 3, 3, 3),  
 predict\_dev\_squared = c('', '', '', '', '',  
 '', '', '', '', ''))  
  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared  
## 1 10 3   
## 2 9 3   
## 3 9 3   
## 4 7 3   
## 5 5 3   
## 6 2 3   
## 7 3 3   
## 8 1 3   
## 9 6 3   
## 10 7 3

1. What is the number of participants?

Answer: **10 participants**

data$n <- 10  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 3 10  
## 2 9 3 10  
## 3 9 3 10  
## 4 7 3 10  
## 5 5 3 10  
## 6 2 3 10  
## 7 3 3 10  
## 8 1 3 10  
## 9 6 3 10  
## 10 7 3 10

1. What is the mean happiness score?

Answer: The average happiness score is **5.9** on the scale of 1-10.

data$happy\_sum <- (10+9+9+7+5+2+3+1+6+7)  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 3 10  
## 2 9 3 10  
## 3 9 3 10  
## 4 7 3 10  
## 5 5 3 10  
## 6 2 3 10  
## 7 3 3 10  
## 8 1 3 10  
## 9 6 3 10  
## 10 7 3 10  
## happy\_sum  
## 1 59  
## 2 59  
## 3 59  
## 4 59  
## 5 59  
## 6 59  
## 7 59  
## 8 59  
## 9 59  
## 10 59

data$mean\_value <- 59/10  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 3 10  
## 2 9 3 10  
## 3 9 3 10  
## 4 7 3 10  
## 5 5 3 10  
## 6 2 3 10  
## 7 3 3 10  
## 8 1 3 10  
## 9 6 3 10  
## 10 7 3 10  
## happy\_sum mean\_value  
## 1 59 5.9  
## 2 59 5.9  
## 3 59 5.9  
## 4 59 5.9  
## 5 59 5.9  
## 6 59 5.9  
## 7 59 5.9  
## 8 59 5.9  
## 9 59 5.9  
## 10 59 5.9

1. What is the deviance between participants’ scores and the mean happiness score?

Answer: Below are the deviance scores for each participant.

10-5.9

## [1] 4.1

9-5.9

## [1] 3.1

9-5.9

## [1] 3.1

7-5.9

## [1] 1.1

5-5.9

## [1] -0.9

2-5.9

## [1] -3.9

3-5.9

## [1] -2.9

1-5.9

## [1] -4.9

6-5.9

## [1] 0.1

7-5.9

## [1] 1.1

data$deviance <- data$happiness - data$mean\_value  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 3 10  
## 2 9 3.1 3 10  
## 3 9 3.1 3 10  
## 4 7 1.1 3 10  
## 5 5 -0.9 3 10  
## 6 2 -3.9 3 10  
## 7 3 -2.9 3 10  
## 8 1 -4.9 3 10  
## 9 6 0.1 3 10  
## 10 7 1.1 3 10  
## happy\_sum mean\_value  
## 1 59 5.9  
## 2 59 5.9  
## 3 59 5.9  
## 4 59 5.9  
## 5 59 5.9  
## 6 59 5.9  
## 7 59 5.9  
## 8 59 5.9  
## 9 59 5.9  
## 10 59 5.9

1. Calculate the sum of errors/total deviation.

Answer: **~0 (or -3.55e-15)**

4.1+3.1+3.1+1.1+(-.9)+(-3.9)+(-2.9)+(-4.9)+.1+1.1

## [1] -0.000000000000002220446

data$dev\_sum <- sum(data$deviance)  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 3 10  
## 2 9 3.1 3 10  
## 3 9 3.1 3 10  
## 4 7 1.1 3 10  
## 5 5 -0.9 3 10  
## 6 2 -3.9 3 10  
## 7 3 -2.9 3 10  
## 8 1 -4.9 3 10  
## 9 6 0.1 3 10  
## 10 7 1.1 3 10  
## happy\_sum mean\_value dev\_sum  
## 1 59 5.9 -0.000000000000003552714  
## 2 59 5.9 -0.000000000000003552714  
## 3 59 5.9 -0.000000000000003552714  
## 4 59 5.9 -0.000000000000003552714  
## 5 59 5.9 -0.000000000000003552714  
## 6 59 5.9 -0.000000000000003552714  
## 7 59 5.9 -0.000000000000003552714  
## 8 59 5.9 -0.000000000000003552714  
## 9 59 5.9 -0.000000000000003552714  
## 10 59 5.9 -0.000000000000003552714

1. Calculate the deviance squared for each participant.

Answer: Below are the squared values for each participant.

(10-5.9)^2

## [1] 16.81

(9-5.9)^2

## [1] 9.61

(9-5.9)^2

## [1] 9.61

(7-5.9)^2

## [1] 1.21

(5-5.9)^2

## [1] 0.81

(2-5.9)^2

## [1] 15.21

(3-5.9)^2

## [1] 8.41

(1-5.9)^2

## [1] 24.01

(6-5.9)^2

## [1] 0.01

(7-5.9)^2

## [1] 1.21

data$dev\_squared <- data$deviance^2  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 10  
## 2 9 3.1 9.61 3 10  
## 3 9 3.1 9.61 3 10  
## 4 7 1.1 1.21 3 10  
## 5 5 -0.9 0.81 3 10  
## 6 2 -3.9 15.21 3 10  
## 7 3 -2.9 8.41 3 10  
## 8 1 -4.9 24.01 3 10  
## 9 6 0.1 0.01 3 10  
## 10 7 1.1 1.21 3 10  
## happy\_sum mean\_value dev\_sum  
## 1 59 5.9 -0.000000000000003552714  
## 2 59 5.9 -0.000000000000003552714  
## 3 59 5.9 -0.000000000000003552714  
## 4 59 5.9 -0.000000000000003552714  
## 5 59 5.9 -0.000000000000003552714  
## 6 59 5.9 -0.000000000000003552714  
## 7 59 5.9 -0.000000000000003552714  
## 8 59 5.9 -0.000000000000003552714  
## 9 59 5.9 -0.000000000000003552714  
## 10 59 5.9 -0.000000000000003552714

1. Calculate the sum of squared errors/sum of squares.

Answer: The sum of squares is **86.9**.

(10-5.9)^2 + (9-5.9)^2+ (9-5.9)^2 + (7-5.9)^2 + (5-5.9)^2 + (2-5.9)^2 + (3-5.9)^2 + (1-5.9)^2 + (6-5.9)^2 + (7-5.9)^2

## [1] 86.9

data$ss <- sum(data$dev\_squared)  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 10  
## 2 9 3.1 9.61 3 10  
## 3 9 3.1 9.61 3 10  
## 4 7 1.1 1.21 3 10  
## 5 5 -0.9 0.81 3 10  
## 6 2 -3.9 15.21 3 10  
## 7 3 -2.9 8.41 3 10  
## 8 1 -4.9 24.01 3 10  
## 9 6 0.1 0.01 3 10  
## 10 7 1.1 1.21 3 10  
## happy\_sum mean\_value dev\_sum ss  
## 1 59 5.9 -0.000000000000003552714 86.9  
## 2 59 5.9 -0.000000000000003552714 86.9  
## 3 59 5.9 -0.000000000000003552714 86.9  
## 4 59 5.9 -0.000000000000003552714 86.9  
## 5 59 5.9 -0.000000000000003552714 86.9  
## 6 59 5.9 -0.000000000000003552714 86.9  
## 7 59 5.9 -0.000000000000003552714 86.9  
## 8 59 5.9 -0.000000000000003552714 86.9  
## 9 59 5.9 -0.000000000000003552714 86.9  
## 10 59 5.9 -0.000000000000003552714 86.9

1. Calculate the degrees of freedom.

Answer: Degrees of freedom is **9**.

10-1

## [1] 9

data$df <- 10 - 1  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 10  
## 2 9 3.1 9.61 3 10  
## 3 9 3.1 9.61 3 10  
## 4 7 1.1 1.21 3 10  
## 5 5 -0.9 0.81 3 10  
## 6 2 -3.9 15.21 3 10  
## 7 3 -2.9 8.41 3 10  
## 8 1 -4.9 24.01 3 10  
## 9 6 0.1 0.01 3 10  
## 10 7 1.1 1.21 3 10  
## happy\_sum mean\_value dev\_sum ss df  
## 1 59 5.9 -0.000000000000003552714 86.9 9  
## 2 59 5.9 -0.000000000000003552714 86.9 9  
## 3 59 5.9 -0.000000000000003552714 86.9 9  
## 4 59 5.9 -0.000000000000003552714 86.9 9  
## 5 59 5.9 -0.000000000000003552714 86.9 9  
## 6 59 5.9 -0.000000000000003552714 86.9 9  
## 7 59 5.9 -0.000000000000003552714 86.9 9  
## 8 59 5.9 -0.000000000000003552714 86.9 9  
## 9 59 5.9 -0.000000000000003552714 86.9 9  
## 10 59 5.9 -0.000000000000003552714 86.9 9

1. Calculate the variance/mean squared error for your model.

Answer: Variance is **9.66**.

86.9/9

## [1] 9.655556

sd(data$happiness)^2

## [1] 9.655556

data$var <- data$ss/data$df  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 10  
## 2 9 3.1 9.61 3 10  
## 3 9 3.1 9.61 3 10  
## 4 7 1.1 1.21 3 10  
## 5 5 -0.9 0.81 3 10  
## 6 2 -3.9 15.21 3 10  
## 7 3 -2.9 8.41 3 10  
## 8 1 -4.9 24.01 3 10  
## 9 6 0.1 0.01 3 10  
## 10 7 1.1 1.21 3 10  
## happy\_sum mean\_value dev\_sum ss df var  
## 1 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 2 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 3 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 4 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 5 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 6 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 7 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 8 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 9 59 5.9 -0.000000000000003552714 86.9 9 9.655556  
## 10 59 5.9 -0.000000000000003552714 86.9 9 9.655556

1. Calculate the standard deviation for your sample.

Answer: Standard deviation is **3.11**.

sqrt(9.66)

## [1] 3.108054

data$sd\_value <- sqrt(data$var)  
sd(data$happiness)

## [1] 3.107339

data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 10  
## 2 9 3.1 9.61 3 10  
## 3 9 3.1 9.61 3 10  
## 4 7 1.1 1.21 3 10  
## 5 5 -0.9 0.81 3 10  
## 6 2 -3.9 15.21 3 10  
## 7 3 -2.9 8.41 3 10  
## 8 1 -4.9 24.01 3 10  
## 9 6 0.1 0.01 3 10  
## 10 7 1.1 1.21 3 10  
## happy\_sum mean\_value dev\_sum ss df var sd\_value  
## 1 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 2 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 3 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 4 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 5 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 6 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 7 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 8 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 9 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 10 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339

1. Make your prediction. You can include deviance, sum of errors, deviance squared values, and sum of squared errors calculations.

Answer: With a prediction of 3 on the happiness scale (not very happy), I’m going to test for the sum of squared errors/sum of squares. The sum of squares is **171**. So randomly choosing a happiness of 3 fit a worse fitting model than using the mean.

10-3

## [1] 7

9-3

## [1] 6

9-3

## [1] 6

7-3

## [1] 4

5-3

## [1] 2

2-3

## [1] -1

3-3

## [1] 0

1-3

## [1] -2

6-3

## [1] 3

7-3

## [1] 4

data$pred\_dev <- data$happiness - data$first\_predict  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 10  
## 2 9 3.1 9.61 3 10  
## 3 9 3.1 9.61 3 10  
## 4 7 1.1 1.21 3 10  
## 5 5 -0.9 0.81 3 10  
## 6 2 -3.9 15.21 3 10  
## 7 3 -2.9 8.41 3 10  
## 8 1 -4.9 24.01 3 10  
## 9 6 0.1 0.01 3 10  
## 10 7 1.1 1.21 3 10  
## happy\_sum mean\_value dev\_sum ss df var sd\_value  
## 1 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 2 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 3 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 4 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 5 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 6 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 7 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 8 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 9 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 10 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## pred\_dev  
## 1 7  
## 2 6  
## 3 6  
## 4 4  
## 5 2  
## 6 -1  
## 7 0  
## 8 -2  
## 9 3  
## 10 4

(10-3)^2

## [1] 49

(9-3)^2

## [1] 36

(9-3)^2

## [1] 36

(7-3)^2

## [1] 16

(5-3)^2

## [1] 4

(2-3)^2

## [1] 1

(3-3)^2

## [1] 0

(1-3)^2

## [1] 4

(6-3)^2

## [1] 9

(7-3)^2

## [1] 16

data$predict\_dev\_squared <- data$pred\_dev^2  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 49 10  
## 2 9 3.1 9.61 3 36 10  
## 3 9 3.1 9.61 3 36 10  
## 4 7 1.1 1.21 3 16 10  
## 5 5 -0.9 0.81 3 4 10  
## 6 2 -3.9 15.21 3 1 10  
## 7 3 -2.9 8.41 3 0 10  
## 8 1 -4.9 24.01 3 4 10  
## 9 6 0.1 0.01 3 9 10  
## 10 7 1.1 1.21 3 16 10  
## happy\_sum mean\_value dev\_sum ss df var sd\_value  
## 1 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 2 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 3 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 4 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 5 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 6 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 7 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 8 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 9 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 10 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## pred\_dev  
## 1 7  
## 2 6  
## 3 6  
## 4 4  
## 5 2  
## 6 -1  
## 7 0  
## 8 -2  
## 9 3  
## 10 4

(10-3)^2 + (9-3)^2 + (9-3)^2 + (7-3)^2 + (5-3)^2 + (2-3)^2 + (3-3)^2 + (1-3)^2 + (6-3)^2 + (7-3)^2

## [1] 171

data$ss\_pred <- sum(data$predict\_dev\_squared)  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 49 10  
## 2 9 3.1 9.61 3 36 10  
## 3 9 3.1 9.61 3 36 10  
## 4 7 1.1 1.21 3 16 10  
## 5 5 -0.9 0.81 3 4 10  
## 6 2 -3.9 15.21 3 1 10  
## 7 3 -2.9 8.41 3 0 10  
## 8 1 -4.9 24.01 3 4 10  
## 9 6 0.1 0.01 3 9 10  
## 10 7 1.1 1.21 3 16 10  
## happy\_sum mean\_value dev\_sum ss df var sd\_value  
## 1 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 2 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 3 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 4 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 5 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 6 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 7 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 8 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 9 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 10 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## pred\_dev ss\_pred  
## 1 7 171  
## 2 6 171  
## 3 6 171  
## 4 4 171  
## 5 2 171  
## 6 -1 171  
## 7 0 171  
## 8 -2 171  
## 9 3 171  
## 10 4 171

1. Calculate the standard error from your calculations using the mean.

Answer: The standard error is **0.98**.

3.11/sqrt(10)

## [1] 0.9834684

data$se <- data$sd\_value/(sqrt(data$n))  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 49 10  
## 2 9 3.1 9.61 3 36 10  
## 3 9 3.1 9.61 3 36 10  
## 4 7 1.1 1.21 3 16 10  
## 5 5 -0.9 0.81 3 4 10  
## 6 2 -3.9 15.21 3 1 10  
## 7 3 -2.9 8.41 3 0 10  
## 8 1 -4.9 24.01 3 4 10  
## 9 6 0.1 0.01 3 9 10  
## 10 7 1.1 1.21 3 16 10  
## happy\_sum mean\_value dev\_sum ss df var sd\_value  
## 1 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 2 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 3 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 4 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 5 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 6 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 7 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 8 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 9 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 10 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## pred\_dev ss\_pred se  
## 1 7 171 0.9826269  
## 2 6 171 0.9826269  
## 3 6 171 0.9826269  
## 4 4 171 0.9826269  
## 5 2 171 0.9826269  
## 6 -1 171 0.9826269  
## 7 0 171 0.9826269  
## 8 -2 171 0.9826269  
## 9 3 171 0.9826269  
## 10 4 171 0.9826269

1. Calculate confidence intervals using a 95% z-score distribution.

Answer: The lower confidence interval was **3.97** and the upper confidence interval is **7.83**.

5.9 - (1.96\*.98)

## [1] 3.9792

5.9 + (1.96\*.98)

## [1] 7.8208

data$lower\_ci <- data$mean\_value - (1.96\*data$se)  
data$upper\_ci <- data$mean\_value + (1.96\*data$se)  
  
data

## happiness mean deviance dev\_squared first\_predict predict\_dev\_squared n  
## 1 10 4.1 16.81 3 49 10  
## 2 9 3.1 9.61 3 36 10  
## 3 9 3.1 9.61 3 36 10  
## 4 7 1.1 1.21 3 16 10  
## 5 5 -0.9 0.81 3 4 10  
## 6 2 -3.9 15.21 3 1 10  
## 7 3 -2.9 8.41 3 0 10  
## 8 1 -4.9 24.01 3 4 10  
## 9 6 0.1 0.01 3 9 10  
## 10 7 1.1 1.21 3 16 10  
## happy\_sum mean\_value dev\_sum ss df var sd\_value  
## 1 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 2 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 3 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 4 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 5 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 6 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 7 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 8 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 9 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## 10 59 5.9 -0.000000000000003552714 86.9 9 9.655556 3.107339  
## pred\_dev ss\_pred se lower\_ci upper\_ci  
## 1 7 171 0.9826269 3.974051 7.825949  
## 2 6 171 0.9826269 3.974051 7.825949  
## 3 6 171 0.9826269 3.974051 7.825949  
## 4 4 171 0.9826269 3.974051 7.825949  
## 5 2 171 0.9826269 3.974051 7.825949  
## 6 -1 171 0.9826269 3.974051 7.825949  
## 7 0 171 0.9826269 3.974051 7.825949  
## 8 -2 171 0.9826269 3.974051 7.825949  
## 9 3 171 0.9826269 3.974051 7.825949  
## 10 4 171 0.9826269 3.974051 7.825949

1. What does the 95% confidence intervals tell us about the average happiness value we calculated?

Answer: The average happiness value for our sample was 5.9. I am 95% confident that the population average happiness value is between 3.97 and 7.83.