Partial answer key to homework for Chapter 5 – Part II

5.36 extension

The level of significance is chosen to be α = 0.05.

Confidence interval method:

1.

Ho:μ≤80   
Ha:μ>80

2.

The “one-sided” C.I. for μ is (77.843, ∞)

> t.test(x = ex5.36[,2], alternative = "greater", mu = 80, conf.level = 0.95)

One Sample t-test

data: ex5.36[,2]

t = 0.8427, df = 19, p-value = 0.2049

alternative hypothesis: true mean is greater than 80

95 percent confidence interval:

77.84345 Inf

sample estimates:

mean of x

82.05

3. Since 80 is inside this interval, do not reject Ho.

4. There is not sufficient evidence that the mean comprehension for all fourth graders is greater than 80.

Test statistic method:

1.

Ho:μ≤80   
Ha:μ>80

2.

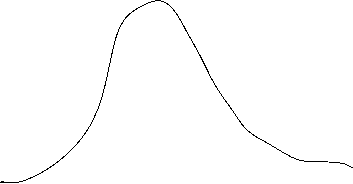
t=0.843 (using the same R code as above)

3.

t0.05, 19 = 1.729

> qt(p = 0.95, df = 20-1)

[1] 1.729133



4. Since 0.843 < 1.729, do not reject Ho.

5. There is not sufficient evidence that the mean comprehension for all fourth graders is greater than 80.

P-value method:

1.

Ho:μ≤80   
Ha:μ>80

2.

t=0.843.

The p-value is 0.2049.

(using the same R code as above)

3.

α = 0.05

4. Since 0.2049 > 0.05, do not reject Ho.

5. There is not sufficient evidence that the mean comprehension for all fourth graders is greater than 80.

5.41

a.

The 95% confidence interval on the mean dissolved oxygen level is (4.57, 5.33).

> ex5.41<-read.table("C:/sdata/ex5-41.txt", header=T, row.names=1, sep=",")

> nrow(ex5.41)

[1] 8

> t.test(x = ex5.41, conf.level = 0.95)

One Sample t-test

data: ex5.41

t = 31.0853, df = 7, p-value = 9.207e-09

alternative hypothesis: true mean is not equal to 0

95 percent confidence interval:

4.573459 5.326541

sample estimates:

mean of x

4.95

b.

No, since the interval contains 5, we don’t enough evidence to say that.

c.

The level of significance is chosen to be α = 0.05.

Confidence interval method:

1.

Ho:μ≥5  
Ha:μ<5

2.

The “one-sided” C.I. for μ is (-∞, 5.252)

> t.test(x = ex5.41, alternative = "less", mu = 5, conf.level = 0.95)

One Sample t-test

data: ex5.41

t = -0.314, df = 7, p-value = 0.3813

alternative hypothesis: true mean is less than 5

95 percent confidence interval:

-Inf 5.251691

sample estimates:

mean of x

4.95

3. Since 5 is inside this interval, do not reject Ho.

4. There is not sufficient evidence that the mean oxygen level is less than 5 ppm.

Test statistic method:

1.

Ho:μ≥5  
Ha:μ<5

2.

t=-0.314 (using the same R code as above)

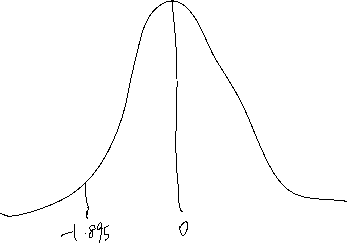
3.

-t0.05, 19 = -1.895

> qt(p = 0.05, df = 8-1)



[1] -1.894579



4. Since -0.314 > -1.895, do not reject Ho.

5. There is not sufficient evidence that the mean oxygen level is less than 5 ppm.

P-value method:

1.

Ho:μ≥5  
Ha:μ<5

2.

t=-0.314.

The p-value is 0.3813.

(using the same R code as above)

3.

α = 0.05

4. Since 0.3813 > 0.05, do not reject Ho.

5. There is not sufficient evidence that the mean oxygen level is less than 5 ppm.

5.43

a. The sample mean of the mercury concentration after the accident is 1.466.

> ex5.58<-read.table("C:/sdata/ex5-58.txt", header=T, sep=",")

> ex5.58 <- as.vector(ex5.43[,1])

> ex5.58

[1] 1.60 1.77 1.61 1.08 1.07 1.79 1.34 1.07 1.45 1.59 1.43 2.07 1.16 0.85 2.11

> mean(ex5.58s)

[1] 1.466

b.

The 95% confidence interval on the mean mercury concentration after the accident is (1.26, 1.67).

> t.test(x = ex5.58, conf.level = 0.95)

One Sample t-test

data: ex5.58

t = 15.0819, df = 14, p-value = 4.736e-10

alternative hypothesis: true mean is not equal to 0

95 percent confidence interval:

1.257521 1.674479

sample estimates:

mean of x

1.466

c.

The level of significance is α = 0.05

Confidence interval method:

1.

Ho:μ≤1.2  
Ha:μ>1.2

2.

The “one-sided” C.I. for μ is (1.295, ∞)

> t.test(x = ex5.58, alternative = "greater", mu = 1.2, conf.level = 0.95)

One Sample t-test

data: ex5.58

t = 2.7365, df = 14, p-value = 0.008032

alternative hypothesis: true mean is greater than 1.2

95 percent confidence interval:

1.294796 Inf

sample estimates:

mean of x

1.466

3. Since 1.2 is not in the interval, reject Ho.

4. There is enough evidence to indicate that the mean mercury concentration has increased after the accident.

Test statistic method:

1.

Ho:μ≤1.2  
Ha:μ>1.2

2.

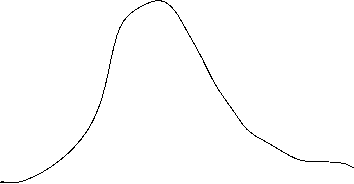
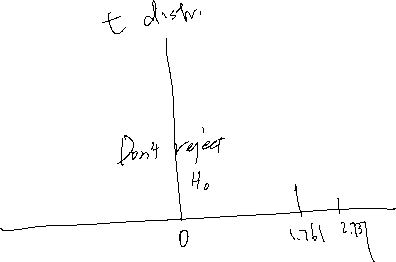
t=2.737 (using the same R code as above)

3.

t0.05, 14 = 1.761

> qt(p = 0.95, df = 15-1)

[1] 1.76131



4. Since 2.737 > 1.761, reject Ho.

5. There is enough evidence to indicate that the mean mercury concentration has increased after the accident.

P-value method:

1.

Ho:μ≤1.2  
Ha:μ>1.2

2.

t=2.737. The p-value is 0.008.

(using the same R code as above)

3.

α = 0.05

4. Since 0.008 < 0.05, reject Ho.

5. There is enough evidence to indicate that the mean mercury concentration has increased after the accident.

d.

The power of the test are 0.235, 0.396, 0.578, 0.744 for mercury concentrations of 1.28, 1.32, 1.36, 1.40, respectively.

> diff.in.means <- c(1.28, 1.32, 1.36, 1.40) - 1.2

> effect.size <- abs(diff.in.means)

> sigma <- 0.32

> alpha <- 0.05

> n<-15

> power.t.test(n = n, d = effect.size, sd = sigma,

sig.level = alpha, type = "one.sample", alternative =

"one.sided")

One-sample t test power calculation

n = 15

delta = 0.08, 0.12, 0.16, 0.20

sd = 0.32

sig.level = 0.05

power = 0.2348073, 0.3963224, 0.5780555, 0.7441821

alternative = one.sided

5.61

The level of significance is α = 0.05

Confidence interval method:

1.

Ho:μ≤25  
Ha:μ>25

2.

The “one-sided” C.I. for μ is (23.00, ∞)

> ex5.61<-read.table("C:/sdata/ex5-61.txt", header=T, sep=",")

> ex5.61 <- as.vector(ex5.61[,1])

> ex5.61

[1] 28 26 24 25 30 32 27 15 28 31 55 42 10 12 38

> t.test(x = ex5.61, alternative = "greater", mu = 25, conf.level = 0.95)

One Sample t-test

data: ex5.61

t = 1.0833, df = 14, p-value = 0.1485

alternative hypothesis: true mean is greater than 25

95 percent confidence interval:

22.99721 Inf

sample estimates:

mean of x

28.2

3. Since 25 is in the interval, do not reject Ho.

4. There is not enough evidence to indicate that the mean time to fill an order has increased.

Test statistic method:

1.

Ho:μ≤25  
Ha:μ>25

2.

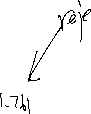
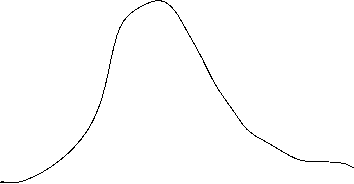
t=1.083 (using the same R code as above)

3.

t0.05, 14 = 1.761

> qt(p = 0.95, df = 15-1)

[1] 1.76131



4. Since 1.083 < 1.761, do not reject Ho.



5. There is not enough evidence to indicate that the mean time to fill an order has increased.



P-value method:

1.

Ho:μ≤25  
Ha:μ>25

2.

t=1.083.

The p-value is 0.149.

(using the same R code as above)

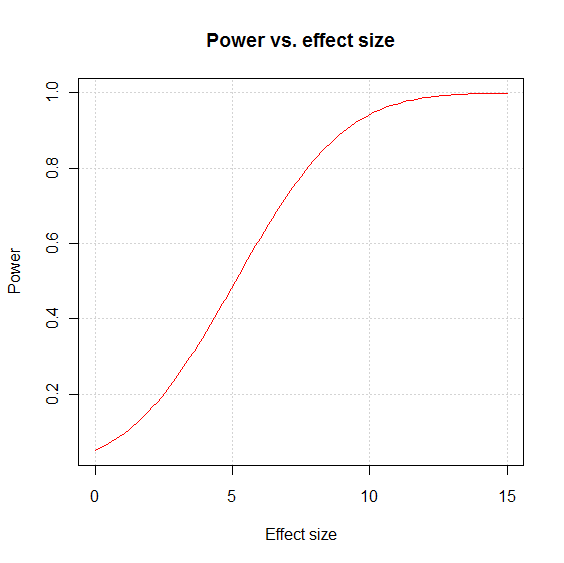
3.

α = 0.05

4. Since 0.149 > 0.05, do not reject Ho.

5. There is not enough evidence to indicate that the mean time to fill an order has increased.

The power vs. effect size is:



> n <- 15

> crit.val <- qt(p = 0.95, df = n - 1)

> sigma <- sqrt(var(ex5.61))

> curve(expr = 1-pt(q = crit.val, df = n - 1, ncp =

sqrt(n)\*x/sigma), xlim = c(0,15), col = "red", xlab

= "Effect size", ylab = "Power", main = "Power vs. effect size",

panel.first = grid(lty = "dotted", col = "lightgray"))

5.62

a)

Point estimate

Confidence interval = (49.71, 98.65)

> ex5.62<-read.table("C:/sdata/ex5-62.txt", header=T, sep=",")

> nrow(ex5.62)

[1] 15

> head(ex5.62)

Day Yield

1 1 57.8

2 2 58.3

3 3 50.3

4 4 38.5

5 5 47.9

6 6 157.0

> mean(ex5.62[,2])

[1] 74.18

> t.test(x = ex5.62[,2], conf.level = 0.95)

One Sample t-test

data: ex5.62[, 2]

t = 6.5027, df = 14, p-value = 1.396e-05

alternative hypothesis: true mean is not equal to 0

95 percent confidence interval:

49.71317 98.64683

sample estimates:

mean of x

74.18

b)

The level of significance is α = 0.05

Confidence interval method:

1.

Ho:μ≤50  
Ha:μ>50

2.

The “one-sided” C.I. for μ is (54.09, ∞)

> t.test(x = ex5.62[,2], alternative = "greater", mu = 50, conf.level = 0.95)

One Sample t-test

data: ex5.62[, 2]

t = 2.1196, df = 14, p-value = 0.0262

alternative hypothesis: true mean is greater than 50

95 percent confidence interval:

54.08771 Inf

sample estimates:

mean of x

74.18

3. Since 50 is outside the interval, reject Ho.

4. There is enough evidence to indicate that the average daily output is greater than 50 tons of ore.

Test statistic method:

1.

Ho:μ≤50  
Ha:μ>50

2.

t= 2.1196 (nearly 2.12)



(using the same R code as above)

3.

t0.05, 14 = 1.761

> qt(p = 0.95, df = 15-1)

[1] 1.76131

A close up of text on a white background

Description automatically generated

4. Since 2.12 > 1.761, reject Ho

5. There is enough evidence to indicate that the average daily output is greater than 50 tons of ore

P-value method:

1.

Ho:μ≤50  
Ha:μ>50

2.

t= 2.1196

The p-value is 0.0262.

(using the same R code as above)

3.

α = 0.05

4. Since 0.0262 < 0.05, reject Ho.

5. There is enough evidence to indicate that the average daily output is greater than 50 tons of ore.