**Name \_\_\_\_\_\_Heather Hopkins\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Lab Assignment 10**

**DIRECTIONS**

* ***In a typed word processing document, clearly answer the following questions.***
* ***Be sure to show all of your work by providing your R commands, solutions/output, and interpretation.***
* ***Please circle or highlight your final answers.***

**For the following questions, determine whether to use a parametric or non-parametric test (look at assumptions or test for normality). Perform the hypothesis testing in R and write down the results and the R commands you used. Draw the distribution with the critical values. Where needed perform tests at =0.05. Make conclusions using both the p-value and test statistic. Underline your answers.**

A) The zika virus has been linked to severe neurological diseases and can cause microcephaly, reducing the brain size of a baby. Ultrasounds have measured the brain size (cm) of 3 week old babies in the womb before and after infection of zika

Before zika: 12.9, 13.5, 12.8, 15.6, 17.2, 19.2, 12.6, 15.3, 14.4, 11.3

After zika: 12.7, 11.6, 10, 15.2, 16.8, 20, 12, 15.5, 15, 10.9

– First state the null and alternative hypothesis.

H0: There is no decrease in brain size after infection. HA: Brain size is decreased after infection.

–Test for the normality of the distributions. Are the samples normally distributed?

before=c(12.9, 13.5, 12.8, 15.6, 17.2, 19.2, 12.6, 15.3, 14.4, 11.3)

hist(before,xlab="Before Zika",col="tomato",main="Head Size")

shapiro.test(before)

Shapiro-Wilk normality test

data: before

W = 0.94444, p-value = 0.6033 (Before is not normally distributed.)

after=c(12.7, 11.6, 10, 15.2, 16.8, 20, 12, 15.5, 15, 10.9)

hist(after,xlab="After Zika",col="deepskyblue1",main="Head Size")

shapiro.test(after)

Shapiro-Wilk normality test

data: after

W = 0.9463, p-value = 0.6249 (After is not normally distributed.)

– Is there a decrease in brain size after zika infection (assume the data is normally distributed)?

t.test(before,after)

Welch Two Sample t-test

data: before and after

t = 0.41319, df = 16.955, p-value = 0.6846

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-2.094697 3.114697

sample estimates:

mean of x mean of y

14.48 13.97

There is no significant decrease in brain size after Zika infection (p-value is not less than or equal to 0.05/t stat is not in the rejection region—do not reject the null hypothesis).

– Is there a decrease in brain size after zika infection (assume the data is not normally distributed)?

z.test(after,sigma.x=sd(after),mu=14.48,alternative="two.sided")

One-sample z-Test

data: after

z = -0.523, p-value = 0.601

alternative hypothesis: true mean is not equal to 14.48

95 percent confidence interval:

12.05876 15.88124

sample estimates:

mean of x

13.97

There is no significant decrease in brain size after Zika infection (p-value is not less than or equal to 0.05/z stat is not in the rejection region—do not reject the null hypothesis).

B) You are asked to test whether pollution levels in a nearby pond are reduced by stopping industrial waste dumping. Here the values of pollution at each site:

With dumping (before): 214, 159, 169, 272, 103, 179, 200, 149, 132, 148, 194, 104, 219, 119, 234

Without dumping (after): 159, 135, 141, 101, 102, 168, 62, 167, 174, 159, 66, 118, 181, 171, 112

–First state the null and alternative hypothesis.

H0: Pollution levels are not reduced after stopping waste dumping. HA: Pollution levels are reduced after stopping waste dumping.

–Does stopping waste dumping decrease levels of pollution in the pond assume the data is normally distributed)?

t.test(with,without)

Welch Two Sample t-test

data: with and without

t = 2.3727, df = 26.587, p-value = 0.02516

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

5.196052 72.003948

sample estimates:

mean of x mean of y

173.0 134.4

Stopping waste dumping reduces pollution levels (p-value is less than 0.05/t stat is within the rejection region—reject the null hypothesis).

–Does stopping waste dumping decrease levels of pollution in the pond assume the data is not normally distributed)?

z.test(without,sigma.x=sd(without),mu=173.0,alternative="two.sided")

One-sample z-Test

data: without

z = -3.8254, p-value = 0.0001306

alternative hypothesis: true mean is not equal to 173

95 percent confidence interval:

114.6231 154.1769

sample estimates:

mean of x

134.4

Stopping waste dumping reduces pollution levels (p-value is less than 0.05/z stat is within the rejection region—reject the null hypothesis).

–Plot both the With dumping and Without dumping values in different colors and symbols on the same plot. Label both axes.

plot(with,xlab="With and Without Dumping",ylab="Pollution Values",main="Pollution Pre- & Post-Dumping",col="snow4",pch=2)

points(without,col="maroon",pch=0)

legend(6,275,pch=c(2,0),col=c("snow4","maroon"),c("With","Without"))



C) 6 subjects were given a drug to dull pain. Their reaction time to a shock stimulus was measured (in ms).

Prior to treatment: 91, 87, 99, 77, 81, 91, 75

After Treatment: 91, 99, 103, 111, 99, 104, 102

–First state the null and alternative hypothesis.

H0: Pain resistance was not increased after treatment. HA: Pain resistance was increased after treatment.

–Did the drug increase the resistance to pain (assume the data is normally distributed)?

t.test(prior,post)

Welch Two Sample t-test

data: prior and post

t = -3.8678, df = 10.774, p-value = 0.002719

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

-24.230664 -6.626479

sample estimates:

mean of x mean of y

85.85714 101.28571

The drug increased resistance to pain (p-value is less than 0.05/t stat is within the rejection region—reject the null hypothesis).

–Did the drug increase the resistance to pain (assume the data is not normally distributed)?

z.test(post,sigma.x = sd(post),mu=85.85714,alternative="two.sided")

One-sample z-Test

data: post

z = 6.7194, p-value = 1.824e-11

alternative hypothesis: true mean is not equal to 85.85714

95 percent confidence interval:

96.78543 105.78600

sample estimates:

mean of x

101.2857

The drug increased resistance to pain (p-value is less than 0.05/z stat is within the rejection region—reject the null hypothesis).

D) You are asked to compare the average wing size (in cm) of two groups of *Drosophila melanogaster*. The first group consists of *Drosophila* from brazil; the second group is North America *Drosophila*. The data are given below.

Brazilian = 18, 22, 21, 17, 20, 17, 23, 20, 22 ,21

North America = 16, 17, 14, 21, 19, 18, 13, 15, 17, 21

–First state the null and alternative hypothesis.

H0: The North Americans equals the Brazilians. HA: The North Americans do not equal the Brazilians.

–Is the wing size equal in both groups (assume the data is normally distributed and the variances are equal)?

t.test(Brazilian,NorthAmerican,var.equal = TRUE)

Two Sample t-test

data: Brazilian and NorthAmerican

t = 2.7412, df = 18, p-value = 0.01342

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

0.7006872 5.2993128

sample estimates:

mean of x mean of y

20.1 17.1

Wing size is equal between the two groups (p-value is less than 0.05/t stat is within the rejection region—reject the null hypothesis).

–Is the wing size equal in both groups (assume the data is not normally distributed)?

z.test(Brazilian,NorthAmerican,sigma.x=sd(Brazilian),sigma.y=sd(NorthAmerican))

Two-sample z-Test

data: Brazilian and NorthAmerican

z = 2.7412, p-value = 0.006122

alternative hypothesis: true difference in means is not equal to 0

95 percent confidence interval:

0.8549559 5.1450441

sample estimates:

mean of x mean of y

20.1 17.1

The wing size is equal between the two groups (p-value is less than 0.05/z stat is within the rejection region—reject the null hypothesis).