Anthony Le

ST 511 (Lab: Tu 4:00-5:00)

October 25, 2016

Homework 4

Question 1: Exercise 20

1. Rank transformations of the data (used Excel)

|  |  |  |  |
| --- | --- | --- | --- |
| Kcal | Patient | Order | Rank |
| 18.8 | Nontrauma | 1 | 1 |
| 20 | Nontrauma | 2 | 2 |
| 20.1 | Nontrauma | 3 | 3 |
| 20.9 | Nontrauma | 4 | 4.5 |
| 20.9 | Nontrauma | 5 | 4.5 |
| 21.4 | Nontrauma | 6 | 6 |
| 22 | Trauma | 7 | 7 |
| 22.7 | Nontrauma | 8 | 8 |
| 22.9 | Nontrauma | 9 | 9 |
| 23 | Trauma | 10 | 10 |
| 24.5 | Trauma | 11 | 11 |
| 25.8 | Trauma | 12 | 12 |
| 30 | Trauma | 13 | 13 |
| 37.6 | Trauma | 14 | 14 |
| 38.5 | Trauma | 15 | 15 |

1. Rank sum of trauma (group 1) = 7 + 10 + 11 + 12 + 13 + 14 + 15 = 82

Rank sum of nontrauma (group 2) = 1 + 2 + 3 + 4.5 + 4.5 + 6 + 8 + 9 = 38

1. The test statistic, T, is the sum of all the ranks of one group, called “group 1.” Group 1 is conventionally the group with the smaller sample size, thus, T=82, the rank sum of the trauma group (the group with the smaller sample size).

> n1<-7 # sample size of trauma (group 1)

> n2<-8 # sample size of nontrauma (group 2)

> r.Kcal<-rank(ex0318$Kcal) # rank of data set

> r.Kcal # print ranks of data set

[1] 3.0 9.0 1.0 4.5 4.5 8.0 6.0 2.0 15.0 12.0

[11] 7.0 10.0 14.0 13.0 11.0

> meanKcal<-n1\*mean(r.Kcal) # mean of all ranks times sample size of group 1

> sdKcal<-sd(r.Kcal)\*sqrt(n1\*n2/(n1+n2)) # sd of all ranks

> sdKcal # print sd of all ranks

[1] 8.633269

> T<-82 # T statistic of trauma (group 1)

> pnorm(T,mean=meanKcal,sd=sdKcal) # area to the right of T=82 for normal dist with mean 56, sd 8.633269

[1] 0.9987006

One-sided p-value = 0.9987

Question 2: Exercise 21

# Wilcoxon rank sum test with trauma group treated as group 1

# null hypothesis: true location shift is equal to 0

# alternative hypothesis: true location shift is greater than 0

> wilcox.test(Kcal~Patient,data=ex0318,alternative="greater",exact=FALSE,correct=FALSE)

Wilcoxon rank sum test

data: Kcal by Patient

W = 2, p-value = 0.9987

alternative hypothesis: true location shift is greater than 0

p-values are the same (p-value=0.9987)

Question 3: Exercise 22

> wilcox.test(Kcal~Patient, data=ex0318,alternative="greater",exact=FALSE,correct=FALSE)

Wilcoxon rank sum test

data: Kcal by Patient

W = 2, p-value = 0.9987 # one-sided Wilcoxon rank sum test; p-value

alternative hypothesis: true location shift is greater than 0

> with(ex0318,wilcox.test(x=Kcal[Patient=="Trauma"],y=Kcal[Patient=="Nontrauma"],correct=FALSE,exact=FALSE,conf.int=TRUE))

Wilcoxon rank sum test

data: Kcal[Patient == "Trauma"] and Kcal[Patient == "Nontrauma"]

W = 54, p-value = 0.002599 # two-sided Wilcoxon rank sum test for CI

alternative hypothesis: true location shift is not equal to 0

95 percent confidence interval:

1.999966 16.200060 # (2.00, 16.20) is the 95% CI of δ

sample estimates:

difference in location

5.628919 # point estimate of δ; the trauma group have 5.63 Kcal

# more in metabolic expenditure than the nontrauma

# group.

Two-sided 95% confidence interval for δ is 2.00 to 16.20.

Question 4:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Welch Two-Sample T-Test | | | | | |
|  | t-statistic | p-value | df | 95% CI (from two-sided test) | means |
| One-sided | -2.9701 | 0.9885 | 6.4282 | (1.478, 14.140) | Trauma: 28.771  Nontrauma: 20.963 |

The two-sided p-value is 0.9987 from the rank sum procedures which is only a little bit bigger than the p-value of 0.9885 from the one-sided Welch’s t-test. So, the results are not noticeably different than with rank sum procedures.

Question 5:

There is strong evidence of a positive difference between the cross-fertilized plants and the self-fertilized plants (one-sided p-value = 0.003693, from a sign test). A 95% confidence interval for the probability of positive difference is estimated to be 0.637 to 1.00.