Sachin_Shubham

Sachin Shubham

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Task 1

In an experiment in which infants interacted with objects, Sommerville et al. (2005) randomly divided 30 infants into a research-first versus watch-first condition. The authors' state, 'Whereas 11 of 15 infants in the reach-first condition looked longer at the new goal events than the new path events, only 4 of 15 infants in the watch-first condition showed this looking time preference.' Is the difference observed between the two groups greater than can be attributed to chance if you see $\alpha = 0.05$? What if you use $\alpha = 0.01$?

Solution:

By hypothesis test of proportion

```
prfc <- (11/15)
pwfc <- (4/15)
n1<-15
n2<-15

p<-(n1*prfc+n2*pwfc)/(n1+n2)

z<-((prfc-pwfc)/(sqrt(p*(1-p)*(1/n1+1/n2))))
```

z = 2.556039

p value = 0.010588

At alpha 0.05, the p value = 0.010588 < alpha = 0.05, therefore we reject the null hypothesis that the babies appear to be reaching for the new goal at random. The alternative hypothesis validate that the reaching for goal isn't by chance.

At alpha 0.01, the p value = 0.010588 > alpha = 0.01, therefore we fail to reject the null hypothesis.

Task 2

A new method of teaching children to read promises more consistent improvement in reading ability across students. The new method is implemented in one randomly chosen class, while another class is randomly chosen to represent the standard method. Improvement in reading ability using a standardized test is given for the students in each class in Table 1. Use the appropriate test to see whether the claim can be sustained.
new_method=(13.0, 16.7,15.1, 16.7,16.5, 18.4,19.0, 16.6,20.2, 19.4,19.9, 23.6, 23.3, 16.5,17.3, 24.5)

standard_method=(20.1, 27.0,16.7, 19.2,25.6, 19.3,25.4, 26.7,22.0, 14.7,16.8, 16.9,23.8, 23.7,23.6, 21.7)

Solution:

```
new_method<-c(13.0, 16.7,15.1, 16.7,16.5, 18.4,19.0, 16.6,20.2, 19.4,19.9, 
23.6,
             23.3, 16.5,17.3, 24.5)

standard_method<-c(20.1, 27.0,16.7, 19.2,25.6, 19.3,25.4, 26.7,22.0, 
14.7,16.8,
                  16.9,23.8, 23.7,23.6, 21.7)


var.test(standard_method,new_method, alternative = "two.sided")

## 
##  F test to compare two variances
## 
## data:  standard_method and new_method
## F = 1.502, num df = 15, denom df = 15, p-value = 0.44
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.5247826 4.2987949
## sample estimates:
## ratio of variances 
##           1.501976
```

Since p-value =0.44 > 0.05 = α, we fail to reject the null hypothesis. At the α = 0.05 level of significance, there is not enough evidence to conclude that the new method of teaching children to read promises more consistent improvement in reading ability across students.

Task 3

Chlorinated hydrocarbons (mg/kg) found in samples of two species of fish in a lake are as follows: species1=(34, 1, 167, 20)

species2=(45, 86, 82, 70, 160, 170)

Perform a hypothesis test to determine whether there is a difference in the main level of hydrocarbons between the two species. Check assumptions.

Solution:

By Hypothesis Two Sample T-test

```
species1<-c(34, 1, 167, 20)

species2<-c( 45, 86, 82, 70, 160, 170)

t.test(species1, species2)
```

```
##
##  Welch Two Sample t-test
##
## data:  species1 and species2
## t = -1.0827, df = 4.8201, p-value = 0.3301
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -158.71537   65.38204
## sample estimates:
## mean of x mean of y
##   55.5000  102.1667
```

Our study find that at t = -1.0827, df = 4.8201, p-value = 0.3301 and CI[-158.71537 65.38204] we fail to reject the null hypothesis as p-value =0.3301 > 0.05 = α. At the α = 0.05 level of significance, there is not enough evidence to conclude the claim.

Task 4

A certain soft drink bottler claims that less than 10% of its customers drink another brand of soft drink on a regular basis. A random sample of 100 customers yielded 18 who did in fact drink another brand of soft drink on a regular basis. Do these sample results support the bottler's claim? (Use a level of significance of 0.05.)

Solution:

```
p = 0.10
p_hat = 0.18

z = (p_hat-p)/(sqrt((p*(1-p))/100))
z

## [1] 2.666667

pnorm(z)

## [1] 0.9961696
```

Since, p-value = 0.9961696 > 0.05 = α, we fail to reject the null hypothesis. At the α = 0.05 level of significance, there is not enough evidence that less than 10% of the customers drink another brand. Thus the results do not support the bottler's claim.

Task 5

It is said that the average weight of healthy 12-hour-old infants is supposed to be 7.5 lb. A sample of newborn babies from a low-income neighborhood yielded the following weights (in pounds) at 12 hours after birth: At the α = 0.01 significance level, can we conclude that babies from this neighborhood are underweight?

Solution:

By inference on the population mean hypothesis test

```
sample_size<-c(6.0, 8.2, 6.4, 4.8,8.6, 8.0, 6.0,7.5, 8.1, 7.2)


mu0 = 7.5
sample_mean  = mean(sample_size)
t.test(sample_size, alternative = "less", mu=mu0)
```

```
##
##  One Sample t-test
##
## data:  sample_size
## t = -1.079, df = 9, p-value = 0.1543
## alternative hypothesis: true mean is less than 7.5
## 95 percent confidence interval:
##      -Inf 7.793529
## sample estimates:
## mean of x
##      7.08
```

Our study finds that t-statistic -1.079, p-value = 0.1543, df = 9, α=0.05, 95% CI [-Inf 7.793529]. Since α<p-value, a big p(>0.05), fail to reject the null hypothesis. Therefore, this is strong evidence that babies from this neighborhood are not underweight