Week 5 Assignment

2023-06-18

Question1

Ho : mu = 108 Ha : mu > 108

With researcher fails to reject the null hypothesis at a 0.02 level of significance, there is not sufficient evidence at evidence at the 0.02 level of significance that the new technique lengthens training time.

Question 2

The actual number of do not fail chips is 49% of the chips, where the stated percentage of the chips that do not fail is 51%.

Ho: p = 0.51 H1: p != 0.51

```
actual_number <- 1600*0.49
stated_percentage <- 0.51
prop.test(actual_number,n = 1600,stated_percentage, conf.level = 0.98)
```

```
##
##  1-sample proportions test with continuity correction
##
## data:  actual_number out of 1600, null probability stated_percentage
## X-squared = 2.4816, df = 1, p-value = 0.1152
## alternative hypothesis: true p is not equal to 0.51
## 98 percent confidence interval:
##  0.4606981 0.5193700
## sample estimates:
##    p
## 0.49
```

Answer: With P-value (0.1152) greater than sigma (0.02), we have failed to reject the null hypothesis and conclude that there is not sufficient evidence to support the claim that the percentage of chips that do not fail is different from 51%.

Question 3

Ho : mu = 4.4 H1 : mu != 4.4

We want to test that the current ozone level is not normal which is 4.8. Hence, alternative hypothesis will be current level of ozone is different from the normal level of ozone which is 4.8 ppm.

Question 4

Ho : sd = 10 H1 : sd < 10

```
n <- 23
mean <- 159
s <- 9.684
```

```
sd <- 10
df <- n-1
df
```

```
## [1] 22
```

I am using one-tailed, therefore my sigma is 0.05 with 95% confidence level. Other than that, my df is 22

critical value = 12.23

```
chisqr <- round((((n -1)*s^2)/sd^2),3)
chisqr
```

```
## [1] 20.632
```

```
p_value <- round(pchisq(chisqr,22),3)
p_value
```

```
## [1] 0.456
```

test statistic = 20.639 p-value = 0.456

Conclusion:

Since p-value (0.456) is larger than sigma(0.05), we do not reject the null hypothesis. We can conclude that there is not sufficient evidence to show that the standard deviation of the test scores has decreased.

Question 5

Ho : Number of fatal accidents does not vary from month to month H1 : Number of fatal accidents does vary from month to month

The null hypothesis indicates that the proportions of fatal accidents during each month are all thought to be equal.

Creating a table and finding the expected proportions for each category

```
Month <- as.factor(c("Jan", "Feb", "Mar", "Apr", "May", "Jun", "July", "Aug", "Sep", "Oct", "Nov", "Dec
Fatal_accidents <- c(11,19,24,16,11,7,7,17,9,19,18,12)
accident_table <- data.frame(Month,Fatal_accidents)
accident_table
```

```
##    Month Fatal_accidents
## 1    Jan              11
## 2    Feb              19
## 3    Mar              24
## 4    Apr              16
## 5    May              11
## 6    Jun               7
## 7   July               7
## 8    Aug              17
## 9    Sep               9
## 10   Oct              19
## 11   Nov              18
## 12   Dec              12
```

```
expected_proportions <- round(mean(Fatal_accidents),2)
expected_proportions
```

```
## [1] 14.17
```

Ho: Pi = 14.17 Ha: There is some difference amongst the proportions

E(njan) = 14.17

E(njul) = 14.17

Test statistic

```
chisq.test(Fatal_accidents)
```

```
##
##  Chi-squared test for given probabilities
##
## data:  Fatal_accidents
## X-squared = 22.847, df = 11, p-value = 0.01857
```

```
mychi <- (Fatal_accidents - mean(Fatal_accidents))^2 / mean(Fatal_accidents)
total_mychi <- round(sum(mychi),3)
total_mychi
```

```
## [1] 22.847
```

```
p_value <- 1 - pchisq(sum(mychi),11)
p_value
```

```
## [1] 0.01857364
```

Value of test statistic = 22.847

Degree of freedom = 11

Critical value = 24.725

At the 0.01 level of significance, p-value (0.01857) is greater than sigma(0.01), we failed to reject the null hypothesis. We can conclude that there is not enough evidence to reject the claim that the the number of fatal accidents does not vary from month to month.

Question 6

Ho: mu1 = mu2 H1: mu2 < mu2

Compute the value of t test statistic

```
mean1 <- 1060
mean2 <- 1000
n1 <- 19
n2 <- 13
vr1 <- 41
vr2<- 24
```

```r
t_test <- function(mean1,mean2, n1, n2, vr1,vr2){
  S2p <- (((n1 -1)*(vr1^2)) + ((n2 - 1)*(vr2^2)))/(n1+n2-2)
  test_score <-(mean1-mean2)/sqrt(S2p*((1/n1)+(1/n2)))
  return(test_score)
}
t_score <- round(t_test(mean1 = mean1, mean2 = mean2, n1, n2, vr1, vr2),2)
t_score
```

```
## [1] 4.74
```

t test statistic = 4.74

Finding df

```r
df <- n1 + n2 - 2
df
```

```
## [1] 30
```

df = 30 critical value = 2.46

if t < 2.46 or t > 2.46, we reject the Ho; else fail to reject Ho.

With a significance level of 0.01, t(4.74) is greater than critical value(2.46). Therefore, we have enough evidence to reject the null hypothesis and accept the alternative hypothesis.

Question 7

```r
p1 <- c(29,47,29,40,36,17,37)
p2 <- c(44,38,21,49,49,25,35)
n <- 7
dbar <- sum(p1 - p2)/n
dbar
```

```
## [1] -3.714286
```

```r
var.test(p1,p2)
```

```
##
##  F test to compare two variances
##
## data:  p1 and p2
## F = 0.74952, num df = 6, denom df = 6, p-value = 0.7352
## alternative hypothesis: true ratio of variances is not equal to 1
## 95 percent confidence interval:
##  0.1287886 4.3620141
## sample estimates:
## ratio of variances
##          0.7495183
```

```r
t.test(p1,p2, paired = T, conf.level = 0.98)
```

```
##
##  Paired t-test
##
## data:  p1 and p2
## t = -0.9898, df = 6, p-value = 0.3605
## alternative hypothesis: true mean difference is not equal to 0
## 98 percent confidence interval:
##  -15.507307   8.078735
## sample estimates:
## mean difference
##       -3.714286
```

mean of paired difference = -3.7

```
df = length(p1) + length(p2) -1
df
```

```
## [1] 13
```

df = 6 critical value = 3.143

```
Sd <- sqrt(sum(((p1-p2)-dbar)^2)/(n-1))
Sd
```

```
## [1] 9.928314
```

standard deviation of paired difference

```
SE <- Sd/sqrt(n)
SE
```

```
## [1] 3.75255
```

```
lp <- dbar - (3.143*SE)
up <- dbar + (3.143*SE)
print(c(lp,up))
```

```
## [1] -15.508551   8.079979
```

98% intervals lower endpoint = -15.5086 upper endpoint = 8.0799

Question 8

Ho: vr1 = vr2 H1: vr1 != vr2

Finding df1 and df2

```
n1 = 11
n2 = 4
df1 <- n1 - 1
df2 <- n2 -1
df1
```

```
## [1] 10
```

```
df2
```

```
## [1] 3
```

critical value = 0.2072, 14.4189

Compute F test

```
round((26.57/30.78),4)
```

```
## [1] 0.8632
```

F stat = 0.8632

At 0.05 level of significance, 0.2072 < F(0.8632) <14.4189. Therefore, we fail to reject null hypothesis and conclude that there is enough evidence support the claim of alternative hypothesis.

Question 9

```
7129.15 - 2209.62
```

```
## [1] 4919.53
```

SSE = 4919.53

```
14 + 1
```

```
## [1] 15
```

n = 15 k = 4

```
4 -1
```

```
## [1] 3
```

degree of freedom among treatments = 3

```
15 -4
```

```
## [1] 11
```

degree of freedom of experimental error = 11

```
round((736.54/1.65),2)
```

```
## [1] 446.39
```

mean square of experimental error = 446.39

sum of squares of sample means about the grand mean = 2209.62

variation of the individual measurement about their respective means = 4919.53

The critical value of F at a the 0.05 level = 3.5874

No, F is not significant at 0.05