hw2_Mohammad_Imtiaz_Nur

Mohammad Imtiaz Nur

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ID: 1878074

Task 1:

Let,

p_1 = proportion of success for reach-first condition,

p_2 = watch-first condition.

H_0: $p_1 = p_2$ [The difference observed in the looking behavior between the two groups is not significant].

H_1: $p_1 \neq p_2$ [The difference observed in the looking behavior between the two groups is significant].

```
research<-prop.test(x = c(11, 4), n = c(15, 15),
              alternative = "two.sided")
research
```

```
##
##  2-sample test for equality of proportions with continuity correction
##
## data:  c(11, 4) out of c(15, 15)
## X-squared = 4.8, df = 1, p-value = 0.02846
## alternative hypothesis: two.sided
## 95 percent confidence interval:
##  0.08351543 0.84981790
## sample estimates:
##    prop 1    prop 2
## 0.7333333 0.2666667
```

Selecting $\alpha = 0.05$, the p value (0.02846) is less than 0.05. So, we can reject the null hypothesis. So, the proportion in looking behavior is significant, hence, the difference observed between the two groups greater than can be attributed to chance.

Selecting $\alpha = 0.01$, for the p value (0.0284597) is greater than 0.01. Therefore, we fail to reject the null hypothesis. Hence, we can say that the difference observed between the two groups greater than can not be attributed to chance.

Task 2:

Let

H_0: $\mu_1 = \mu_2$ [No significant improvement after applying the new method].

H_1: $\mu_1 \neq \mu_2$

```
# performance after applying new method
new <-c(13.0, 15.1, 16.5, 19.0, 20.2, 19.9, 23.3, 17.3,
        16.7, 16.7, 18.4, 16.6, 19.4, 23.6, 16.5, 24.5)

# performance after applying standard method
standard <-c(20.1, 16.7, 25.6, 25.4, 22.0, 16.8, 23.8, 23.6,
             27, 19.2, 19.3, 26.7, 14.7, 16.9, 23.7, 21.7)

test <- t.test(new, standard)
test
```

```
##
##  Welch Two Sample t-test
##
## data:  new and standard
## t = -2.3066, df = 28.839, p-value = 0.02846
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -5.4837806 -0.3287194
## sample estimates:
## mean of x mean of y
##  18.54375  21.45000
```

Since, the p value (0.028) is less than 0.05, we can reject the null hypothesis. Hence, there is significance difference in the improvement after applying the new method of reading.

Task 3:

Let,

H_0: $\mu_1 = \mu_2$. No difference in the main level of hydrocarbons between the two species.

H_1: $\mu_1 \neq \mu_2$

```
spec1 <- c(34, 1, 167, 20)
spec2 <- c(45, 86, 82, 70, 160, 170)

carbon <- t.test(spec1, spec2)
carbon
```

```
##
##  Welch Two Sample t-test
##
## data:  spec1 and spec2
## 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
```

Since, the p value (0.33) is much greater than significance level 0.05, we fail to reject the null hypothesis. Hence, there is no significant difference in the main level of hydrocarbons between the two species of fish.

But this seems a little bit problematic since the means are different and we can see there is an outlier in the data for species 1 which is 167. Let's try to keep that out from the dataset and then again perform the t test and check the result.

```
spec1_1 <- c(34, 1, 20)
spec2 <- c(45, 86, 82, 70, 160, 170)

carbon_1 <- t.test(spec1_1, spec2)
carbon_1
```

```
##
##  Welch Two Sample t-test
##
## data:  spec1_1 and spec2
## t = -3.6693, df = 6.6046, p-value = 0.008831
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -138.52159  -29.14508
## sample estimates:
## mean of x mean of y
##  18.33333 102.16667
```

This time the p value (0.0088) is less than 0.05. Therefore, we can reject the null hypothesis and conclude that the there is a significant difference in the main level of hydrocarbons between the two species of fish.

Task 4:

Let,

H_0: $p_1 \geq 0.10$ [10% or more customers drink from another brand of soft drink on a regular basis].

H_1: $p_1 < 0.10$ [Less than 10% customers drink from another brand of soft drink on a regular basis].

```
#proportion test
proportion<-prop.test(18, 100, p = 0.1, alternative = "less")
proportion
```

```
##
##  1-sample proportions test with continuity correction
##
## data:  18 out of 100, null probability 0.1
## X-squared = 6.25, df = 1, p-value = 0.9938
## alternative hypothesis: true p is less than 0.1
## 95 percent confidence interval:
##  0.0000000 0.2568643
## sample estimates:
##    p
## 0.18
```

The proportion test on the data, we get that the p value is (0.994) which is larger than the significance value of 0.05. Therefore, we fail to reject the null hypothesis. Hence, we can say that the bottlers claim is not true.

Task 5:

Let,

H_0: $\mu = 7.5$ [Babies from the neighborhood are healthy].

H_1: $\mu < 7.5$ [Babies from the neighborhood are underweight].

```
w <- c(6.0, 8.6, 7.5, 8.2, 8.0, 8.1, 6.4, 6.0, 7.2, 4.8)
weight <- t.test(w, mu = 7.5, alternative = "less")
weight
```

```
##
##  One Sample t-test
##
## data:  w
## 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
```

From the result, we get that the p value is (0.1543) which is larger than the significance value of 0.01. Therefore, we fail to reject the null hypothesis. Hence, we can conclude that the babies from the neighborhood are not underweight.