612303050 Deshmukh Mehmood Rehan's Assignment 5

Q1. During the economic boom , a researcher believes that the economic recession may have an adverse impact on the average monthly salary of I.T professionals. To verify his belief , a random sample of 12 I.T professionals gave the following average monthly salary. 70000, 78000, 62000, 66000, 61000, 72000, 58000, 64000, 60000, 73000, 74000, 76000 Test whether the average monthly salary has gone below Rs 73000

```r
#Null Hypothesis: H0: μ >= 73000
#Alternate Hypothesis: H1: μ < 73000
#Level of significance: α = 0.05
#Given data
salary <- c(70000, 78000, 62000, 66000, 61000, 72000, 58000, 64000, 60000,
73000, 74000, 76000)

p_value_q1 = t.test(salary, mu = 73000, alternative = "less")$p.value

print(p_value_q1)

## [1] 0.01193286

if(p_value_q1 < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}

## [1] "Reject Null Hypothesis"
```

Q2. The time in minutes taken by complete a job by machine I and machine II is given below. Machine I: 20, 16, 26, 27, 23, 22, 25 Machine II: 27, 33, 42, 35, 32, 34, 38, 29, 40 Can we conclude that the variability in time distribution of population is less than that of population II? Use α=0.05

```r
#Null Hypothesis: H0: σ1 >= σ2
#Alternate Hypothesis: H1: σ1 < σ2
#Level of significance: α = 0.05
#Given data

machine1 <- c(20, 16, 26, 27, 23, 22, 25)
machine2 <- c(27, 33, 42, 35, 32, 34, 38, 29, 40)

p_value_q2 = var.test(machine1, machine2, alternative='less')$p.value

print(p_value_q2)

## [1] 0.2752115
```

```r
if(p_value_q2 < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}

## [1] "Fail to reject Null Hypothesis"
```

Q3. The heights of 10 female students in a college are found to be 57, 60, 54, 52, 58, 61, 59, 54, 57, 62 inches. Is it reasonable to believe that average height of female is greater than 52 inches? Use 5% level of significance.

```r
#Null Hypothesis: H0: μ <= 52
#Alternate Hypothesis: H1: μ > 52

#Level of significance: α = 0.05
#Given data
height <- c(57, 60, 54, 52, 58, 61, 59, 54, 57, 62)

p_value_q3 = t.test(height, mu = 52, alternative = "greater")$p.value

print(p_value_q3)

## [1] 0.000275454

if(p_value_q3 < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}

## [1] "Reject Null Hypothesis"
```

Q4. A machine part was designed to withstand an average pressure of 120 units. A random sample of size 100 from a large batch was tested and it was found that the average pressure with these parts can withstand is 105 units with a standard deviation of 20 units. Test whether the batch meets the specification.

```r
#Null Hypothesis: H0: μ = 120
#Alternate Hypothesis: H1: μ < 120

#Level of significance: α = 0.05
#Given data
n <- 100
xbar <- 105
mu <- 120
sd <- 20

z_q4 = (xbar - mu)/(sd/sqrt(n))
p_value_q4 = pnorm(z_q4, 0, 1)
```

```r
print(p_value_q4)

## [1] 3.190892e-14

if(p_value_q4 < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}

## [1] "Reject Null Hypothesis"
```

Q5. A random sample of 10 boys had the following Intelligent Quotients (IQ) 70,120,110,101,88,83,95,89,107,125 Do these data support the assumption that the population mean IQ is 100?

```r
#Null Hypothesis: H0: μ = 100
#Alternate Hypothesis: H1: μ != 100

#Level of significance: α = 0.05

#Given data
IQ <- c(70,120,110,101,88,83,95,89,107,125)

p_value_q5 = t.test(IQ, mu = 100)$p.value

print(p_value_q5)

## [1] 0.8295856

if(p_value_q5 < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}

## [1] "Fail to reject Null Hypothesis"
```

Q6. A random sample of 100 recorded deaths in the United States during the past year showed an average life span of 71.8 years. Assuming a population standard deviation of 8.9 years, does this seem to indicate that the mean life span today is greater than 70 years? Use a 0.05 level of significance. (Hint Using Z-test)

```r
#Null Hypothesis: H0: μ <= 70
#Alternate Hypothesis: H1: μ > 70

#Level of significance: α = 0.05

#Given data
n <- 100
```

```r
xbar <- 71.8
mu <- 70
sd <- 8.9

z_q6 = (xbar - mu)/(sd/sqrt(n))
p_value_q6 = pnorm(z_q6, 0, 1 , lower.tail = FALSE)

print(p_value_q6)

## [1] 0.02156381

if(p_value_q6 < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}

## [1] "Reject Null Hypothesis"
```

Q7. A manufacturer of sports equipment has developed a new synthetic fishing line that the company claims has a mean breaking strength of 8 kilograms with a standard deviation of 0.5 kilogram. Test the hypothesis that $\mu = 8$ kilograms against the alternative that $\mu = 8$ kilograms if a random sample of 50 lines is tested and found to have a mean breaking strength of 7.8 kilograms. Use a 0.01 level of significance.

```r
#Null Hypothesis: H0: μ = 8
#Alternate Hypothesis: H1: μ != 8

#Level of significance: α = 0.01

#Given data
n <- 50
xbar <- 7.8
mu <- 8
sd <- 0.5

z_q7 = (xbar - mu)/(sd/sqrt(n))
p_value_q7 = 2*pnorm(z_q7, 0, 1, lower.tail = FALSE)

print(p_value_q7)

## [1] 1.995322

if(p_value_q7 < 0.01){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}

## [1] "Fail to reject Null Hypothesis"
```

Q8.The time in minutes taken by two experts to respond the queries is as follows: Expert I: 6,9,4,1,9,9,3,4,10 Expert II:5,7,4,1,8,7,4,3,9 Test at 5% level of significance whether the variability in time taken by expert I is greater than that of expert II

```
#Null Hypothesis: H0: σ1 <= σ2
#Alternate Hypothesis: H1: σ1 > σ2

#Level of significance: α = 0.05
#Given data

expert1 <- c(6,9,4,1,9,9,3,4,10)
expert2 <- c(5,7,4,1,8,7,4,3,9)

p_value_q8 = var.test(expert1, expert2, alternative='greater')$p.value

print(p_value_q8)

## [1] 0.2684287

if(var.test(expert1, expert2)$p.value < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}

## [1] "Fail to reject Null Hypothesis"
```

Q9.A researcher claims that the average salary of assistant professors is more than $42,000. A sample of 30 assistant professors has a mean salary of $43,260. At α= 0.05, test the claim that assistant professors earn more than $42,000/year (on average). The standard deviation of the population is $5230.

```
#Null Hypothesis: H0: μ <= 42000
#Alternate Hypothesis: H1: μ > 42000

#Level of significance: α = 0.05

#Given data
n <- 30
xbar <- 43260
mu <- 42000
sd <- 5230

z_q9 = (xbar - mu)/(sd/sqrt(n))
p_value_q9 = pnorm(z_q9, 0, 1 , lower.tail = FALSE)

print(p_value_q9)

## [1] 0.09349081
```

```r
if(p_value_q9 < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}
```

```
## [1] "Fail to reject Null Hypothesis"
```

Q10. Using the following data (Take α=0.05)(Hint Using F -test) Sample I: 13, 15, 18, 20, 22, 9, 16 Sample II: 21, 18, 20, 16, 9 Test the hypothesis Ho: H1:

```r
#Null Hypothesis: H0: σ1 = σ2
#Alternate Hypothesis: H1: σ1 != σ2

#Level of significance: α = 0.05
#Given data

sample1 <- c(13, 15, 18, 20, 22, 9, 16)
sample2 <- c(21, 18, 20, 16, 9)

p_value_q10 = var.test(sample1, sample2)$p.value

print(p_value_q10)
```

```
## [1] 0.8098576
```

```r
if(p_value_q10 < 0.05){
  print("Reject Null Hypothesis")
}else{
    print("Fail to reject Null Hypothesis")
}
```

```
## [1] "Fail to reject Null Hypothesis"
```