Hypothesis Testing Assignment Questions

Answer = 1

To test whether the new customer feedback process has improved satisfaction, we can perform a **one-sample t-test**

STEP = 1

Null Hypothesis (H_0): 72

Alternative Hypothesis (H_1): Mean score > 72 (This is a one-tailed test.)

Given Data

- **Population means before(mu): = 72**
- **Sample mean after{x} = 78**
- **Sample standard deviation: (std)= 10**
- **Sample size: (n) = 30**
- **Significance level: (alpha) = 0.05**

STEP = 2

STANDAR ERROR:

SE = Sigma/Sqrt(n)

Sigma (std) =10

Sample size(n) = 30 sqrt (5.477)

10/5.477 = *1.82*

STEP = 3

We use the t-statistic formula:

T CAL (XBAR- MU)/SE

Xbar = 78

MU = 72

SE = 1.82

(78-72)/1.82 = 3.29

STEP = 4

Critical Value

Sample size (n)

Degrees of freedom: df = 30 - 1 = 29

From the t-distribution table, the critical value for a one-tailed test at alpha = 0.05 and df = 29 is approximately **1.699.**

Decision

- Calculated t-value: **3.29**
- Critical t-value: **1.699**

Since **3.29 > 1.699,** we **reject the null hypothesis.**

Conclusion

There is **statistically significant evidence** at the 5% level to conclude that the new customer feedback process has **improved customer satisfaction**.

Answer = 2

To verify the school's claim, we'll perform a one-sample t-test to see if the sample mean is significantly greater than the national average.

STEP = 1

Null Hypothesis (H_0): 75

Alternative Hypothesis (H_1): MU >75 (This is a one-tailed test.)

Given Data

- **National average: (MU)= 75**
- **Sample means: {xbar} = 77**
- **Sample standard deviation: (std) = 8**
- **Sample size: (n) = 50**
- **Significance level: (alpha) = 0.01**

STEP = 2

STANDAR ERROR:

SE = Sigma/Sqrt(n)

Sigma (std) =8

Sample size(n) = 50 sqrt (7.071)

8/7.071 = 1.13

STEP = 3

We use the t-statistic formula:

T CAL (XBAR- MU)/SE

Xbar = 77

MU = 75

SE = 1.13

77-75)/1.13 = 1.77

STEP = 4

Critical Value

Sample size (n)

Degrees of freedom: df = 50-1 = 49

From the t-distribution table, the critical value for a **one-tailed test** at alpha = 0.01 and df = 49 is approximately **2.405.**

Decision

- Calculated t-value: **1.77**
- Critical t-value: **2.405**

Since 1.77 < 2.405, we **fail to reject the null hypothesis**.

Conclusion

At the 0.01 significance level, there is **not enough statistical evidence** to support the school's claim that their students' average math score is higher than the national average.

Answer = 3

To determine whether the new sales strategy significantly increased average daily sales, we'll perform a **one-sample t-test**.

STEP = 1

Null Hypothesis (H_0): 10,000

Alternative Hypothesis (H_1): MU >10,000 (This is a one-tailed test.)

Given Data

- **Population means: (mu) = 10,000**
- **Sample mean: {xbar} = 11,200**
- **Sample standard deviation: (std) = 1,500**
- **Sample size: (n) = 15**
- **Significance level: (alpha) = 0.05**

STEP = 2

STANDAR ERROR:

SE = Sigma/Sqrt(n)

Sigma (std) =1,500

Sample size(n) = 15 sqrt (3.873)

1500/3.873 = 387.29

STEP = 3

We use the t-statistic formula:

T CAL (XBAR- MU)/SE

Xbar = 11,200

MU = 10,000

SE = 387.29

(11,200-10,000)/387.29 = 3.10

STEP = 4

Critical Value

Sample size (n)

Degrees of freedom: df = 15 - 1 = 14

From the t-distribution table, the critical value for a **one-tailed test** at alpha = 0.05 and df = 14 is approximately **1.761**.

Decision

- Calculated t-value: **3.10**
- Critical t-value: **1.761**

Since 3.10 > 1.761, we **reject the null hypothesis**.

Conclusion

At the 5% significance level, there is **strong statistical evidence** that the new sales strategy has **increased average daily sales**.

Answer = 4

To test if the advertised lifespan of 1200 hours is accurate, we'll perform a **one-sample t-test** since the population standard deviation is unknown and the sample size is relatively small (n = 40).

STEP = 1

Null Hypothesis (H_0): 1200 hour

Alternative Hypothesis (H_1): !1200 hour (This is a two-tailed test.)

Given Data

- **Population means: (mu) = 1200 hour**
- **Sample mean {xbar}= 1180 hours**
- **Sample standard deviation (std) = 50 hours**
- **Sample size (n) = 40**
- **Significance level (alpha) = 0.05**

STEP = 2

STANDAR ERROR:

SE = Sigma/Sqrt(n)

Sigma (std) = 50

Sample size(n) = 40 sqrt (6.32)

50/6.32 = 7.91

STEP = 3

We use the t-statistic formula:

T CAL (XBAR- MU)/SE

XBar = 1180

MU = 1200

SE = 7.91

(1800 – 1200)/7.91 = -2.53

STEP = 4

Critical Value

Sample size (n)

Degrees of freedom (df) = 40 - 1 = 39

From the t-distribution table, **the critical t-value for a two-tailed test at α = 0.05 and df = 39 is approximately: t_{critical} 2.022**

Decision

- Calculated t-value: **-2.53**
- Critical t-value: **2.022**

Since 2.53 > 2.022, **we reject the null hypothesis**.

Conclusion

At the 0.05 significance level, there is **sufficient evidence to conclude** that the actual mean lifespan of the bulbs **differs from the advertised 1200 hours**

Answer = 5

To test whether the average height of adult males in the city differs from the national average of 5.8 feet, we'll perform a **two-tailed one-sample t-test**.

STEP = 1

Null Hypothesis (H_0): 5.8

Alternative Hypothesis (H_1): !5.8 (This is a two-tailed test.)

Given Data

- **Population mean: (mu) = 5.8feet**
- **Sample mean {xbar}= 5.7feet**
- **Sample standard deviation (std) = 0.3feet**
- **Sample size (n) = 25**
- **Significance level (alpha) = 0.01**

STEP = 2

STANDAR ERROR:

- **SE = Sigma/Sqrt(n)**

- **Sigma (std) = 0.3**
- **Sample size(n) = 25 sqrt (5)**

0.3/5 = 0.06

STEP = 3

We use the t-statistic formula:

T CAL (XBAR- MU)/SE

Xbar = 5.7

MU = 5.8

SE = 0.06

(5.7-5.8)/0.06 = 1.67

STEP = 4

Critical Value

Sample size (n)

Degrees of freedom (df) = 25 - 1 = 24

From the t-distribution table, **the critical t-value for a two-tailed test at α = 0.01 and df = 24 t_{critical} 2.797**

Decision

- Calculated t-value**: -1.67**
- Critical t-value: **2.797**

Since 1.67 < 2.797**, we fail to reject the null hypothesis.**

Conclusion

At the 1% significance level, there is not enough evidence to conclude that the average height of adult males in the city differs from the national average of 5.8 feet.