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Assignment 1
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1. Many Alpine ski centers base their calculations of revenues and profits on the belief that the average skier ski's four times a year with a population standard deviation of 2. To investigate this belief a random sample of 63 skiers was drawn and each participant was asked to report the number of times they skied last year. This yielded a mean of 4.84. Can we infer at the 10% significance level that the assumption of ski centers is wrong?

H0: $\mu = 4$
H1: $\mu \neq 4$
(Two-tail test)

63 skiers were drawn, and their average is 4.84. We are given σ as 2, and α as .10. Thus,

$$Z = \frac{4.84-4}{2/\sqrt{63}} = 3.3336 \qquad Z=\frac{\overline{X}-\mu}{\sigma_{\overline{X}}}=\frac{\overline{X}-\mu}{\sigma/\sqrt{n}}$$

P-value = $P(Z > 3.3336) + P(Z < -3.3336)$ = 0.0009 ($p < \alpha$, reject H_o!)

For $\alpha = .10$, critical values are $\pm$ 1.6449
Z calculated (3.3336) > Z critical (1.6449) - Reject H_o

We have enough evidence at 10% significance level to conclude that assumption of ski centers is wrong. The number of average skier ski's is different from 4.

2. An analyst wants to conduct a hypothesis test to determine if the mean time spent on investment research is different from 3 hours per day. A random sample of 64 portfolio managers yielded a sample mean time to be 2.5 hours. The population standard deviation is 1.5 hours. Conduct the hypothesis test using 1% level of significance and state your findings.

H0: $\mu = 3$
H1: $\mu \neq 3$
(Two-tail test)

64 portfolio managers yielded sample mean of 2.5 hours. We are given σ as 1.5, and α as .01. Thus,

$$Z = \frac{2.5-3}{1.5/\sqrt{64}} = -2.6667 \qquad Z=\frac{\overline{X}-\mu}{\sigma_{\overline{X}}}=\frac{\overline{X}-\mu}{\sigma/\sqrt{n}}$$

P-value = $P(Z > 2.6667) + P(Z < -2.6667)$ = 0.0077 ($p < \alpha$, reject H_o!)

For $\alpha = .01$, critical values are $\pm$ 2.5758
Z calculated (-2.6667) < Z critical (-2.5758) - Reject H_o

We have enough evidence at 1% significance level to conclude that mean time spent on investment research is different from 3 hours per day.

3. The owner of a coffee shop hires a new employee and wants to make sure that all lattes the new employee makes are consistent. He believes that each latte has an average of 4 oz of espresso. If this is not the case, they must increase or decrease the amount. A random sample of 25 lattes shows a mean of 4.6 oz of espresso and a sample standard deviation of .22 oz. Use alpha = .05 and run the appropriate analysis.

H0: $\mu = 4$
H1: $\mu \neq 4$
(Two-tail test)

25 lattes shows a sample mean of 4.6 oz. We are given s as .22oz, and α as .05. Thus,

$$t = \frac{4.6-4}{.22/\sqrt{25}} = 13.6364 \qquad t = \frac{\overline{X}-\mu}{s/\sqrt{n}}$$

df = n – 1 = 24 Given df, for α = .05, critical values are $\pm$ 2.0639
P-value (8.48495E-13) < .05 t calculated (13.6364) > t critical (2.0639) - Reject H_o!
(Reject H_o)

We have enough evidence at 5% significance level to conclude that we need to adjust the amount of espresso used in lattes to ensure consistency.

4. To see if women ages 18-25 years spend a different amount than the national average of $24.44 per shopping trip to a local mall, the manager surveyed 30 women. She found that the sample average amount spent per trip was $23.37 with a sample standard deviation of $3.70. With alpha = 0.05, can it be concluded that 18-25 years old spend a different amount at the local mall than the national average?

H0: $\mu = 24.44$
H1: $\mu \neq 24.44$
(Two-tail test)

Surveyed 30 women, found sample average to be $23.37. We are given s as $3.70, and α as .05. Thus,

$$t = \frac{23.37-24.44}{3.7/\sqrt{30}} = -1.584 \qquad t = \frac{\overline{X}-\mu}{s/\sqrt{n}}$$

df = n – 1 = 29 Given df, for α = .05, critical values are $\pm$ 2.0452
P-value (0.1240) > .05 |t calculated (-1.584)| < t critical (2.0452) – Fail to Reject H_o!
(Fail to reject H_o) = 1.584 < 2.0452

There is not enough evidence at 5% significance level to conclude that 18-25 years old spend a different amount at the local mall than the national average.

5. A random sample of 10 college students was drawn from a large university. Their ages are 22, 17, 27, 20, 23, 19, 24, 18, 19, and 24 years. Conduct the appropriate test to determine that the population mean is not equal to 20.

   $H0: \mu = 20$
   $H1: \mu \neq 20$
   (Two-tail test)

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

sample mean =
(22 + 17 + 27 + 20 + 23 + 19 + 24 + 18 + 19 + 24) / 10 = 21.3

$$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

sample standard deviation = 3.199

10 students were drawn, their mean and standard deviation are calculated as follows respectively, 21.3 and 3.199. We take α as .05. Thus,

$$t = \frac{21.3-20}{3.199/\sqrt{10}} = 1.2851 \qquad t = \frac{\overline{X}-\mu}{s/\sqrt{n}}$$

df = n – 1 = 9

Given df, for α = .05, critical values are $\pm$ 2.2622

P-value (0.2308) > .05
(Fail to reject H_o)

t calculated (1.2851) < t critical (2.2622) – Fail to Reject H_o!

There is not enough evidence at 1%, 5% or 10% significance levels to conclude that the population mean of ages of the students at the university is not equal to 20 years.