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DAMT Assignment -

Q4) Given

$$\bar{x} = 37.7$$

$$\sigma = 9.2$$

$$\alpha = 0.90 \Rightarrow (1-\alpha) = 1 - 0.90 = 0.10$$

The average number of concurrent users \bar{x} = 100

The random selected times is 37.7

The Standard deviation $\sigma = 9.2$.

④ Construct a 90% confidence interval for the Experience Expectation of the number of concurrent users.

$$\text{Confidence Interval} = \bar{x} + z_{\alpha/2} \left(\frac{\sigma}{\sqrt{n}} \right)$$

$$= 37.7 \pm 1.645 \left(\frac{9.2}{\sqrt{100}} \right)$$

$$= 37.7 \pm 1.5134$$

$$(36.19, 39.21)$$

Confidence interval is (36.19, 39.21)

⑤ At the 1% significance level, do these data provide significant evidence that the mean number of concurrent users is greater than 35.

$$H_0: \mu = 35 \quad H_1: \mu > 35$$

$$\alpha = 0.01$$

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

$$\approx \frac{37.7 - 35}{9.2/\sqrt{100}} = 2.93$$

$$z(2.93) > z(2.33) \quad H_0 \text{ is rejected}$$

mean of concurrent user greater than 35. $[z = 2.935]$

Q.9)

Given,

Three randomly selected computer engineers have salaries (\$ 1000s)

30, 50, 70.

a)

Construct a 90% confidence interval for the average salary of an entry-level computer engineer.

Here, $\bar{x} = \frac{30+50+70}{3} [n=3]$

$= 50$

Sample Variance $\sigma^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$

$\frac{800}{3-1} = 400$

Sample standard deviation $\sigma = 20$.

b)

at a 10% level of significance, that the average salary of an entry-level computer is different from \$ 60,000.

$\alpha = 0.1$ and the null hypothesis $H_0: \mu_0 = 80$.
Alternative hypothesis $H_A: \mu \neq 80$.

This will be two tailed test. If mean is in 90% interval, we should accept H_0 . Here, \$60 mean is inside our confidence interval [16.28, 83.71]. Therefore we accept the null hypothesis and reject alternative H_A .

We can say that sample does not provide enough evidence to support claim

Q) For 90% Confidence interval, we get (P.P)

$1-\alpha = 0.90$, and
 $\alpha = 0.1$

Confidence Interval for Standard deviation

$$\left[\sqrt{\frac{(n-1)s^2}{\chi^2_{0.05}}}, \sqrt{\frac{(n-1)s^2}{\chi^2_{0.95}}} \right]$$

$$\left[\sqrt{\frac{2(20)^2}{\chi^2_{0.05}}}, \sqrt{\frac{2(20)^2}{\chi^2_{0.95}}} \right] \quad \left\{ \begin{array}{l} \chi^2_{0.99} = 5.99 \\ \chi^2_{0.05} = 0.05 \\ \chi^2_{0.95} = 0.10 \end{array} \right\}$$

$$\left[\sqrt{\frac{800}{5.99}}, \sqrt{\frac{800}{0.1}} \right]$$

$$= [11.5566, 89.4427]$$

Q) 10) we collect a sample of 200 items and find 24 defective items in it.

for the given Sample size $n = 200$
where, defective items is 24.

$$\text{Proportion} = 24/100 = 0.12$$

Q) Confidence interval for the proportion will be

Here $\alpha = 0.04$

$$Z_{1/2} = Z_{0.02} = 2.055$$

$$C.I. = \hat{p} + Z_{1/2} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$$= 0.12 \pm (2.0555) \sqrt{\frac{(0.12)(0.88)}{200}}$$

$$\Rightarrow 0.12 \pm 0.0472$$

$$[0.0728, 0.1672]$$

- (b) At most 1 in 10 times is defective so, for significance level $\alpha = 0.04$
 null hypothesis $H_0: P_0 = 0.1$
 one sided tail alternative $H_A: P_0 > 0.1$
 or

Z-test for proportion based on sample size $n = 200$

$$Z_{\text{obs}} = \frac{\hat{P} - P_0}{\sqrt{\frac{P_0(1-P_0)}{n}}} = \frac{0.12 - 0.1}{\sqrt{\frac{(0.1)(0.9)}{200}}} = 0.9434.$$

for the right tail test;

$$P(Z \geq Z_{\text{obs}}) = 1 - \phi(0.9434)$$

$$= 1 - 0.8264$$

$$\approx 0.1736.$$

Since, our P-value exceeds for both of our α values $0.04 \& 0.15$, we will accept null hypothesis. We do not have sufficient evidence to disprove this claim for a 1% to 15% level of significance.

9.15)

T.A

Def. X.

n

Proportion

$$D_A = 42/70 = 0.6$$

Ques: T.B.W.S. consists of 59 + 100 = 159 mabsorts of 59% & 41 mabsorts of 41% of the total.

Ans: $D_B = 59/159 = 0.377$

Null hypothesis where $H_0: \hat{P}_1 = \hat{P}_2 = 0$
 $H_1: \hat{P}_1 - \hat{P}_2 \neq 0$

$$\alpha = 0.05$$

Test statistic is.

$$Z = \frac{\hat{P}_1 - \hat{P}_2}{\sqrt{\frac{\hat{P}_1(1-\hat{P}_1)}{n_1} + \frac{\hat{P}_2(1-\hat{P}_2)}{n_2}}}$$

$$= \frac{0.6 - 0.59}{\sqrt{\frac{0.6(1-0.6)}{70} + \frac{0.59(1-0.59)}{100}}}$$

$$= 0.13$$

P-value for the test statistic.

$$P\text{-value} = 2P(Z > z_0)$$

$$= 2(1 - P(Z \leq 0.13))$$

$$= 2(1 - 0.551717)$$

$$= 2(0.448283)$$

$$= 0.896566$$

P-value > 0.05 (reject hypothesis)

No significant difference between \bar{P}_A & \bar{P}_B at level 5%

9.16)

	mean	Standard deviation	Sample size
Before	50.00	7.62	14
After	40.20	7.96	20

$$df = n_1 + n_2 - 2$$

$$= 14 + 20 - 2$$

$$> 32$$

Critical value of 95% confidence interval with 32 degree of freedom is

$$= 2.037$$

Q Given 95% confidence Interval = ?

$$(\bar{x}_1 - \bar{x}_2) \pm t_{0.025} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$n_1 = 14, n_2 = 20$$

$$\bar{x}_1 = 50.00, \bar{x}_2 = 40.20$$

$$s_1 = 7.62, s_2 = 9.96$$

$$s_p = \sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1 + n_2 - 2}}$$

$$= \sqrt{\frac{(14-1)(7.62)^2 + (20-1)(9.96)^2}{14 + 20 - 2}}$$

$$= \sqrt{\frac{1958.708}{32}} = 7.8236$$

\therefore 95% confidence interval.

$$= (\bar{x}_1 - \bar{x}_2) \pm t_{0.025} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$= (50 - 40.20) \pm (2.037)(7.8236) \sqrt{\frac{1}{14} + \frac{1}{20}}$$

$$= 9.8 \pm (15.93667) \sqrt{0.121429}$$

$$= 9.8 \pm (15.93667)(0.345466)$$

$$= 9.8 \pm 5.5534$$

$$(9.8 - 5.5534, 9.8 + 5.534)$$

$$(4.2466, 15.3534)$$

(b) H₀: no significant reduction in rate of intrusion attempts.

H₁: there is significant reduction in rate of intrusion attempts.

$$X = 0.05$$

when varience are assumed equal,

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$\approx \frac{(50 - 40.20)}{\sqrt{8.236 \sqrt{\frac{1}{14} + \frac{1}{20}}}} \approx \frac{9.8}{\sqrt{12.4289}} = \underline{\underline{3.595}}$$

P-value = $\text{TDIST}(n, \text{degree of freedom}, \text{tails})$

$$\text{P-value} = \text{TDIST}(3.595, 32, 2) \\ = \underline{\underline{0.001091}}$$

~~P-value < 0.05~~

P-value is < 0.05
reject null hypothesis

when varience are assumed unequal

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}} \\ = \frac{(50 - 40.20)}{\sqrt{\left(\frac{7.62}{14}\right)^2 + \left(\frac{4.96}{20}\right)^2}} \\ = \frac{9.8}{\underline{\underline{2.40}}} \\ = \underline{\underline{3.629}}$$

If of varience to be equal is

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} \right)^2}{\frac{s_1^2}{n_1(n_1-1)} + \frac{s_2^2}{n_2(n_2-1)}}$$

Dimensional Analysis
6P350500

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$$F = \left(\frac{(7.62)^2}{14} + \frac{(7.96)^2}{20} \right)$$
$$= \left(\frac{(7.62)^2}{14} + \frac{(7.96)^2}{20} \right)$$
$$= \frac{(7.62)^2}{14} + \frac{(7.96)^2}{20}$$
$$= 28.90$$

$$P\text{-value} = 1 - \text{DIST}(3.629, 28, 2)$$
$$\approx 0.001125$$

P-value < 0.05 , reject hypothesis H_0 . Both cases when variance are assumed to be equal and variance are assumed to be unequal we reject H_0 .

This is a significant reduction in rate of intrusion attempt.

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9.20) pilot Sample of 40 installation
Time has a sample standard deviation $s = 6.2 \text{ min}$
and the assumed $\sigma = 5 \text{ min}$
 $\sigma = 5, s = 6.2 \text{ & } n = 40$

Null hypothesis : $H_0 = \sigma^2 = 25$
Alternative hypothesis : $H_1 = \sigma^2 \neq 25$
level of significance $\alpha = 0.05$,

Test statistic is $\frac{(n-1)s^2}{\sigma^2}$

$$\frac{(40-1)(6.2)^2}{25} = \frac{39 \times 38.44}{25}$$

$$\frac{1499.16}{25} = 59.9664$$

The degree of freedom is $40 - 1 = 39$

The P-value is $P\text{-value} = 0.017043$ [Chi-Square distribution].

The P-value (0.017043) is less than the given Significance level (0.05)

→ Hence you can reject null hypothesis.

9.22) mean
SD

Sample size

	Server A	Server B
mean	6.7	7.5
SD	0.6	1.2
Sample size	30	20

$$H_0: \sigma_x = \sigma_y$$

$$H_1: \sigma_x \neq \sigma_y$$

Test statistic is f-test values

$$F = \frac{S_y^2}{S_x^2} = \frac{(1.2)^2}{(0.6)^2} = \frac{1.44}{0.36} = 4$$

$$df \Rightarrow v_1 = n_1 - 1 = 30 - 1 = 29$$

$$v_2 = n_2 - 1 = 20 - 1 = 19$$

P-value is < 0.05 , we reject null hypothesis
evidence say that variance are unequal
 $(\sigma_x^2 \neq \sigma_y^2)$

(b)

f-critical value all

$$f_{left} = F(1 - \alpha_{12}, n_1 - 1, n_2 - 1)$$

$$= F(0.975, 29, 19) = 0.448 \quad [\because \text{from f-table, } f_{left} \text{ value}]$$

$$f_{right} = F[\alpha_{12}, n_1 - 1, n_2 - 1]$$

$$= F[0.025, 29, 19] = 2.402$$

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Confidence interval

$$F_{left} = F\left(\alpha/2, n_1 - 1, n_2 - 1\right)$$

$$= F(0.975, 29, 19) = 0.448 \quad [\because \text{from f-table}]$$

$$F_{right} = F[\alpha/2, n_1 - 1, n_2 - 1]$$

$$= F[0.025, 29, 19] = 2.402$$

Confidence interval

$$F_{left} \left(\frac{s_x^2}{s_y^2} \right) < \frac{\sigma_x^2}{\sigma_y^2} < F_{right} \left(\frac{s_x^2}{s_y^2} \right)$$

$$\therefore (0.448) \left(\frac{(0.6)^2}{(1.2)^2} \right) < \frac{\sigma_x^2}{\sigma_y^2} < 2.402 \\ \therefore 0.112 < \frac{\sigma_x^2}{\sigma_y^2} < 0.6005$$

$$= 0.11 < \frac{\sigma_x^2}{\sigma_y^2} < 0.60.$$

Required confidence interval.

$$0.11 < \frac{\sigma_x^2}{\sigma_y^2} < 0.60$$

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9.23)

	Quiz 1	Quiz 2	Quiz 3	Quiz 4	Quiz 5	Quiz 6
Anthony	85	92	97	65	75	96
Eric	81	79	76	84	83	77

$$\text{mean } (\bar{x}) = \frac{\sum x_i}{n} \Rightarrow \frac{85+92+97+65+75+96}{6}$$

$$\begin{aligned} \text{Standard deviation } (s_n) &= \sqrt{\frac{1}{n-1} \sum (x_i - \bar{x})^2} \\ &= \sqrt{\frac{(85-85)^2 + (92-85)^2 + \dots + (96-85)^2}{6-1}} \\ &= \sqrt{\frac{814}{5}} = \underline{12.259} \end{aligned}$$

$$\text{mean } (\bar{x}_e) = \frac{\sum x_i}{n} \Rightarrow \frac{81+79+76+84+77+83}{6}$$

$$480/6 = 80$$

$$\begin{aligned} SD &= \sqrt{\frac{1}{n-1} \sum (x_i - \bar{x})^2} \\ &= \sqrt{\frac{(81-80)^2 + (79-80)^2 + \dots + (77-80)^2}{6-1}} \\ &= \sqrt{\frac{52}{5}} \\ &= \underline{3.225} \end{aligned}$$