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DAMT Assignment.

9.7) 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 at = 100
The random selected times is 37.7
The Standard deviation $\sigma = 9.2$.

(a) 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 $(36.19, 39.21)$

(b) At the 1% Significance level, do these data provide Significance evidence that the mean number of concurrent users is greater than 35.

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

$\alpha = 0.01$

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

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

$z(2.93) > z(2.33)$ H_0 is rejected

mean of concurrent user greater than 35. $\boxed{z = 2.935}$

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9.9) given,
Three randomly selected computer engineers have Salaries (\$ 1000s)
30, 50, 70.

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

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

$= 50$

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

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

Sample standard deviation $\sigma = 20$.

(b) at a 10 % level of significance, that the average salary of all entry-level computer is different from \$ 80,000.

$\alpha = 0.1$ and the null hypothesis $H_0: \mu_0 = 80$
Alternative hypothesis $H_A: \mu_A \neq 80$.
This will be twin tailed test, If mean is in 90% interval, we should accept H_0. Here, 80 mean is inside our confidence interval [16.28, 83.11]
Therefore we accept the null hypothesis and reject alternative H_A.
we can say that sample does not provide enough evidence to support claim

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(c) for 90% confidence interval, we get

$1-\alpha = 0.90$

$\alpha = 0.1$

Confidence interval for standard deviation

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

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

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

$$= [11.5566, 89.4427]$$

9. (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.

Proportion $= 24/100 = 0.12$

(a) Confidence interval for the proportion will be

Here $\alpha = 0.04$

$Z_{\alpha/2} = Z_{0.02} = 2.055$

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

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

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$\Rightarrow 0.12 \pm 0.0472$
$[0.0728, 0.1672]$

(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 $H_A : P_0 > 0.1$
on

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

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

for the right tail test;

$$P\{Z \geq Z_{obs}\} = 1 - \phi(0.9434)$$
$$= 1 - 0.8264$$
$$= 0.1736.$$

→ 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 4.1 & 15% level of significance.

9.15)

	x	n	Proportion
T_A	42	70	$p_A = 42/70 = 0.6$
T_B	59	100	$p_B = 59/100 = 0.59$

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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-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 $\hat{P}_A$ & $\hat{P}_B$ at level 5%

9.18)

	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

$= 2.037$

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(a) Given 95% confidence Interval =

$(\bar{x}_1 - \bar{x}_2) \pm t_{a/2}\, S_p \sqrt{1/n_1 + 1/n_2}$

$n_1 = 14$, $n_2 = 20$

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

$s_1 = 7.62$, $s_2 = 7.96$

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

$$= \sqrt{\frac{(14-1)(7.62)^2 + (20-1)(7.96)^2}{14+20-2}}$$

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

$$= \sqrt{61.2096}$$

$$= 7.8236.$$

$\therefore$ 95% confident indeed.

$$= (\bar{x}_1 - \bar{x}_2) \pm t_{a/2}\, S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

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

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

$$= 9.8 \pm (15.93667)(0.348466)$$

$$= 9.8 \pm 5.5534.$$

$(9.8 - 5.5534, 9.8 + 5.534)$

$(4.2466, 15.3534)$

(b) Ho: no significant reduction in rate of instrusion attempts.

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

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1002022847

$\alpha = 0.05$

when varience are accused equal,

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

$$= \frac{(50 - 40.20)}{7.8236 \sqrt{\frac{1}{14} + \frac{1}{20}}} = \frac{9.8}{2.7262} = 3.595$$

P-value = (TDIST (x, degree of freedom, tails)

P-value = (TDIST (3.595, 32, 2))
= 0.001091

~~p-value~~ (P-value is < 0.05

reject null hypothesis

when varience are accused unequal

$$t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}}$$

$$= \frac{(50.00 - 40.20)}{\sqrt{\frac{(7.62)^2}{14} + \frac{(7.96)^2}{20}}}$$

$$= \frac{9.8}{2.70}$$

$$= 3.629$$

If of varience to be equal is

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{s_1^4}{n_1^2(n_1-1)} + \frac{s_2^4}{n_2^2(n_2-1)}}$$

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

$$= \frac{\left(\frac{(7.62)^2}{14} + \frac{(7.96)^2}{20} \right)^2}{\frac{(7.64)^4}{14^2(14-1)} + \frac{(7.96)^4}{20^2(20-1)}}$$

$$= 28.90$$

P-value = TDIST(3.629, 28. 2)
= 0.001125

P-value < 0.05, reject hypothesis H_0. Both cases when variance are consumed 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 $s = 6.2$ min
and the assumed of $\sigma = 5$ min
$\sigma = 5$, $s = 6.2$ & $n = 40$
Null hypothesis: $H_0 = \sigma^2 = 5^2$
Alternative hypothesis: $H_1 = \sigma^2 \neq 5^2$
Level of significance = $\alpha = 0.05$.

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

$\frac{(40-1)(6.2)^2}{5^2} = \frac{39 \times 38.44}{25}$

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

The degree of freedom is
$\Rightarrow n-1 \quad 40-1 = 39$

The p-value is
P-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.

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9.22)

	Server A	Server B
mean	6.7	7.5
SD	0.6	1.2
Samplisize	30	20

$H_0 : \sigma x = \sigma y$
$H_1 : \sigma x \neq \sigma y$
$\alpha = 0.05$

Test statistic is f-test values

$f = \frac{Sy^2}{Sx^2} = \frac{(1.2)^2}{(0.6)^2} = \frac{1.44}{0.36} = 4$

$df \Rightarrow v_1 = n_1 - 1 = 30 - 1 = 29$
$v_2 = n_2 - 1 = 20 - 1 = 19.$

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
$f_{left} = F(1 - \alpha/2, n_1 - 1, n_2 - 1)$
$= F(0.975, 29, 19) = 0.448$ [∴ from f-table of value]

$f_{right} = F[\alpha/2, n_1 - 1, n_2 - 1]$
$= F[0.025, 29, 19] = 2.402$

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Confidence interval

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

$= F(0.975, 29, 19) = 0.448$ [∴ from f-table of value]

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

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

confidence interval

$$F_{left}\left(\frac{S_x^2}{S_x^2}\right) < \frac{\sigma x^2}{\sigma x^2} < F_{right}\left(\frac{S_x^2}{S_y^2}\right)$$

$$= (0.448)\left(\frac{(0.6)^2}{(1.2)^2}\right) < \frac{\sigma x^2}{\sigma y^2} < 2.402\left(\frac{(0.6)^2}{(1.2)^2}\right)$$

$$= 0.112 < \frac{\sigma x^2}{\sigma y^2} < 0.6005$$

$$= 0.11 < \frac{\sigma x^2}{\sigma y^2} < 0.60.$$

Required confidence Interval.

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9.23)

	Quiz1	Quiz2	Quiz3	Quiz4	Quiz5	Quiz6
Anthony	85	92	97	65	75	96
Eric	81	79	76	84	83	77

mean $(\bar{x}) = \frac{\Sigma n}{n} = \frac{85+92+97+65+95+96}{6}$

$= 85$

Standard deviation $(sn) = \sqrt{\frac{1}{n-1}\Sigma(x_i - \bar{x})^2}$

$= \sqrt{\frac{(85-85)^2 + (92-85)^2 + \cdots + (96-85)^2}{6-1}}$

$\sqrt{814/5} = 12.759$

mean $(\bar{x}_E) = \frac{\Sigma u}{n} = \frac{81+79+76+84+37+83}{6}$

$480/6 = 80$

$SD = \sqrt{\frac{1}{n-1}\Sigma(x_i - \bar{x})^2}$

$= \sqrt{\frac{(81-80)^2 + (79-80)^2 + \cdots + (77-80)^2}{6-1}}$

$= \sqrt{52/5}$

$= \underline{\underline{3.225}}$

@ Is there significant evidence to support Anthony's claim? State H_0 and H_A. Test equality of variance and choose a suitable two-sample t test. Then conduct the test and state conclusions.

H_0 based on anthony claim will be
$H_0 = \mu_x = \mu_y$ and $H_A : \mu_x > \mu_y$
and the comparing variances as the static
H_0 $\sigma_x = \sigma_y$ and H_A $\sigma_x \neq \sigma_y$
then

$$f_{obs} = \frac{s_x^2}{s_y^2} = \frac{(12.25)^2}{(3.22)^2} = 15.65$$

Since $n = 6$ we have $(n-1)$ is 5 degree
using f-distribution we have
$P = (0.002)(0.01)$
Now we can understand that there is a significant change in P and variance.

for t-distribution.
$H_0 = \mu_x = \mu_y$ and $H_A = \mu_x > \mu_y$

$$t_{obs} = \frac{\mu_x - \mu_y}{\sqrt{\frac{\sigma_x^2}{n} + \frac{\sigma_y^2}{n}}} = \frac{85 - 8}{\sqrt{\frac{(12-76)^2}{6} + \frac{(3.22)^2}{n}}}$$

$\Rightarrow 0.43$

Now using approximation:

$$\frac{\left(\frac{S_x^2}{n} + \frac{S_y^2}{n}\right)^2}{\frac{S_x^2}{n^2(n-1)} + \frac{S_y^2}{m^2(m-1)}} = \frac{\left(\frac{12.76^2}{6} + \frac{3.2^2}{6}\right)^2}{\frac{12.76}{180} + \frac{3.26}{180}} \approx 5.64$$

by using distribution - table

$\underline{\underline{P > 0.010}}$

We don't have enough data to support anthoy's ~~cate~~ claim.

(ii) Is there significant variance ~~ratio~~ evidence to support Eric's claim.

$H_0 : \sigma_x = \sigma_y$ and $H_A = \sigma_x > \sigma_y$

from which

$0.001 < p < 0.005$

from ~~which~~ this we can significant evidence that Eric is more stable