General Procedure For Testing hypothesis About μ or Mean. σ (known):-

(i) Formulation of Hypothesis:

null hyp $H_0: \mu = \mu_0$ general notation
alternative hyp $H_1: \mu \neq \mu_0$.

(ii) Level of Significance:

$\alpha = 0.05$ or 5%.

(iii) Test Statistic:

$$Z = \frac{\bar{X} - \mu_0}{\sigma / \sqrt{n}}$$

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$$Z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

(iv) Critical Region:

Reject H_0 if

$Z\,(\text{cal}) \geq / > \alpha/2)$

(v) Calculation:

(vi) Conclusion:

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Example:

10 devices cell is taken voltage test gives the following result 1.52, 1.53, 1.49, 1.48, 1.47, 1.49, 1.51, 1.50, 1.45, 1.46. The mean voltage of the cells when store volts 1.51 volts Assuming the S.D to remain unchanged at 0.02V is there reason to believe that the cell has deteriorated are $\alpha = 0.05$.

① Formation of hypothesis:-

Null hypothesis:-

$H_0 : \mu = 1.51$

Alternative hypothesis:

$H_1 : \mu \neq 1.51$

$H_0 : \mu = 1.51$

Alternative hypothesis:

$H_1 : \mu \neq 1.51$

(2) Level of Significance:

$\alpha = 0.05$

(3) Test Statistic:

$$Z = \frac{\bar{X} - \mu_0}{\sigma / \sqrt{n}}$$

(4) Critical region:

Reject H_0 if

$$|Z_{(cal)}| \geq Z_{\alpha/2}$$

$$|Z_{(cal)}| \geq Z_{(0.05/2)}$$

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$$|Z_{(cal)}| \geq Z_{0.0025}$$

$$|Z_{(cal)}| \geq 1.96$$

(5) Calculation:

$n = 10$, $\sigma = 0.02$, $\mu_0 = 1.51$

$\bar{x} = ?$

$$\bar{x} = \frac{\sum x_i}{n}$$

$$\bar{x} = 1.49$$

$$Z = \frac{1.49 - 1.57}{0.02/\sqrt{10}}$$

$$Z = -3.162.$$

$0.02/\sqrt{10}$

$Z = -3.162.$

(6) Conclusion:

From the provided evidence $3.162 \geq 1.96$ So we reject H_0 and concluded that result are significant.

Example:

A home heating oil delivery Company would like to estimate the annual usage for its Constomers who lives in Single Family home. A Sample 100 customers indicated an average annual usage of 1103 gallons on a Simple S.D of 327.8 gallous At the 100% level of Significant is the evidence that the annual usage exceeds 1000 gallons per year?

(1) Formation of hypothesis:

Null : H_0 : $\mu \leq 1000$

Alternative : H_1 : $\mu > 1000$.

(2) Level of Significance:

$$\alpha = 0.01$$

(3) Test Statistic:

$$Z = \frac{\bar{X} - \mu}{S.D / \sqrt{n}}.$$

$S.D/\sqrt{n}$.

nce

(4) Critical region:

Reject H_0 if

$Z_{(cal)} \geq Z_\alpha$.

$Z_{(cal)} \geq Z_{0.01}$

$Z_{(cal)} \geq 2.326$.

(5) Calculation:

$n = 100, \bar{x} = 1103, S = 327.8$

$$Z = \frac{110.3 - 1000}{327.8/\sqrt{100}}$$

$Z = 3.14$.

(6) Conclusion:

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From the provided evidence.

$3.14 \geq 2.326$ so we reject H_0 and concluded that results are significant.

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One Sample z test for testing mean

σ known

$$z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

σ known n > 30

$$z = \frac{\bar{x} - \mu_0}{S / \sqrt{n}}$$

One Same t - test for Testing mean

σ - known

$$t = \frac{\bar{x} - \mu_0}{s / \sqrt{n}}$$ with $(n-1)$ d.f

Formulas for Small & Capital "S":

$$S = \sqrt{\frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2}$$

$$s = \sqrt{\frac{1}{n-1}\left(\Sigma x^2 - \left(\frac{\Sigma x}{n}\right)^2\right)}$$

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$$s = \sqrt{\frac{1}{n-1}\left(\Sigma x^2 - \left(\frac{\Sigma x}{n}\right)^2\right.}$$

Q: General Procedure for testing mean when σ is unknown.

(1) Formation of hypothesis:

Null hypothesis $H_0: \mu = \mu_0$

Alternative hypothesis $H_0: \mu \neq \mu_0$

Level of Significance:

$\alpha = 0.05$.

Test Statistic:

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} \quad \text{with } \nu = n-1 \text{ df}$$

Critical region:

$$|t_{(cal)}| \geq t_{\alpha/2}(\nu) \Rightarrow \text{(new)}$$

Calculation:

Conclusion:

One Tail Test

$H_0: \mu = \mu_0$

$H_1: \mu < \mu_0$

$t_{(cal)} \leq t_\alpha(\nu)$

:Exercise:

Q:1

(1) Formation of hypothesis:.

Null hypothesis : $H_0 : \mu = 67.39$

Alternate hypothesis: $H_1 : \mu > 67.39$

(2) Level of Significance:

$\alpha = 0.05$

(3) Test Statistics:-

$$z = \frac{\bar{x} - \mu_0}{\sigma / \sqrt{n}}$$

(4) Critical region:-

Rej H_0 if

$|z_{cal}| \geq z_{0.05}$

$|z_{cal}| \geq 1.645$.

Rej H_0 if

$$|Z_{(cal)}| \geq Z_{0.05}$$

$$|Z_{(cal)}| \geq 1.645.$$

(5) Calculation:

Data:

$\mu_0 = 67.39$, $\sigma = 1.30$

$n = 400$, $\bar{x} = 67.47$

$$Z = \frac{67.47 - 67.39}{1.30 / \sqrt{400}}$$

$$Z = 1.23$$

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From Provided evidence $1.645 \geq 1.28$
So we ~~accept~~ don't reject H_0 and results are insignificant.

Q:2 A Sample of 100 observation from a Population with $\sigma = 2$ inches has $\bar{x} = 66.5$ inches. Test the null hypothesis $H_0 : \mu = 67$ against the alternative hypothesis $H_1 : \mu \neq 67$ use 1% level of hypo.

Formation of hypothesis:

Null Hypothesis : $H_0 : \mu = 67$
Alternate hypothesis: $H_1 : \mu \neq 67$

Null Hypothesis : $H_0 : \mu = 67$

Alternate hypothesis: $H_1 : \mu \neq 67$

(2) Level of Significance:

$$\alpha = 0.01$$

(3) Test Statistics:-

$$Z = \frac{\bar{X} - \mu_0}{\sigma / \sqrt{n}}$$

(4) Critical region:

Reject Ho if

$$|Z_{(cal)}| \geq Z_{0.01}$$

$$|Z_{(cal)}| \geq 2.575$$

Q:3 A Sample of 900 plants is found to have a mean of 34 cm. can it is reasonable regarded as a random Sample from a large Population with mean 32 cm and Standard deviation 23 cm. use 5% level of significance.

Formation of hypothesis:

Null hypothesis: $H_0 : \mu = 32$

Alternative hypothesis: $H_1 : \mu \neq 32$.

(2) Level of Significance:

$\alpha = 0.05$

(3) Test Statistics:

$$Z = \frac{\bar{x} - \mu_0}{S.D/\sqrt{n}}$$

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(4) Critical region:

Reject H_0 if:

$$|Z_{(cal)}| \geq Z_{0.05}$$

$$|Z_{(cal)}| \geq 1.645.$$

(5) Calculation.

Data:

$n = 900$, $\bar{x} = 34$, S.D $= 23$

$$Z = \frac{34 - 32}{23/\sqrt{900}}$$

$$Z = 2.61$$

CHAPTER # 17

(10) outline:

Testing hypothesis about variance of a normal population:

(1) Formation of hypothesis:

$H_0 : \sigma^2 = \sigma_0^2$ and $H_1 : \sigma^2 \neq \sigma_0^2$

$H_0 : \sigma^2 \leq \sigma_0^2$ and $H_1 : \sigma^2 \geq \sigma_0^2$

$H_0 : \sigma^2 \geq \sigma_0^2$ and $H_1 : \sigma^2 \leq \sigma_0^2$

(2) Level of Significance:

$\alpha = 5\%, 2\%, 1\%$

(3) Test Statistic

$\chi^2 = nS^2$

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Calculation:

Conclusion:

$$S^2 \; \frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2$$

$$S = \sqrt{\frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2}$$

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Q:1 A Sample of 25 observation has $S^2 = 12.6$ would you accept or reject at the 5% level of significance the hypothesis that $\sigma^2 = 20$.

Null hypothesis: $H_0 : \sigma^2 = 20$

Alternative hypothesis: $H_1 : \sigma^2 \neq 20$

level of Significant:

$\alpha = 0.05$

Test Statistic:

$$\chi^2 = \frac{nS^2}{\sigma_0^2}$$

$$v = (n-1)\,df$$

$v = (n-1)$ df

Critical region:

$$\chi^2 \le \chi^2_{1-\frac{\alpha}{2}}(n-1), \quad \chi^2 \le \chi^2_{1-\frac{0.05}{2}}(24)$$

$$\chi^2 \ge \chi^2_{\frac{\alpha}{2}}(n-1), \quad \chi^2 \ge \chi^2_{\frac{0.05}{2}}(24)$$

Calculation.

$$\chi^2 = \frac{ns^2}{\sigma_0^2}$$

Since $n = 25$, $s^2 = 12.6$, $\sigma^2 = 20$

$$\chi^2 = \frac{25(12.6)}{20} = \frac{316}{20} = 15.8$$

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Conclusion:

From the provided evidence $15.8 \neq 12.40$ So, we don't reject H_0 and concluded that the results are insignificant.

Q:2 A Sample of 9 Parts produced

$\alpha = 5\%, 2\%, 1\%$.

(3) Test Statistic

$$\chi^2 = \frac{nS^2}{\sigma_0^2}$$

$$\chi^2 = \frac{\Sigma (x-\bar{x})^2}{\sigma_0^2}$$

with $v = (n-1)$ df

(4) Critical region:

Reject H_0 if

(i) $\chi^2_{(cal)} \leq \chi^2_{1-\frac{\alpha}{2}}(n-1)$ and $\chi^2_{(cal)} \geq \chi^2_{(\alpha/2)}(n-1)$

$\alpha/2 (n-1)$

(ii) $\chi^2_{(cal)} \geq \chi^2_{\alpha}(n-1)$

(iii) $\chi^2_{(cal)} \leq \chi^2_{1-\alpha}(n-1)$

$|Z_{(cal)}| \geq 1.645.$

(i) **Calculation:**

Data:

$n = 900$, $\bar{x} = 34$, S.D $= 23$

$$Z = \frac{34 - 32}{23 / \sqrt{900}}$$

$$Z = 2.61$$

Conclusion:

From Provided evidence $2.61 \geq 1.645$, So we reject Ho, and the result are significant.

Calculation:

Data: $\sigma = 2$, $\bar{x} = 66.5$

$n = 100$, $\mu = 67$

$$z = \frac{66.5 - 67}{2/\sqrt{100}}$$

$$z = -2.5$$

Conclusion:

From providing evidence $2.5 \ngtr 2.575$ dont reject H_0 and the result are insignificant.

Q:3 A Sample of 900 Plants is found to