

TESTING OF HYPOTHESIS FOR POPULATION VARIANCE USING

Z-TEST [NORMAL POPULATION] :

1. $H_0 : \sigma^2 = \sigma_0^2$; $H_1 : \sigma^2 \neq \sigma_0^2$ For two-tailed test

$H_0 : \sigma^2 \leq \sigma_0^2$; $H_1 : \sigma^2 > \sigma_0^2$
 $H_0 : \sigma^2 \geq \sigma_0^2$ (OR) ; $H_1 : \sigma^2 < \sigma_0^2$ } For one-tailed test

2. TEST STATISTIC :

$$Z = \frac{|\sigma_s^2 - \sigma_0^2|}{\sigma_0^2 \sqrt{\frac{2}{n}}} \sim N(0,1)$$

~~TEST~~

3. If $Z_{cal} < Z_{\alpha}$; H_0 is Accepted
otherwise rejected.

Problems:

- A random sample of size 65 screws is taken from a population of big box of screws and measured their length (in mm) which gives sample variance 9.0. Test the two years old population variance 10.5 is still maintained at present at 5% Level of significance.

TESTING OF HYPOTHESIS FOR TWO POPULATION VARIANCES USING Z-TEST

1. $H_0 : \sigma_1^2 = \sigma_2^2$ and $H_1 : \sigma_1^2 \neq \sigma_2^2$ For two-tailed test

$H_0 : \sigma_1^2 \leq \sigma_2^2$ and $H_1 : \sigma_1^2 > \sigma_2^2$
 $H_0 : \sigma_1^2 \geq \sigma_2^2$ (OR) and $H_1 : \sigma_1^2 < \sigma_2^2$ } For two-tailed test

2. TEST STATISTIC:

$$Z = \frac{|(\sigma_{s1}^2 - \sigma_{s2}^2) - (\sigma_1^2 - \sigma_2^2)|}{\sqrt{\frac{2\sigma_1^4}{n_1} + \frac{2\sigma_2^4}{n_2}}} \sim N(0, 1)$$

If $\sigma_1^2 = \sigma_2^2 = \sigma^2$ then

$$Z = \frac{|(\sigma_{s1}^2 - \sigma_{s2}^2)|}{\sigma^2 \sqrt{2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \sim N(0, 1)$$

If σ_1^2 & σ_2^2 are unknown, then

$$Z = \frac{|(\sigma_{s1}^2 - \sigma_{s2}^2)|}{\sigma_{s1}^2 \sqrt{2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

3. If $|Z_{cal}| < Z_{\alpha}$; H_0 is Accepted otherwise Rejected.

Problems:

Q1. A comparative study of variation of weights (in pound) of army soldiers and Navy sailors was made. The sample variance of the weight of 120 soldiers was 60 pounds and the sample variance of the weight of 160 sailors was 70 pounds. Test whether the soldiers and sailors have equal variation in their weights. Use 5% level of significance.

Q2 ~~A comparative study of~~ A random sample of size 120 bulbs is taken from a lot of which gives the standard deviation of the life of electric bulbs 7 hours. Test the standard deviation of the life of bulbs of the lot is 6 hours at 5% level of significance.

Q2 Two sources of raw materials of bulbs are under consideration by a bulb manufacturing company. Both sources seem to have similar characteristics but the company is not sure about their respective uniformity. A sample of 52 lots from source A yields variance 25 and a sample of 40 lots from source B yields variance 7. Test whether the variance of source A significantly ~~differs~~ differs to the variance of source B at $\alpha = 0.05$?