Test for difference for two means:

Formula:

Null hypothesis : $H_0 : \mu_1 = \mu_2$

Test statistic , $z = \dfrac{\bar{x}_1 - \bar{x}_2}{\sqrt{\dfrac{\sigma^2}{n_1} + \dfrac{\sigma^2}{n_2}}}$, $\sigma_1 = \sigma_2 = \sigma$

$$\frac{\bar{x}_1 - \bar{x}_2}{\sigma\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

(or)

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sigma\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad \text{(or)} \quad z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

1) The mean two ~~symbol~~ simple large sample of 1000 and 2000 numbers are 67.5 inches and 68 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation of 2.5 inches. Test at 5% level of significant.

Given:

$n_1 = 1000$, $n_2 = 2000$

$\bar{x}_1 = 67.5$, $\bar{x}_2 = 68$

$\sigma = 2.5$ inches.

Step 1: Formulate μ_0 & μ_1

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 \neq \mu_2$ [two tail test]

Step 2: $LOS_\alpha = 5\% = 0.05$

Step 3: Test of statistic

$$Z = \frac{\overline{x_1} - \overline{x_2}}{\sigma\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$= \frac{67.5 - 68}{2.5\sqrt{\frac{1}{1000} + \frac{1}{2000}}}$$

$$= -5.164$$

$$|Z| = 5.164$$

Step 4: Critical value of 5% is $Z_\alpha = 1.96$

Step 5: Conclusion.

$|Z| = 5.164 > 1.96 = Z_\alpha$

$\therefore$ H_0 is rejected

$\therefore$ H_1 is accepected.

Example (2):

A simple sample of hight of 6400 sailors has a mean of 67.85 inches and S.D of 2.56 inches while a simple sample of height 1600 soldiers. has a mean of 68.55 inches and SD of 2.52 inches. To the data that indicates soilders are on the average taller than sailors? Use 5% level of significant.

Given :

$n_1 = 6400$ $\quad$ $n_2 = 1600$

$\overline{x_1} = 67.85$ $\quad$ $\overline{x_2} = 68.55$

$S_1 = 2.56$ $\quad$ $S_2 = 2.52$

Step 1: Formulate H_0 and H_1

H_0 : $\mu_1 < \mu_2$ [left one tail]

H_1 : $\mu_1 > \mu_2$

Step 2 : $LOS_\alpha = 5\% = 0.05$

Test 3 : Test of statistic

$$Z = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$\overline{x_1} - \overline{x_2}$

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$$= \frac{67.85 - 68.55}{\sqrt{\frac{(2.56)^2}{6400} + \frac{(2.52)^2}{1600}}}$$

$$= \frac{-0.7}{\sqrt{\frac{6.55}{6400} + \frac{6.35}{1600}}}$$

$$= \frac{-0.7}{\sqrt{0.001 + 0.003}}$$

$$\Rightarrow \frac{-0.7}{\sqrt{0.004}} = \frac{-0.7}{0.0632} =$$

$$\Rightarrow \frac{-0.7}{\sqrt{\frac{6.5536}{6400} + \frac{6.3504}{1600}}} = \frac{-0.7}{\sqrt{0.001024 + 0.003969}}$$

$$\frac{-0.7}{\sqrt{0.004993}} = -9.915 \Rightarrow |z| = 9.915$$

Step 4:

Critical value of 5% is $Z_\alpha = -1.645$

Step 5:

Conculusion:

$|z| = 9.915 > -1.645 = Z_\alpha$

$\therefore$ H_0 is rejected, H_1 is accepted.