Semester : IV   Subject : Statistics for AI&DS   Academic Year: 2023-2024.

Z-TEST and t-test:

Z-test is the statistical hypothesis used to determine whether the two sample means calculated are different if the standard deviation is available and the sample is large ($n>30$).

Formula to find the z-test is

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

$\bar{x} \rightarrow$ Mean of sample.
$\mu_0 \rightarrow$ Mean of population.
$\sigma \rightarrow$ Standard Deviation of population.
$n \rightarrow$ No. of observations.

t-Test:-

* The T-test determines how averages of different data sets differ in case the standard deviation or the variance is unknown.

* It is used when the sample size is less ($n<30$).

Formula to find the t-test is

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}.$$

$\bar{x} \rightarrow$ Mean of sample.
$\mu_0 \rightarrow$ Mean of population.
$s \rightarrow$ standard deviation.
$n \rightarrow$ No. of observations.

Semester : 4 Subject: Statistics for AIDS Academic Year: 2023 2024.

Example 4 :

A factory has a machine that dispenses 80ml of fluid in a bottle. An employee beleives the average amount of fluid is not 80ml. Using 40 samples, he measures the average amount dispensed by the machine to be 78ml with a standard deviation of 2.5

(a) State the null and the alternate hypothesis.

(b) At a 95% confidence level, is there enough evidence to support the idea that the machine is not working properly?

Solution:-

$H_0 : \mu = 80$ (Null hypothesis)

$H_a : \mu \neq 80$. (Alternate hypothesis).

Given data : $n = 40, \mu = 80, \bar{x} = 78, \sigma = 2.5$;

Since the null hypothesis is $\mu = 80$, we will be using two tailed test.

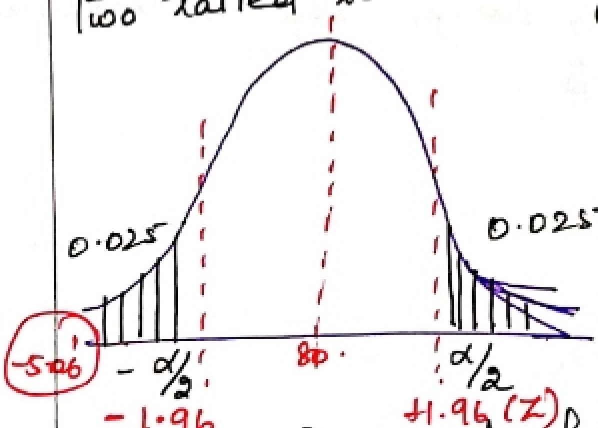
Confidence level = 95%.

$C = \frac{95}{100} = 0.95$.

$C + \alpha = 1$

$\alpha = 1 - 0.95 = 0.05$

$\boxed{\alpha = 0.05}$



Degree of freedom $= n - 1$.
$= 40 - 1 = 39$.

According to z table the value is 1.96.

$$Z_\alpha = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

$$= \frac{78 - 80}{2.5/\sqrt{40}} = \frac{-2}{0.395}.$$

$$\boxed{Z_\alpha = -5.06}$$

Since $Z_\alpha = -5.06 < -1.96$.

The null hypothesis is rejected.

Example:2

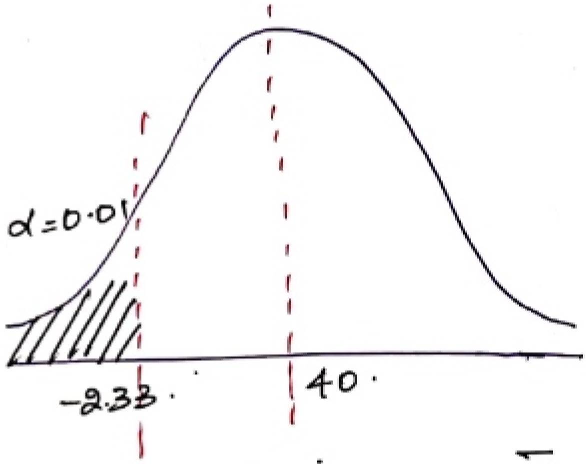
Mice with an average lifespan of 32 months will live up to 40 months when fed by a certain nutrious food. If 64 mice fed on this diet have an average lifespan of 38 months and standard deviation of 5.8 months, is there any reason to beleive that lifespan is less than 40 months. $(\alpha = 0.01)$

Solution:-

Null Hypothesis $H_0 : \mu = 40$ months.

Alternate Hypothesis $H_1 : \mu < 40$.

Since alternate hypothesis $= \mu < 40$, we choose Left one tail test.



<u>Given data</u>:

$\mu = 40,\ \bar{x} = 38,\ \sigma = 5.8$

$n = 64;\ \alpha = 0.01$

Degree of freedom $= n-1$

$= 64-1 = 63.$

z value $= 2.33$.

Calculate Z_α :

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

$$= \frac{38-40}{5.8/\sqrt{64}} = \boxed{-2.76}$$

$$\boxed{Z_\alpha = -2.76 < -2.33}.$$

We reject null hypothesis.

We conclude that there is ~~no~~ reason to beleive that the areage lifespan of mice with nutrious food is less than 40 months.

Scanned with OKEN Scanner