2M/3M

What is Sampling?.

"Sampling may be defined as "the selection of some party on Aggregate (or) Totality is made."

(or)

i.e It is the process of obtaining information about an entire population by examining only a part of it."

Explanation:- In most of the research work and surveys the approach happens to be "To make Generalizations" based on Samples. The researcher quite often selects only a few items from the population (or) Universe.

All, this is done on the assumption that the sample data will enable him to estimate the population.

The items so selected from population is called Sample. The selection process is called Sample Design. And, finally "We get Valid and Reliable Conclusions."

Exit. Cooking Rice
2. Mars - satellite =?
3. blood Sample
4. Urine Samples.

2M What are the two Consideration that are to to decide Sample Size?

There are two Consideration to decide Sample Size.

1. Sample Size increases Variation in individual items increases

$\therefore$ $\boxed{n}$ increases $\boxed{\sigma^2}$ also increases

2.. Larger Sample Size, We get more accuracy.

$\boxed{\text{i.e } n \propto \text{Accuracy level}}$.

3M/5M for

Describe the Sampling distribution of Variances?

The Sampling distribution of Variances Can be Obtained by drawing all the possible Random Samples of Size $\boxed{n}$ from the population. Then, we will calculate the Variance for each Samples.

$$\boxed{s^2 = \frac{\Sigma (x-\bar{x})^2}{n}}$$

(where n = Sample size of Sample

~~For problems;~~—

Note;— 1. population of Variance;— $\sigma^2 = \frac{\Sigma (x-\mu)^2}{n}$

n = population size

2. Sampling distribution (S.D) of Variance;— $s^2 = \frac{\Sigma (x-\bar{x})^2}{}$

n = Samples size.

Normal population = Small Sample

Non-Normal population = Large Sample.

V.V.Imp 10M

Explain Sampling Distribution of the Means σ-Unknown & σ-known briefly? 92

Sampling Distribution of the Means 2 types → σ - known (i.e In Population)
→ σ - Unknown (i.e In Samples).

Case-1:- S.D of the Means σ-known:-

(i.e In population, this case exists)

or

S.D of Means:-

→ This S.D of the Means σ-known also know as S.D of Means.

→ It is represented $\underline{\overline{X}}$.

i.e $\overline{X}$ = Sampling distribution of Means.

→ S.D of Means are two types ① Infinite Population.
② Finite Population.

→ ① **Infinite population:-** $\boxed{N \to \infty}$

i.e Sampling is done with Replacement.

With Replacement :- N^n = population

S.D of Means = $\boxed{\mu = E(\bar{x})}$

S.D of Standard deviation = $\sigma^2 = \frac{\Sigma (x-\mu)^2}{n}$

Here we are using only Z-test.

Used to find Means

- Single Mean: $|Z_{cal}| = \frac{\bar{x}-\mu}{\frac{\sigma}{\sqrt{n}}}$
- two Means: $|Z_{cal}| = \frac{\bar{x}_1-\bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}$

Used to find proportions.

- Single proportion: $|Z_{cal}| = \frac{p-P}{\sqrt{\frac{PQ}{n}}}$
- Two proportions: $|Z_{cal}| = \frac{P_1-P_2}{\sqrt{\frac{P_1Q_1}{n_1}+\frac{P_2Q_2}{n_2}}}$

Without Replacement :- N_{C_n} = Small Samples :-

S.D of Means = $\boxed{\mu = E(\bar{x})}$

S.D of Standard deviation :- $s^2 = \frac{(x-\bar{x})^2}{n}$

In this, we are using ① t-test ② f-test ③ χ^2-test.

In Samples (ie Small Samples) we will use d.f (degrees of freedom)

$\boxed{\text{Here, we you have to write all they } t, f, \chi^2.}$

2011, 2013 - Supply

Explain t - Distribution, properties & Applications?

t-distribution :- (or) Student's t - distribution

$\boxed{n<30}$ → t-distribution is a Continuous probability distribution

→ This t-distribution is used when σ — Unknown (i.e σ is not known).

→ It is used for testing of hypothesis, when Sample Size is Small.

→ i.e This t-distribution is used in "Small Samples"

Definition :- " The test statistic $\boxed{t = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}}$ is a Random Variable having the t-distribution with $\boxed{v = n-1}$ degrees of freedom & with probability density function $f(t) = y_0 \left(1+\frac{t^2}{v}\right)^{\frac{v+1}{2}}$. "

where $y_0 = \int_{-\infty}^{+\infty} f(t)\, dt = 1$

This is known as t-distribution (or) Student's t-dist

~~This is more general than the Central Limit theorem. So, it does not require the knowledge of σ. So, it is assumed to be Normal.~~ ×

Properties of t-distribution:-

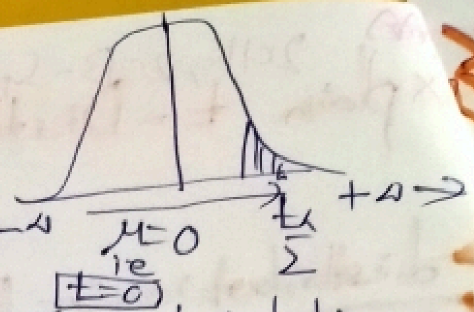

fig: t-distribution

1. The shape of this t-distribution is Bell-shaped.

2. The two tails of the Curve on both sides extends to $\boxed{\infty}$. It depends on d.f (degrees of freedom)

3. It is Symmetrical about the Line $\boxed{t=0}$.

4. It is Unimodel (i.e Mean = Median = Mode)

5. The Variance of t-distribution exceeds 1, but approaches 1 as $n \to \infty$

$\boxed{\text{ie t-distribution} = \text{N.D}, \text{ when } V=(n-1) \to \infty}$

6. In N.D:- $\mu = 0$ } $\boxed{\text{i.e Mean} = 0}$ in both the distributions.
In t-distb:- $t=0$

t-distribution (t-test) (i.e σ = Unknown, i.e s = known)
(n<30) - 2 - types.

Single Mean

$$t = \frac{\bar{x}-\mu}{\frac{S}{\sqrt{n}}}$$

Two Means
or
Equality of two Means.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

pplications of t-distribution:-

1. To test the Single Mean, when σ - is Unknown.
2. To test the Equality of two Means, when σ - is Unknown.
3. To test the Correlation Co-efficient (r) & Regression Coefficient.

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10M Reg-2012, Supply-2013 Explain chi-Square (χ^2)-distribution, properties & Applications?

χ^2-distribution:- (or) chi-Square distribution:-

→ χ^2-distribution is a Continuous probability distribution.

→ χ^2-distribution was extensively used as a Measure of (or) test Goodness of fit.

→ χ^2-distribution used to measure (or) test the Independence of attributes (r x c tables).

→ χ^2-distribution used to test S^2 & σ^2 are given

→ χ^2-distribution used "to Convert Descriptive statements into Numerical one's."

Properties of χ^2-distribution :-

1. χ^2-distribution Curve is not Symmetrical, lies entirely in I^{st} Quadrant.

∴ which is not Normal Curve

χ^2 - Varies ⟹ 0 to ∞.

2. χ^2 - depends on d.f (degrees of freedom).

3. χ^2 - distribution is used
   1. Analysis of Variance (ANOVA)
   2. Sampling Distribution
   3. r×c tables
   4. Goodness of fit.

   ...etc

~~4.~~ Mean = V

Variance = 2V } where $V = n-1$ degrees of freedom

Application of χ^2 - distribution :-

1. To test Goodness of fit
2. To test r×c tables (or) Independence of attributes
3. To test Correlation Coefficient & Regression Coefficient
4. To test both σ^2 & s^2 are given.

Explain F-distribution, properties & Applications?

F-distribution:- (or) Fisher's F-test:- (or) Ratio test:- (or)

Sampling distribution of the Ratio of two Sample Variances:-

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→ F-distribution is Continuous probability distribution.

→ F is always a +ve number

→ F-test always use Ratio of two Samples

$$\boxed{F = \frac{S_1^2}{S_2^2} = \frac{\text{Always high value}}{\text{Lower value}}}$$

properties:-

1. F distribution Curve lies entirely in I^{st}-Quadra

2. F depends not only on two parameters ν_1 & ν_2.

3. The Mode of f-distribution is less than Unity.

Large Samples

D of Means (σ - known)

1. $n \geq 30$ & $n = 30$
2. Z-test (Mean & proportion)
3. d.f is not used.
4. Z-test = Continuous probability distribution
5. Z-test $\cong$ N.D

Small Samples

S.D of Means (σ - Unknown)

1. $n < 30$
2. f-test, T6
   t-test
   χ^2-test are used
3. Compulsory d.f is used

   d.f = degrees of freedom.
4. f-test =

   t-test = Continuous P.D

   χ^2-test = Continuous P.D
5. t-test $\cong$ N.D

   $\boxed{\chi^2\text{-test} \ncong \text{N.D}}$

   f-test $\cong$ N.D

1 (0m) Explain Testing of Hypothesis?

(or)

Write the procedure of Testing of Hypothesis? 97

→ According to C.R. Rao, great statistician who was one of the first few people in the world to receive a Masters degree in statistics.

→ The theory of Testing may appear to be " postmortem examination"

→ Testing of Hypothesis (or) Test of Significance.

→ The Main objective the Sampling Theory is the study of the " tests of Hypothesis •

Example:-

1. A Drug chemist is to decide, whether a new drug is really effective in Curing a disease.

2. A Quality Control Manager is to determine, whether a process is working properly.

2013-Supply Statistical Hypothesis?-

" To arrive at decisions about the population on the basis of sample information, we make assumptions (or) Guess about the population, such

Assumption is called "Statistical Hypothe

Ex:- 1. The majority of men in the city are Smokers.

2. The teaching Methods in both, the Schools are effective.

① **Null Hypothesis :- (H_0) :-**

A Hypothesis of No-difference is called Null Hypothesis.

$$\boxed{H_0 : \mu = \mu_0}$$

It is denoted by H_0.

② **Alternative Hypothesis :- (H_1) :-**

A Hypothesis, which is against to Null hypothesis.

(or)

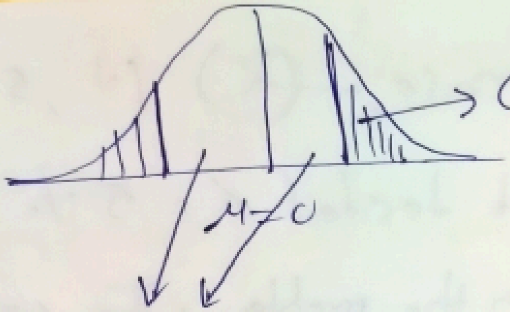
A Hypothesis, which Contradicts the Null hypothesis is called Alternative Hypothesis.

→ It is denoted by H_1.

→ Depending on the situation, we have to use any one of the case

① $H_1 : \mu_1 \neq \mu_2$:- **Two tailed test :-**

21/2/2023



Critical Region (C.R) or Rejected Region (R.R)

Accepted Region.

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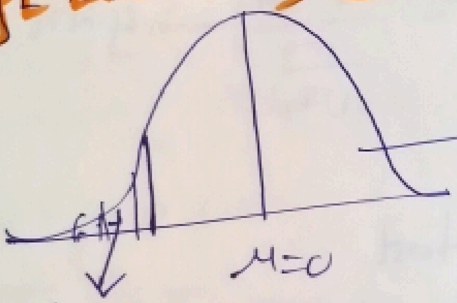
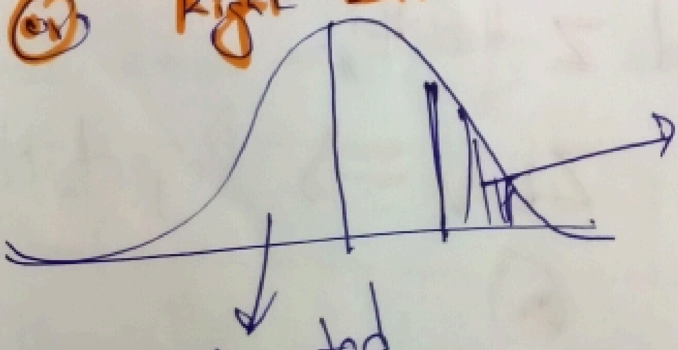
(2) $H_1 : \mu > \mu_0$:— Single tailed test :— or (One-tailed test) or (Left-tailed test)



Accepted Region (A.R)

Critical Region or CR or Rejection Region. R.R

(1) $H_1 : \mu < \mu_0$:— (Single or One tailed test) or Right tailed test :—



Critical Region or Rejection Region. ie C.R or R.R

Accepted Region.

③ Level of Significance :- (α) 1%, 5%, 10%

In general Govt decided $\alpha = 5\%$.

α - is not gives in the problem. Then, we choose $\boxed{5}$

④ Test Statistic :-

Compute the test - statistic

$$Z = \frac{x - E(x)}{S.Error\ of\ x} = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} \rightarrow \text{if it is Z-test}$$

or

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} \rightarrow \text{if it is t-test}$$

or

$$f = \frac{S_1^2}{S_2^2} \rightarrow \text{if it is f-test.}$$

or

$$\chi^2 = \frac{\Sigma(O-E)^2}{E} \rightarrow \text{if it is } \chi^2\text{- test.}$$

⑤ Conclusion :-

Suppose I used Z-test :-

$$|Z_{cal}| > Z_{t.v} \Rightarrow \text{Reject } H_0$$

or

$$|Z_{cal}| < Z_{t.v} \Rightarrow \text{Accept } H_0.$$ (t.V = Table Values from

Explain Errors in Testing of Hypothesis ?

(or)

Explain Errors ? (or) Explain Type-I Error & Type-II Error ?

→ There are two types of errors involved in testing a Null Hypothesis (H_0).

⇒ We decide to accept (or) to reject the lot after examining a sample from it. As, such we have two types of errors.

① Type-I error :- (or) α-error

$\boxed{\text{Reject } H_0 \text{ when it is True}}$

i.e If the H_0 is true, but it rejected by test procedure, then the error made is called "Type-I error (or) α-error."

② Type-II error :- (or) β-error :-

$\boxed{\text{Accept } H_0 \text{, when it is wrong}}$

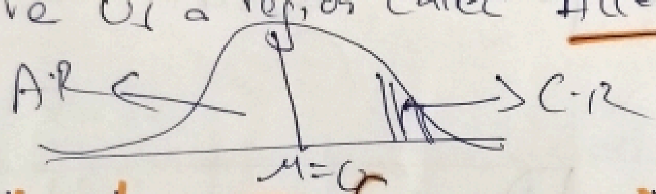
i.e If the H_0 is false, ~~but it is wrong~~, but it is accepted by test. Then it is called type-II error.

Sizes of type-I & type-II are also known as producers risk & Consumers risk

Explain difference b/w Critical Region & Critical Values?

Critical Region :- A Region corresponding to Statistic $\boxed{t}$ in the Sample space $\boxed{S}$ which leads to the rejection of H_0 is called Critical Region or Rejection Region.

* "Those region which lead to the acceptance of H_0 give us a region called Acceptance Region"



Critical Values or Significant Values :-

The value of the test statistic, which separates the Critical Region & the acceptance region is called significant values.

The value is dependent on (1) α

(2) H_0. (whether, it is one - tailed or two - tailed.)