Subject: Advanced Statistics
Class- B.Com IV semester
Topic: Testing of hypothesis

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Key Definitions

- A population (universe) is the collection of all members of a group
- A sample is a portion of the population selected for analysis
- A parameter is a numerical measure that describes a characteristic of a population
- A statistic is a numerical measure that describes a characteristic of a sample

Terminology

- A **hypothesis** is a claim or statement about a property of a population.
- A **hypothesis test** (or a **test of significance**) is a procedure for testing a claim about a property of a population.
- The **null hypothesis**, denoted as H_0, is a statement that the value of a population parameter is equal to some claimed value.

TERMINOLOGY

- Hypothesis Testing: A decision making process for evaluating claims about a population. Every situation begins with a statement of a hypothesis.
- Statistical Hypothesis: A conjecture about a population parameter. The conjecture may or may not be true.
- Two types of statistical hypotheses: Null hypothesis and Alternative hypothesis.
- Null: Symbolized by H_0, is a statistical hypothesis that states that there is no difference between parameter and a specific value.
- Alternative: Symbolized by H_1, is statistical hypothesis that states a specific difference between parameter and a specific value.

❶ One-tailed (directional)

H_A: $\rho > 0$

H_A: $\rho < 0$

❷ Two-tailed (non directional)

H_A: $\rho \neq 0$

What: Test statistics

Test statistic, *t*

- The test statistic is a **mathematical formula** that allows researchers **to determine the likelihood of obtaining sample outcomes** if the **null hypothesis were true**.
  - The **value of the test statistic** is used to **make a decision** regarding the null hypothesis.
    - The **larger the value** of the test statistic, **the further the distance**, or number of standard deviations, a **sample mean** is **from the population mean** stated in the null hypothesis.

$$\text{test statistic} = \frac{estimate - value\ we\ hypothesize}{standard\ error}$$

$$\text{t-statistic} = \frac{\bar{x} - \mu_o}{s/\sqrt{n}}$$

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

μ_0 is the null hypothesis(given mean) to be tested

σ is the given standard deviation

n is the number of samples

$\bar{x}_n$ is the mean of the samples

z is the tested statistic

Level of Significance

- Definition: The level of significance is the probability of a Type I error (reject the null hypothesis when it is true) and is usually denoted by α.
- That is, $\alpha = Pr_0\{\text{Reject } H_0\}$
- Example problem: $\alpha = Pr_0\{S_4 \geq 4\}$
  - Notice that α is a right sided probability.
- Problem is to find α.

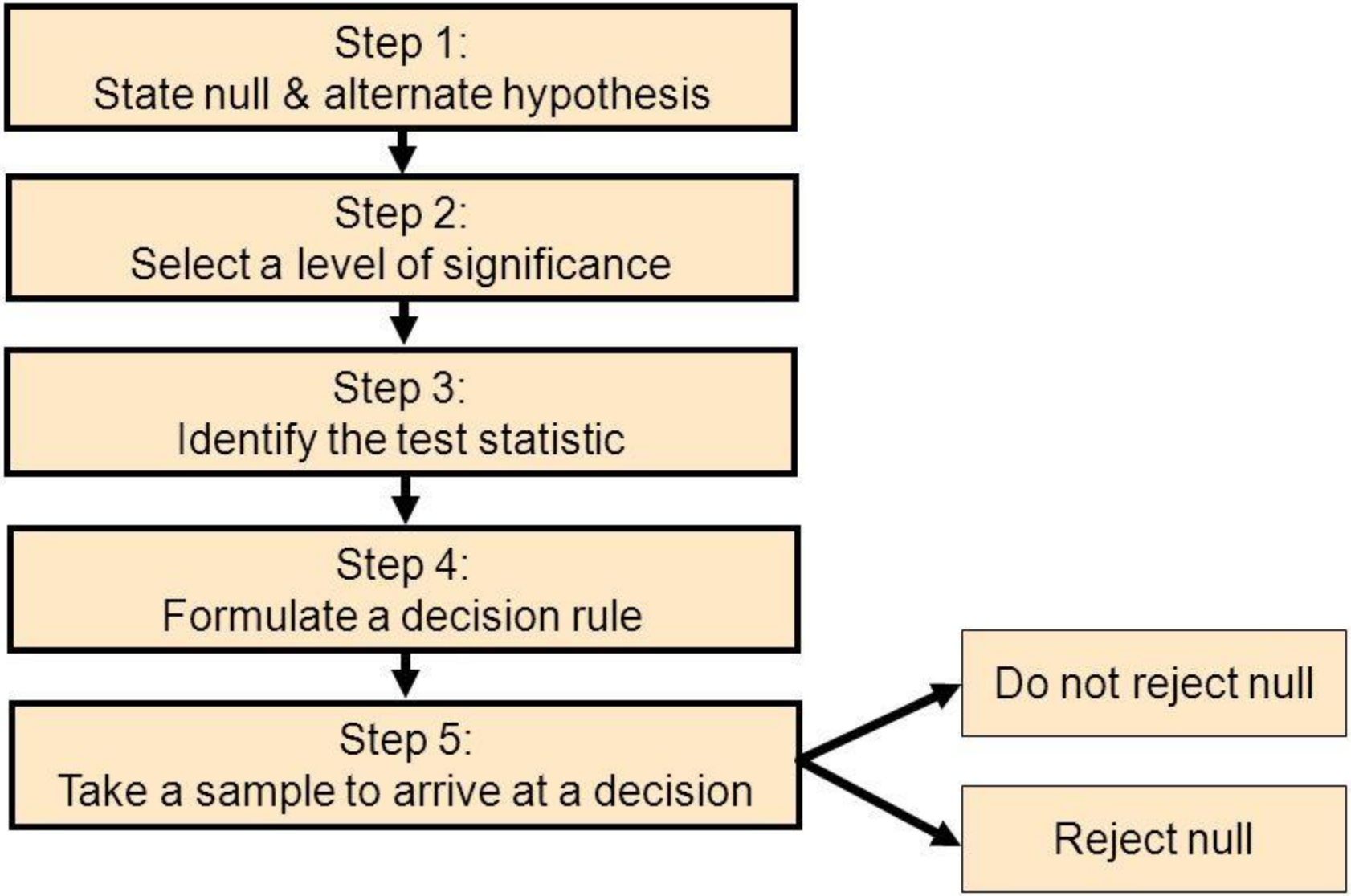
Hypothesis Testing

A hypothesis is a claim or statement about a property of a population (in our case, about the mean or a proportion of the population)

A hypothesis test (or test of significance) is a standard procedure for testing a claim or statement about a property of a population.

It is extremely important to realize that we are not making definitive conclusions. We are giving probabilistic conclusions. We are either concluding that the results we get are likely due to chance, or unlikely.

Five step procedure for testing a hypothesis



Power of the Test

- Recall the possible hypothesis test outcomes:

Key:
Outcome (Probability)

	Actual Situation	
Decision	H_0 True	H_0 False
Do Not Reject H_0	**No error ($1 - \alpha$)**	**Type II Error (β)**
Reject H_0	**Type I Error (α)**	**No Error ($1 - \beta$)**

- β denotes the probability of Type II Error
- $1 - \beta$ is defined as the power of the test

Power = $1 - \beta$ = the probability that a false null hypothesis is rejected

Thank You

Reference

- Gupta S.P(2006),Statistical Methods
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