



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

## COMPUTER SCIENCE AND ENGINEERING

### COURSE HANDOUT

<b>Course Name</b>	PROBABILITY AND STATISTICS
<b>Course Code</b>	AHS010
<b>Programme</b>	B.Tech
<b>Semester</b>	II
<b>Course Coordinator</b>	Mr. J Suresh Goud, Assistant Professor
<b>Course Faculty</b>	Ms. P Srilatha, Assistant Professor
<b>Lecture Number</b>	40
<b>Topic Covered</b>	Type I and Type II Errors
<b>Course Learning Outcome's</b>	Understand the concept of hypothesis testing in real-world problem to selecting the best means to stop smoking.

## Types of Errors:

There are two types of Errors

1. Type-I Error
2. Type-II Error

**Type-I Error:** A Type I error (sometimes called a Type 1 error), is the incorrect rejection of a true null hypothesis. The alpha symbol,  $\alpha$ , is usually used to denote a Type I error.

**Type-II Error:** A Type II error (sometimes called a Type 2 error) is the failure to reject a false null hypothesis. The probability of a type II error is denoted by the beta symbol  $\beta$ .

### Example:

**Hypothesis:** "The evidence produced before the court proves that this man is guilty."

**Null hypothesis:** "This man is innocent."

A type I error occurs when convicting an innocent person (a miscarriage of justice). A type II error occurs when letting a guilty person go free (an error of impunity).

A positive correct outcome occurs when convicting a guilty person. A negative correct outcome occurs when letting an innocent person go free.

### Critical Region:

The critical region is the region of values that corresponds to the rejection of the null hypothesis at some chosen probability level. The shaded area under the Student's t distribution curve is equal to the level of significance. The critical values are tabulated and thus obtained from the Student's t table or another appropriate table. If the absolute value of the t statistic is larger than the tabulated value, then t is in the critical region.

#### 1. One tailed and two tailed tests

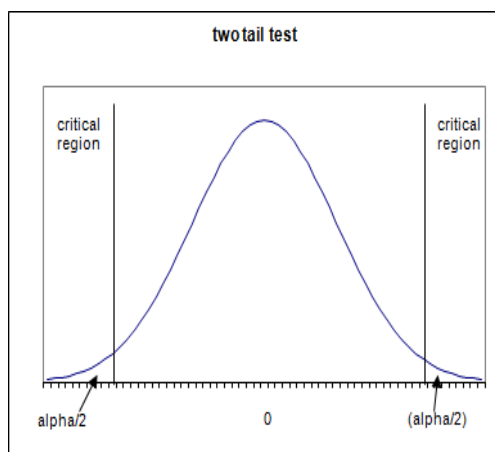
The statistical tests used will be one tailed or two tailed depending on the nature of the null hypothesis and the alternative hypothesis.

The following hypothesis applies to test for the mean:

#### Two tailed test:

$$H_0 : \mu = \mu_0$$

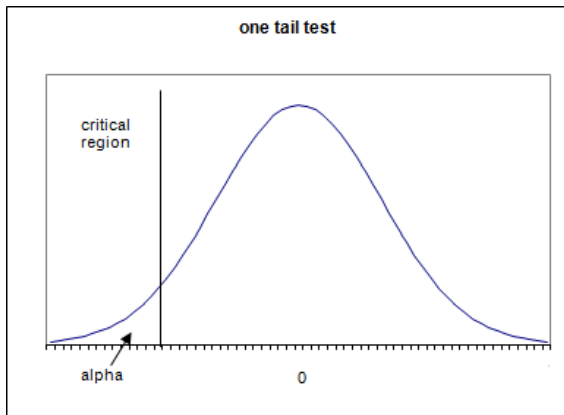
$$H_1 : \mu \neq \mu_0;$$



**One tail tests:**

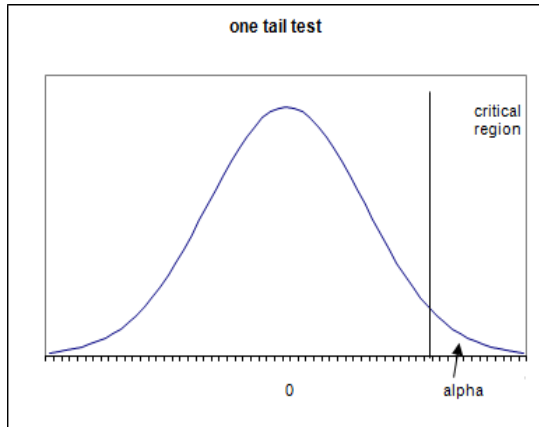
$$H_0 : \mu = \mu_0$$

$$H_1 : \mu < \mu_0;$$



$$H_0 : \mu = \mu_0$$

$$H_1 : \mu > \mu_0;$$



When we are interested only in the extreme values that are *greater than or less than a comparative value* ( $\mu_0$ ) we use a one tailed test to test for significance. When we are interested in determining that things are different or not equal, we use a two tailed.

**Procedure of Test of Hypothesis:**

Step 1: Null Hypothesis ( $H_0$ ): Setup Null Hypothesis

Step 2: Alternative Hypothesis ( $H_1$ ): Setup Alternative Hypothesis

Step3: Level of significance ( $\alpha$ ): Choose  $Z_\alpha$  value from the table

Step 4: Test statistic (Z):  $Z = \frac{t - E(t)}{S.E(t)}$

Step 5: Conclusion:

If  $|Z| < Z_\alpha$  then We accept null hypothesis

If  $|Z| > Z_\alpha$  then We reject null hypothesis