INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE PPT

Course Name	**PROBABILITY AND STATISTICS**
Course Code	AHS010
Programme	B.Tech
Semester	II
Course Coordinator	Mr. J Suresh Goud
Course Faculty	Ms. P Srilatha
Lecture Number	45
Topic Covered	Test of hypothesis for difference of means-2
Course Learning Outcome’s	Apply testing of hypothesis to predict the significance difference in the sample means

Test of Hypothesis for Difference of Means:

Let $\overline{x_1}$ be the mean of the sample size n_1 from the population with mean μ_1 and S.D σ_1 and $\overline{x_2}$ be the mean of the sample size n_2 from the population with mean μ_2 and S.D σ_2.

$$\boxed{Z = \frac{\left(\overline{x_1} - \overline{x_2}\right)}{\sqrt{\left(\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)}}}$$

Note: If σ is unknown then we can use S

$$Z = \frac{\left(\bar{x}_1 - \bar{x}_2\right)}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

If Samples are drawn from the same population i.e., $\sigma_1 = \sigma_2 = \sigma$

$$Z = \frac{\left(\bar{x}_1 - \bar{x}_2\right)}{\sqrt{\left(\frac{\sigma^2}{n_1} + \frac{\sigma^2}{n_2}\right)}}$$

Problems:

1. The mean of wheat from a distinct A was 210 pounds with standard deviation 10 pounds per acre from a sample of 100 plots. In a another district the mean was 220 pounds with standard deviation 12 pounds from a sample of 150 plots. Assuming that the standard deviation of entire state was 11 pounds. Test whether there is any significance difference between two districts.

Solution:

Given

$$n_1 = 100, \ n_2 = 150$$
$$\bar{x}_1 = 210, \ \bar{x}_2 = 220$$
$$s_1 = 10, \ s_2 = 12$$
$$\sigma = 11 \ \alpha = 5\%$$

Step 1: Null Hypothesis: $\bar{x}_1 = \bar{x}_2$

Step 2: Alternative Hypothesis: $\bar{x}_1 \neq \bar{x}_2$

Step 3: Level of Significance:

$$z_\alpha = 1.96 \ \ at \ \ \alpha = 0.05$$

Step4: Test Statistics:

$$Z = \frac{\left(\bar{x}_1 - \bar{x}_2\right)}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

$$= \frac{210 - 220}{\sqrt{\frac{(10)^2}{100} + \frac{(12)^2}{150}}}$$

$$= 7.14$$

$$|Z| = 7.14$$

Step 5: Conclusion:

$$|Z| > Z_{\alpha}$$

$\therefore$ We reject Null Hypothesis

2. A sample of students drawn from two universities their mean and standard deviations are calculated and shown below test the significance difference between two means.

	Mean	S.d	Sample Size
University A	56	10	400
University B	57	15	100

Solution:

Given

$$n_1 = 400,\ n_2 = 100$$
$$\bar{x}_1 = 56,\ \bar{x}_2 = 57$$
$$s_1 = 10,\ s_2 = 15$$
$$\alpha = 5\%$$

Step 1: Null Hypothesis: $\bar{x}_1 = \bar{x}_2$

Step 2: Alternative Hypothesis: $\bar{x}_1 \neq \bar{x}_2$

Step 3: Level of Significance:

$$z_\alpha = 1.96 \ \ at \ \ \alpha = 0.05$$

Step4: Test Statistics:

$$Z = \frac{\left(\bar{x}_1 - \bar{x}_2\right)}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

$$= \frac{56 - 57}{\sqrt{\frac{(10)^2}{400} + \frac{(15)^2}{100}}}$$

$$= 0.632$$

$$|Z| = 0.632$$

Step 5: Conclusion:

$$|Z| < Z_{\alpha}$$

$\therefore$ We accept Null Hypothesis

Exercise:

1. A simple sample of the height of 6400 Englishmen has a mean of 67.85 inches and standard deviation of 2.56 inches while a simple sample of heights of 1600 Austrians has a mean of 68.55 inches and standard deviation of 2.52 inches. Do the data indicate the Austrians are on the average taller than the Englishmen? (Use level of significance)

2. The average marks scored by 32 boys is 72 with a standard deviate of 8. While that for 36 girls is 70 with a standard deviation of 6. Does this indicate that the boys perform better than girls at level of significance 0.05?