

# Statistics on further studies of students in IIT H

## MA4240 Applied Statistics

Shreyas Wankhede, Pradeep Mundlik, Akshitha Kola, Dhatri Reddy,  
Mouktika Cherukupalli, Avinash Malothu, Sumeeth Kumar, Saathvika  
Marri

IIT Hyderabad

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# Outline

- 1 Introduction
- 2 Data Visualization
- 3 Hypothesis Testing

# Introduction

This is the introduction slide.

# Data visualization

# hypothesis Testing

**case 1:** comparing CGPA of students who are willing to pursue higher studies with students who don't want to pursue

We assume our null hypothesis to be that average CGPA of students willing to go for higher studies is greater than those who don't want to. Let  $\alpha = 0.05$ .

$\bar{x}_1$  = sample mean of CGPA of people willing to go for higher studies

$\bar{x}_2$  = sample mean of CGPA of people who don't want higher studies

$s_1^2$  = sample standard deviation of CGPA of people willing for higher studies

$s_2^2$  = sample standard deviation of CGPA of people who don't want

For Hypothesis Testing we make the following statements-

$$H_0 = \mu_1 - \mu_2 \geq 0$$

$$H_a = \mu_1 - \mu_2 < 0$$

## case 1: case 1 continued

information:

$$\bar{x}_1 = 8.4447 \quad (1)$$

$$\bar{x}_2 = 8.3919 \quad (2)$$

$$s_1^2 = 0.7694 \quad (3)$$

$$s_2^2 = 0.5672 \quad (4)$$

$$n_1 = 88 \quad (5)$$

$$n_2 = 26 \quad (6)$$

since  $\frac{s_1^2}{s_2^2} < 4$ , we can assume the population variances would be equal.  
the degrees of freedom,

$$dof = n_1 + n_2 - 2 = 112$$

# hypothesis testing

## case 1 continued

the pooled variance will be:

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} = 0.5317 \quad (7)$$

the test statistic is given by:

$$t = \frac{\bar{x}_1 - \bar{x}_2 - 0}{s_p \sqrt{\frac{n_2 + n_1}{n_1 n_2}}} = 0.3244 \quad (8)$$

Using the rejection region approach, we reject  $H_0$  if  $t_{0.05,112} \geq -t$  where  $t_{0.05,112} = -1.6586$ . we have enough statistical evidence to reject null hypothesis since observer  $t$  is lesser than 1.6586

# hypothesis testing

**Case 4:** Hypothesized proportion testing if there is enough evidence that the proportions of people opting for masters, MBA, PhD are not all equal

Sample data :

Masters	MBA	PhD	Total
50	24	13	87

Let  $P_{Ms}$ ,  $P_{MBA}$ ,  $P_{PhD}$  denote proportions of students willing to pursue Masters, MBA, PhD for higher studies

$$H_0 : P_{Ms} = P_{MBA} = P_{PhD} = \frac{1}{3} \quad H_a : \text{atleast one } P \neq \frac{1}{3} \quad \alpha = 0.05$$

Also,

$$E = \frac{1}{3} \times 87 = 29 \quad (9)$$

and,

$$\chi^2 = \sum \frac{(O - E)^2}{E} \quad (10)$$



## Case 4: Case 4 continued

$$\begin{aligned}\chi^2 &= \frac{(50 - 29)^2}{29} + \frac{(24 - 29)^2}{29} + \frac{(13 - 29)^2}{29} \\ &= 15.2 + 0.862 + 8.827 \\ &= 24.889\end{aligned}\tag{11}$$

At  $df = 3 - 1 = 2$ ,  $p \text{ value} = 0.0001$

$p \text{ value} < \alpha = 0.05$

Hence there is enough evidence that population proportions are not all equal.