FACULTY OF ENGINEERING & TECHNOLOGY

Dr. Vinod Kumar Yadav
Assistant Professor in Mathematics
Rama University Uttar Pradesh, Kanpur

LECTURE- 24

BSc (AG)
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Statistical Methods
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Dr. Vinod Kumar Yadav
Assistant Professor in Mathematics
Rama University Uttar Pradesh, Kanpur

Outline of lecture

- Chi-Square Test

- Introduction

- Conditions of Chi-Square Test

- Applications of Chi-Square Test

- Formula of Chi-Square Test

- Numerical Problem based on Chi-Square Test

- Suggested Readings & References

Introduction

➢ The chi-square distribution is one of the most important distribution function in statistics.

➢ It was discovered by Helmart and later on Karl Pearson.

➢ The square of normal variate is called chi-square variate with one degree of freedom.

Conditions for Chi-Square test

There are following conditions or assumptions which are necessary for chi-square test-

➢ The sample size is large.

➢ The total cell frequency should not be less than 50.

➢ The member of cells should be independent.

➢ In this lest constraints are linear.

Application or uses of Chi-Square test

➢ It is used for test of goodness of fit.

➢ It is used for test of independence.

➢ It is used for test of homogeneity of independent estimate of the population variance & etc.

Formula of Chi-Square test

Chi-Square distribution formula is define as-

$$x^2 = \sum \left[\frac{(f_o - f_e)^2}{f_e} \right]$$

$where,$

$f_o = observed\ frequency$

$f_e = \exp ected\ frequency$

Numerical Problem

* Numerical Question of chi-square

1. The demand for a particular spare part in a factory was found to vary from day-to-day. In a sample study the following information was obtained.

Days	Mon	Tue	Wed	Thu	Fri	Sat.	
No. of parts demanded	1124	1125	1110	1120	1125	1116	

Use chi-square test the hypothesis that no. of parts demanded doesn't depend on the day at 5% level of significance. Given that table value of chi square is 11.07 at 5 degree of freedom.

Answer:- Equal hypothesis

$$\frac{1124 + 1125 + 1110 + 1120 + 1125 + 116}{6} = \frac{6720}{6} = 1120 = f_e \text{ (calculated freq)}$$

$\frac{(f_o - f_e)^2}{f_e}$	Days	Table frequency (f_o)	calculated frequency (f_e)	$(f_o - f_e)$	$(f_o - f_e)^2$	
$\frac{16}{1120} = 0.0143$	Mon	1124	1120	4	16	
$\frac{25}{1120} = 0.0223$	Tue	1125	1120	5	25	
$\frac{100}{1120} = 0.0893$	Wed	1110	1120	-10	100	
$\frac{0}{1120} = 0$	Thu	1120	1120	0	0	
$\frac{25}{1120} = 0.0223$	Fri	1125	1120	5	25	
$\frac{16}{1120} = 0.0143$	Sat	1116	1120	-4	18	

$\Sigma = 0.01625$

By formula, $\chi^2 = \Sigma\left[\frac{(f_o - f_e)^2}{f_e}\right]$

$\chi^2 = 0.01625$ (calculated value) $= \chi^2_c$

Analysis :- Table value = 11.07   calculated value = 0.01625

$11.07 > 0.01625$

$\chi^2_T > \chi^2_c$

Hence, hypothesis is accepted.

Suggested Readings & References

1) Statistical Methods: P.N. Arora, Sumeet Arora & S. Arora; S. Chand & Company Ltd.

2) Fundamental of Mathematical Statistics: S.C. Gupta & V. Kapoor; Sultan Chand & Sons.

3) Statistics: M.R. Spiegel; Schaum's Outline Series, Mc-Graw Hill Publication.

4) Advanced Engineering Mathematics: Erwin Kreyszig; John Wiley & Sons Inc.

5) Elements of Statistics: J.P. Chauhan & S. Kumar; Krishna Publication.

* THANK YOU *