Stats for BSc
P.G. Sem II
Unit IV

Paper II
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Q. What is Chi-Square? Discuss its applications & Uses

Q. What are the assumptions, requisites & Conditions of Chi-Square test. Discuss its uses & limitations

Ans. Chi-Square test is a statistical device used for testing a null hypothesis. A null hypothesis means the assumption that there is zero difference or no difference between statistics. In Chi-Square test the hypothesis states that the results found in an experiment do not differ significantly from results expected on a probability basis. Garrett (1979) says "the Chi-Square test represents a useful method of comparing experimentally obtained results with those to be expected theoritically on some hypothesis". The formula frequently used for calculating Chi-Square is as follows:

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

Here f_o means observed frequency i.e experimentally obtained results

On the other hand fe means expected frequency i.e theoritically expected results. The hypothesis is that the fo does not differ significantly from the fe. The Chi-square test is used for testing this hypothesis. So this is the basic requisite for a Chi-square Test.

(2) The Chi-square test has several requisites, applications & uses. In this connection the foll. facts may be mentioned.

1) Equal Probability hypothesis: The Chi-square test may be used to test the divergence of observed results from those expected on the hypo. of equal probability. Suppose that 48 subjects were asked to express their attitude toward a particular statement. 24 subjects showed favourable attitude, 12 sub. showed indifferent attitude & 12 subjs. showed unfavourable atti. On the hypo. of equal probability each of the three categories of subjects should consist of 16 subjects. Now

fe means expected frequency i.e theoratically expected results.

The hypothesis says that the fo does not differ significantly from the fe. The chi square test is used to test this hypothesis. So this is basic requisite of this test.

(2) Requisites or characteristics and applications & uses of chi square are as follows:-

(1) Equal Probability hypothesis: The chi square may be used to test the divergence of observed results from those expected on the hypothesis of equal probability. For example if there are 48 subjects & they are asked to express their attitude towards a statement. 24 subjects shows favourably, 12 show indifferent attitude & 12 show unfavourable attitude. Then on the hypothesis of equal probability each of the 3 categories should have 16 subjects.

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Theoretically they should be 5 & 5. Here the table is 2×2 fold. Therefore a correction of ·50 is substracted from (fo-fe).

(4) Entries in Percentage:- Chi Square test can also be used when the entries are in the form of %. However here also a correction of ·5 must be made. Suppose that right response is 70% & wrong response is 30%. Theoritically they should be 50% & 50%. Now in order to test the divergence bet. fo & fe a correction of ·5% must be substracted from (fo-fe).

Entries in Percentage: Chi Square are also used when entries are in the form of percentage (%). However here also a correction of ·5 must be made. For example if the right response is 70% & the wrong response is 30%. Theoretically they should be 50% & 50%. In order to test the divergence between fo & fe a correction of ·5% must be substracted from (fo-fe).

(5) Independence in Contigency tables:- The Chi Square test can also be used to investigate the relationship between traits or attributes which can be classified into two or more categories. For e.g. the same persons may be classified as to their colour (light, brown, black, red) as to eye colour (blue, grey, brown) & the correspondence

Independence in Contigency tables: The chi square test is also applied to investigate the relationship between traits or attributes which can be classified into two or more categories. For example the same persons may be classified ... hair colour ... brown

here the problem is if the fo relating to hair colour & eye colour differs significantly from fe? This problem can be very easily solved by application of chi square test.

relating to hair colour & eye colour differs significantly from fe. This prob. also can very suitably be solved with the application of the Chi-Square test.

6) 2×2 fold Contingency tables :- When the contingency table is 2×2 fold, Chi-square may be calculated without first computing the four expected frequencies. Suppose that a sample of 40 boys were randomly rated as 17 above the national norm & 23 were found at or above the national norm. Among 50 girls 28 were found below national norm & 22 at or above national norm. Now the question is does the fo differ from fe or sex factor for the solution of this prob. Chi-square test be safely used. However here the χ² more suitable formula will be as follows.

A	B	A+B
C	D	C+D
A+C	B+D	N

17 A	23 B	40
28 C	22 D	50

$$\chi^2 = \frac{N(AD-BC)^2}{(A+B)(C+D)(A+C)(B+D)}$$

7) The additive property. Overall Significance — The Chi-square test has an additive property. We have

Chi-sq. can be used in diff. situations for specific purpose. It shows whether the data ... significant or ...

We have discussed before that an overall ... Chi-Square test can be used in separate situations for some specific purpose.

It gives us an overall test of significance of results under different situations.

Just discussed above that Chi-Square test can be used in separate situations for some specific purpose. However Chi-square test can be used to get an overall test of the significance of results ~~under~~ under diff. situations. Acc. to Garrett (1929) in such situation Chi-Square proves more reliable. He says "Combining the data from several exps. will often yield a conclusive result, when then ~~sp~~ separate exps., taken alone, provide only indications.

Garrett (1929) says that combining the data from several experiments will often yield a conclusive result, when separate experiments, taken alone, provide only indications.

So it can be safely concluded that Chi-square test is a very useful statistical device for testing the divergence bet. the experimentally observed result f_o & theoritically expected result f_e under various conditions.

It can be concluded that chi square test is very useful tool for testing the divergence between the experimentally result & theoretically expected result, under various conditions.

Garrett (1929) says that "Combining the data from diff. exps. will yield a conclusive result then separate exps. taken alone provide only indications."