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:

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

Here fo means observed frequency i.e experimentally obtained results

fe means expected frequency
i.e theoretically expected results.

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

On the other hand fe means expected frequency i.e theoretically 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) Requisites or characteristics and applications of chi square:- 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 hypothesis of equal probability. Suppose for example 48 subjects are asked to express their attitude toward a particular statement & they are assumed that 48 subjects were asked to express their attitude toward a particular statement & they are assumed that 24 subjects showed favourable attitude, 12 showed unfavourable attitude & 12 showed indifferent attitude. On the hypothesis of equal probability each of the three categories should have 16 subjects. Now on the hypothesis of equal probability each of the three categories should have 16 subjects. Now

[illegible] differs
[illegible] significantly from the [illegible] This
[illegible] can very easily be
[illegible] by the Chi-Square test.
[illegible] hypothesis of a normal distri-
bution — The Chi-square test
can also be used for testing
the divergence of observed
results from those expected
on the hypo of a normal
distribution. Suppose that
[illegible] sales men were divi-
ded into 3 good, satisfactory
& poor having 16, 20 & 6 resp-
ectively. On the basis of equal nor-
mal distn. hypo the three
categories should have contained
57, 23.6 & 6.7 respectively.
Now the prob is does the fo[illegible]
differ significantly from the fe[illegible]
This prob can suitably be
solved by the Chi-Square test.

Small table entries:— Some
times Chi-Square test is used
when the table entries are
small. If such is the situ-
ation Yate's Correction has
to be made. Suppose that out
of [illegible] persons seven persons
[illegible] response to these
[illegible] made [illegible] response
[illegible] stay [illegible] should

be 5 & 5 Now here the table is 2×2 fold Therefore a correction of ·50 is subtracted 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 25 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 25% must be subtracted 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 hair colour (light brown, black, red) & as to eye colour (blue, grey, brown) & the correspondence

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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 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%. Now to test the divergence between fo & fe a correction of 5% must be substracted from (fo − fe). Pg 119

(5) Independence in Contingency 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 as to hair colour, [illegible] Pg 118

how 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 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 + or - 17 were found below 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 following formula will be more suitable

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

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

Chi can be used in diff situation for some specific purpose. It shows if the data over all significant or not.

We have discussed before that 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.

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

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.

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 & theoritically expected result, under various conditions.

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