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CHI SQUARE TEST ⇒! (χ^2)

A chi-square (χ^2) statistic is a test that measures how expectations compare to ~~actual~~ observed data.

Conditions for chi-square test ⇒!

— × — × — × — × —.

① The sample under study must be large and total of cell frequency should not be less than 50.

2. The member of the cells should be Independent.

3. The cell frequency of each cell should be greater than 5. If any cell frequency less than 5 then it should be combined with the next or preceding cell ~~until~~ until the total frequency exceeds 5.

④ Cell frequency should not involve any logarithmic, exponential or Trigonometric relation, i.e only Linear relation.

CHI-SQUARE (χ^2) IS USED AS ⇒!

— × — × — × — × —.

① Test of Independence ② Test of goodness of fit.

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Degree of freedom ⇒: The Number of degrees of freedom is the number of values in the final calculations of a statistic that are free to vary. The number of independent ways by which a dynamic system can move, without violating any constraint imposed on it, is called number of degrees of freedom.

① if the data is given in the form of a series of variables in a row or column then the degree of Freedom = (No. of items in the series) − 1

② When the number of frequencies are put in cells in a Contingency table.

The d.F = (R−1) (C−1)

where R and C is the number of rows and columns respectively.

Chi-square test (χ^2)

Hypothesis ⇒: On a basis of sample information, we make certain decisions about the population. In taking such decisions we make certain Assumptions. These Assumptions are known as statistical hypothesis. These hypothesis is Tested.

Null hypothesis ⇒: (H_0) It is the hypothesis of no difference. Thus we will presume that there is no significant difference between the observed value and expected value. Then, we will test whether this hypothesis is satisfied by the data or not. If the hypothesis is not approved the difference is considered to be significant. If hypothesis is approved then the difference would be described as due to sampling fluctuation.

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χ^2 Test of goodness of fit:- It helps us to find the deviation of the experiment from the theory is just by chance or it is due to the inadequacy of the theory to fit the observed data.

χ is calculated by means of the following formula.

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} \quad \text{and}$$

$$\Sigma O_i = \Sigma E_i = N$$

Where O_i is the observed frequency and

E_i is the expected (Theoretical) frequency of the cell.

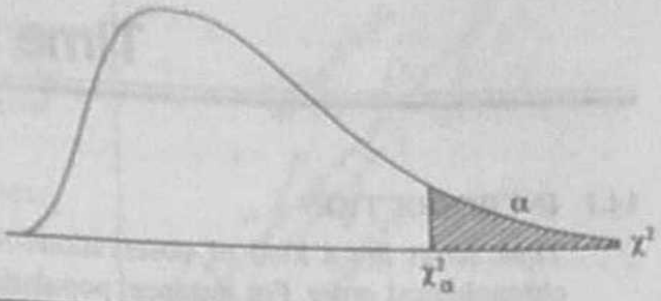
Q. The demand for a particular part in a factory was found to vary from day-to-day. In a sample study the following information was obtained.

Days:	Mon	Tue	Wed	Thurs	Fri	Sat	
No of Parts demanded:	1124	1125	1110	1120	1125	1116	

use χ^2 to test the hypothesis that No. of Parts demand does not depend on the day of the week at 5% level of significance.

TABLE – 3
CHI-SQUARE DISTRIBUTION

The following table provides the values of χ^2_α that correspond to a given upper-tail area α and a specified number of degrees of freedom.



Degree of freedom	Upper-Tail Area					
	.20	.10	.05	.02	.01	.001
1	1.642	2.706	3.841	5.412	6.635	10.827
2	3.219	4.605	5.991	7.824	9.210	13.815
3	4.642	6.251	7.815	9.837	11.345	16.268
4	4.989	7.779	9.488	11.668	13.277	18.465
5	7.289	9.236	11.070	13.388	15.086	20.517
6	8.558	10.645	12.592	15.033	16.812	22.457
7	9.083	12.017	14.067	16.622	18.475	24.322
8	11.030	13.362	15.507	18.168	20.090	26.125
9	12.242	14.648	16.919	19.679	21.666	27.877
10	13.442	15.987	18.307	21.161	23.209	29.588
11	14.631	17.275	19.675	22.618	24.725	31.264
12	15.812	18.549	21.026	24.054	26.217	32.909
13	16.985	19.812	22.362	25.472	27.688	34.528
14	18.151	21.064	23.685	26.873	29.141	36.123
15	19.311	22.307	24.996	28.259	30.578	37.697
16	20.465	23.542	26.296	29.633	32.000	39.252
17	21.615	24.769	27.587	30.995	33.409	40.790
18	22.760	25.989	28.869	32.346	34.805	42.312
19	23.900	27.204	30.144	33.687	36.191	43.820
20	25.038	28.412	31.410	35.020	37.566	45.315
21	26.171	29.615	32.671	36.343	38.932	46.797
22	27.301	30.813	33.924	37.659	40.289	48.268
23	28.429	32.007	35.172	38.968	41.638	49.728
24	29.553	33.196	36.415	40.270	42.980	51.179
25	30.675	34.382	37.652	41.566	44.314	52.620
26	31.795	35.563	38.885	42.856	45.642	54.052
27	32.912	36.741	40.113	44.140	46.963	55.476
28	34.027	37.916	41.337	45.419	48.278	56.893
29	35.139	39.087	42.557	46.693	49.588	58.302
30	36.250	40.256	43.773	47.962	50.892	59.703