ANALYSIS OF SIMULATION DATA:

INPUT MODELING

Lecture # 29

Lecture by Engr. Sidra

Chi-Square (χ_0^2) Test

- Non-parametric Test
- Used to find out how the observed value of a given phenomena is significantly different from the expected value.
- It is appropriate when following conditions are met:
  - *The sampling method is simple sampling.*
  - *The variable under study is categorical (qualitative).*
  - *The expected number of sample observation in each level of variable is at least 5.*

Chi-Square Test: Procedure

1. **Set up the Hypothesis:**
   a. *Null Hypothesis (H_0) = assumes that there is no significant difference between observed and expected value.*
   b. *Alternative Hypothesis(H_1) = assumes that there is a significant difference between observed and expected value.*
2. **Analyze Sample Data:**
   - *Degree of Freedom: (Exact shape of distribution is determined by its DF)*

     $$DF = K - S - 1$$

     - K = # of class intervals, S = # of Parameters
   - *Expected Frequency Count:*

     $$E_i = np_i$$

     - n = # of samples, p_i = probability associated with i^{th} class

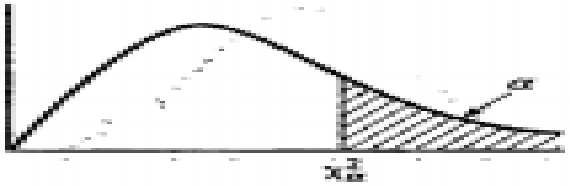
Chi-Square Test: Procedure

3. Test Statistics:

$$\chi_0^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}$$

- Critical Value (CV): $\chi^2_{\alpha,k-s-1}$
  - *The Null Hypothesis H_0 is rejected if* $\chi_0^2 > \chi^2_{\alpha,k-s-1}$
  - *Significance Level (α) : criteria to reject null hypothesis.*

Table A.6 Percentage Points of The Chi-Square Distribution with ν Degrees of Freedom



ν	$\chi^2_{0.995}$	$\chi^2_{0.99}$	$\chi^2_{0.975}$	$\chi^2_{0.95}$	$\chi^2_{0.10}$
1	7.88	6.63	5.02	3.84	2.71
2	10.60	9.21	7.38	5.99	4.61
3	12.84	11.34	9.35	7.81	6.25
4	14.96	13.28	11.14	9.49	7.78
5	16.7	15.1	12.8	11.1	9.2
6	18.5	16.8	14.4	12.6	10.6
7	20.3	18.5	16.0	14.1	12.0
8	22.0	20.1	17.5	15.5	13.4
9	23.6	21.7	19.0	16.9	14.7
10	25.2	23.2	20.5	18.3	16.0
11	26.8	24.7	21.9	19.7	17.3
12	28.3	26.2	23.3	21.0	18.5
13	29.8	27.7	24.7	22.4	19.8
14	31.3	29.1	26.1	23.7	21.1
15	32.8	30.6	27.5	25.0	22.3
16	34.3	32.0	28.8	26.3	23.5
17	35.7	33.4	30.2	27.6	24.8
18	37.2	34.8	31.5	28.9	26.0
19	38.6	36.2	32.9	30.1	27.2
20	40.0	37.6	34.2	31.4	28.4
21	41.4	38.9	35.5	32.7	29.6
22	42.8	40.3	36.8	33.9	30.8
23	44.2	41.6	38.1	35.2	32.0
24	45.6	43.0	39.4	36.4	33.2
25	49.6	44.3	40.6	37.7	34.4
26	48.3	45.6	41.9	38.9	35.6
27	49.6	47.0	43.2	40.1	36.7
28	51.0	48.3	44.5	41.3	37.9
29	52.3	49.6	45.7	42.6	39.1