ASQ CRE Prep course

Lesson II. B. 3. c.

Hypothesis Testing

For Variance

Variation can vary

HYPOTHESIS TESTS FOR VARIANCE

Chi-square (χ^2) Test

- **Two Cases**
  - **Compare sample variance to known population variance.**
  - **Compare observed and expected frequencies (no defined population variance)**

Sample Variance v Known Variance

- **Variances are distributed by χ^2**
- **The χ^2 distribution is not symmetrical**

$$H_o : \mu = \mu_o$$
$$H_a : \mu \neq \mu_o$$

$$H_o : \mu \leq \mu_o$$
$$H_a : \mu > \mu_o$$

$$H_o : \mu \geq \mu_o$$
$$H_a : \mu < \mu_o$$

$$\chi^2 = \frac{(n-1)s^2}{\sigma_X^2}$$

Example

- **The desired variation of a new process should have 4 σ = 60, 95% of the time.**
- **16 samples have a std dev = 12**
- **Does new system meet requirements?**

$$\chi^2 = \frac{(n-1)s^2}{\sigma_X^2}$$

Observed v Expected

- **Let's step through an example**
- **30 boards to 3 three inspectors looking for pass/ fail due to defects**

Observed	Inspectors			Treatment Total
	1	2	3	
Defect ID'd	27	25	22	74
Not ID'd	3	5	8	16
totals	30	30	30	90

- **Any significant (95%) between inspectors?**

Inspector Testing

- **Null Hypothesis**

$$H_o : p_1 = p_2 = p_3$$

- **Alterative Hypothesis**

$$H_a : p_1 \neq p_2 \neq p_3$$

Inspector Critical Value

- **Degrees of Freedom**

$$df = (\#\text{rows} - 1)(\#\text{columns} - 1)$$

- **From table**

  5.99

- **There is only a 5% chance the test statistic value will exceed 5.99**

Inspector Test Statistic

- **Calculate expected values**

$$\text{Expected Value} = \frac{\text{row total} \times \text{column total}}{\text{grand total}}$$

Expected	Inspectors			Treatment Total
	1	2	3	
Defect ID'd	24.67	24.67	24.67	74
Not ID'd	5.33	5.33	5.33	16
totals	30	30	30	90

Inspector Test Statistic

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

$$\chi^2 = \sum \frac{(27-24.67)^2}{24.67} + \cdots$$

$$\chi^2 = 2.89$$

- **Since the test statistic of 2.89**
- **Is less then critical value of 5.99**
- **We conclude there is not enough evidence the inspected show a difference with 95% confidence.**

Does this test show one is different then others?

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Lesson II. B. 3. d.

Hypothesis Testing

Other Comparisons