Chi-square Test

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Learning Objectives

In this chapter you will learn:

- How and when to use chi-square test for contingency tables
- How to use Marascuilo procedure for determining pair-wise differences when evaluationg more than two proproportions
- How and when to use non-parametric tests

Continguency Tables

- Useful in situations comparing multiple population proportions
- Used to classify sample observations according to two or more characteristics
- Also called cross-classification table (cross-tab)

The Marascuilo Procedure for χ^2

- Used when the null hypothesis of equal proportions is rejected
- Enables you to make comparisons between all pairs
- Start with the observed differences, p_j–$p_{j'}$, for all pairs (for $j \neq j'$) then compare the absolute difference to a calculated critical range Critical Range for the Marascuilo Procedure:
- Critical Range = $\sqrt{\chi^2}\sqrt{\frac{p_j(1-p_j)}{n_j} + \frac{p_{j'}(1-p_{j'})}{n_{j'}}}$

(Note: the critical range is different for each pairwise comparison)
A particular pair of proportions is significantly different if:
$|p_j–p_{j'}|$ > critical range for j and j'

Marascuilo Procedure Example

A University is thinking of switching to a trimester academic calendar. A random sample of 100 administrators, 50 students, and 50 faculty members were surveyed:

Opinion	Administrators	Students	Faculty	Total
Favor	63	20	37	120
Opposed	37	30	13	80
Total	100	50	50	200

Using a 1% level of significance, which groups have a different attitude?

Chi-Square Test Results

$H_0 : \pi_1 = \pi_2 = \pi_3$ H_1: Not all of the j are equal (j = 1, 2, 3)

Opinion	Administrators	Students	Faculty	Total
Favor	0=63,e=60	o=20,e=30	o=37, e=30	120
Opposed	o=37,e=40	o=30, e=20	o=13, e=20	80
Total	100	50	50	200

$\chi^2_{STAT} = \sum_{All\ cells} \frac{(f_o - f_e)^2}{f_e} = 12.792$

Marascuilo Procedure: Solution

Marascuilo Procedure

Group	Sample Proportion	Sample Size	Comparison	Absolute Difference	Std. Error of Difference	Critical Range	Results
1	0.63	100	1 to 2	0.23	0.084445249	0.2563	Means are not different
2	0.4	50	1 to 3	0.11	0.078606615	0.2386	Means are not different
3	0.74	50	2 to 3	0.34	0.092994624	0.2822	Means are different

Other Data				
Level of significance	0.01		Chi-sq Critical Value	9.2103
d.f	2			
Q Statistic	3.034854			