Stats Review
Chapter 12

Revised 8/16

Note:

This review is meant to highlight basic concepts from the course.   It does not cover all concepts presented by your instructor. Refer back to your notes, unit objectives, handouts, etc. to further prepare for your exam.

The questions are displayed on one slide followed by the answers are displayed in red on the next.

This review is available in alternate formats upon request.

Goodness-of-Fit Test

A teacher believed the distribution of which day a student would prefer to take a test to be

Day	Monday	Tuesday	Wednesday	Thursday	Friday
proportion	.1	.1	.1	.1	.6

She took a SRS of 150 students and had the following results.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
students	10	10	20	15	95

Test if the SRS of students follow the distribution of the teacher's at the α=.05 level.

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Students	10	10	20	15	95

Test if the SRS of students follow the distribution of the teacher's at the α=.05 level.

Step 1: State the null and alternative hypothesis

H_0: The student's preferred test days follows the distribution of the teacher's prediction.

H_1: The student's preferred test days follows a different distribution.

Step 2: Determine the level of significance

α=.05 level was given

Step 3:

a)Calculate the Expected counts. We take the probabilities times n.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
proportion	.1	.1	.1	.1	.6
Expected	.1(150)=15	.1(150)=15	.1(150)=15	.1(150)=15	.6(150) 90

Continue

Goodness-of-Fit Test

Step 3:

b) Verify the requirements

- All expected counts are greater or equal to 1. Yes met
- No more than 20% of the expected counts are less than 5. Yes met

c) Compute the test statistic

$$\chi_0^2 = \sum \frac{(O_i - E_i)^2}{E_i} = \frac{(10-15)^2}{15} + \frac{(10-15)^2}{15} + \frac{(20-15)^2}{15} + \frac{(15-15)^2}{15} + \frac{(95-90)^2}{90} = 5.278$$

Step 4:

Classical Approach

Determine Critical Value with k-1 degrees of freedom and reject if $\chi_0^2 > \chi_\alpha^2$

DF=k-1=5-1=4, $\chi_\alpha^2 = \chi_{.05}^2$=9.488 (from table)

5.278,9.488 so do not reject

P-value Approach

Determine p-value and if p-value<α, reject the null hypothesis

Using technology, =-value =.26

.26>.05, do not reject

Step 5: State the conclusion

Do *not* reject the null hypothesis. There is *not* sufficient evidence to suggest that the distribution of days is different.

Expected Frequency

A random sample of 830 college students were asked how their tuition is paid. The results were as follows

Methods of Payment

		scholarships	loans	Personal	other
gender	Male	128	190	80	12
	female	160	192	50	18

Determine the expected frequencies used in the Test for Independence and Test for homogeneity.

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Determine the expected frequencies used in the Test for Independence and Test for homogeneity.

Step 1: Add the columns and the rows

Methods of Payment

gender		Scholarships	loans	Personal	other	Total
	Male	128	190	80	12	410
	Female	160	192	50	18	420
	Total	288	382	130	30	830

Step 2: For each cell find the expected frequency

$$Expected\ Frequency = \frac{(row\ total)(column\ total)}{table\ total}$$

Methods of Payment

gender		scholarships	loans	Personal	other
	Male	$=\frac{410\cdot 288}{830}$ **≈142.265**	$=\frac{410\cdot 382}{830}$ **≈188.699**	$=\frac{410\cdot 130}{830}$ **≈64.217**	$=\frac{410\cdot 30}{830}$ **≈14.819**
	female	$=\frac{420\cdot 288}{830}$ **≈145.735**	$=\frac{420\cdot 382}{830}$ **≈193.301**	$=\frac{420\cdot 130}{830}$ **≈65.783**	$=\frac{420\cdot 30}{830}$ **≈15.181**

Chi-Squared test for Independence

A random sample of 830 college students were asked how their tuition is paid. The results were as follows

Methods of Payment

		scholarships	loans	Personal	other
gender	Male	128	190	80	12
	female	160	192	50	18

Determine the expected frequencies used in the Test for Independence and Test for homogeneity. Use the p-value approach at $\alpha = .1$ level of significance.

Chi-Squared test for Independence

A random sample of 830 college students were asked how their tuition is paid. The results were as follows

Methods of Payment

		scholarships	loans	Personal	other
gender	Male	128	190	80	12
	female	160	192	50	18

Determine the expected frequencies used in the Test for Independence and Test for homogeneity. Use the p-value approach at α=.1 level of significance.

Step 1: Determine the null/alternative hypothesis

H_0: The method of payment and gender is independent.

H_1: The method of payment and gender is dependent.

Step 2: Level of Significance? α=.01 level

Step 3: a) Calculate the expected values

From previous problem

Methods of Payment

		scholarships	loans	Personal	other
gender	Male	142.265	188.699	64.217	14.819
	female	145.735	193.301	65.783	15.181

Continue

Chi-Squared test for Independence

Step 3: b) Verify requirements

- All expected frequencies are greater or equal to 1? Yes
- No more than 20% of the expected values are less than 5? Yes

Step 3: c) Compute the test statistic

$$\chi_0^2 = \sum \frac{(O_i - E_i)^2}{E_i} = \frac{(128-142.265)^2}{142.265} + \frac{(190-188.699)^2}{188.699} + \frac{(80-64.217)^2}{64.217} + \frac{(12-14.819)^2}{14.819} +$$

$$\frac{(160-145.735)^2}{145.735} + \frac{(192-193.301)^2}{193.301} + \frac{(50-65.783)^2}{65.783} + \frac{(18-15.181)^2}{15.181} = 11.57$$

Step 4: Reject H_0 if the p-value < α (remember α=.01)

a)Degrees of freedom = (# of rows -1)(# of columns -1)=(r-1)(c-1)=(2-1)(4-1)=3

b)Find p-value.

- Using the table with χ_0^2=11.57 and df=3, p-value is between .005 and .01.
- Using Technology, p-value=.009

.009<.01 so Reject H_0

Step 5: State your conclusion

Reject the null hypothesis. There is sufficient evidence that gender and method of payment are dependent.

Test for homogeneity of Proportions

Two drugs are being tested along with a placebo to see if there is a side effect of hair loss. The table below shows the results. Is there evidence to suggest the proportions of subjects who took each drug who experience hair loss is different at the $\alpha = .01$ level?

	Drug 1	Drug 2	Placebo
Number of people who suffered hair loss	30	16	5
Number of people who did not suffered hair loss	10	40	7

Test for homogeneity of Proportions

Two drugs are being tested along with a placebo to see if there is a side effect of hair loss. The table below shows the results. Is there evidence to suggest the proportions of subjects who took each drug who experience hair loss is different at the α= .01 level?

	Drug 1	Drug 2	Placebo
Number of people who suffered hair loss	30	16	5
Number of people who did not suffered hair loss	10	40	7

The test for homogeneity is the same as the test for independence.

Step 1: Determine the null/alternative hypothesis

$H_0: p_1 = p_2 = p_3$

H_1: At least 1 proportion is different.

Step 2: level of Significance? α=.01 level

Step 3: a) Calculate the expected frequencies

	Drug 1	Drug 2	Placebo
hair loss	18.889	26.444	5.667
No hair loss	21.111	29.556	6.333

Remember:

$$Expected\ Frequency = \frac{(row\ total)(column\ total)}{table\ total}$$

b) Verify requirements

- All expected frequencies are greater or equal to 1? Yes
- No more than 20% of the expected values are less than 5? yes

Continue

Test for homogeneity of Proportions

Step 3: c) Compute the test statistic

$$\chi_0^2 = \sum \frac{(O_i - E_i)^2}{E_i} = \frac{(30-18.889)^2}{18.889} + \frac{(16-26.444)^2}{26.444} + \frac{(5-5.667)^2}{5.667} + \frac{(10-21.111)^2}{21.111} + \frac{(40-29.556)^2}{29.556} + \frac{(7-6.333)^2}{6.333} = 20.349$$

Step 4: Reject H_0 if the p-value < α (remember α=.01)

a) Degrees of freedom = (# of rows -1)(# of columns -1)=(r-1)(c-1)=(2-1)(3-1)=2

b) Find p-value.

- Using the table with χ_0^2=20.349 and df=2, p-value is less than .005
- Using Technology, p-value<.0001

.0001<.01 so Reject H_0

Step 5: State your conclusion

Reject the null hypothesis. There is significant evidence that at least of the drugs experience hair loss at a rate different from the other drugs.