College Prep. Stats.
Chapter 11 Review

1. Listed below are the numbers of deaths from lightning on the different days of the week. The deaths were recorded for a recent period of 35 years (based on data from the National Oceanic and Atmospheric Administration). Use a 0.01 significance level to test the claim that deaths from lightning occur on the different days with the same frequency.

Day	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
Number of deaths	574	445	429	473	428	422	467

a) State the null hypothesis and the alternative hypothesis.

$H_0: \ p_1 = p_2 = p_3 = p_4 = p_5 = p_6 = p_7$ $H_1:$ At least one of the proportions are not equal

b) Determine the expected frequency

Day	Observed Frequency O	Expected Frequency E
Sun	574	462.57
Mon	445	462.57
Tues	429	462.57
Weds	473	462.57
Thurs	428	462.57
Fri	422	462.57
Sat	467	462.57

All the expected frequencies are greater than 5.

c) Calculate the test statistic.

$\chi^2 = 36.3657$

d) Calculate the *p*-value.

P-Value = 0.00000234 < 0.01

e) What is the short and full conclusion?

Reject H_0

There is sufficient evidence to warrant rejection of the claim that deaths from lightning occur on the different days with the same frequency.

2. Researchers investigated the issue of race and equality of access to clinical trials. The table below shows the population distribution and the numbers of participants in clinical trials involving lung cancer (based on data from "Participation in Cancer Clinical Trials," by Murthy, Krumholz, and Gross, Journal of the American Medical Association, Vol. 291, No. 22). Use a 0.01 significance level to test the claim that the distribution of clinical trial participants fits well with the population distribution.

Race/Ethnicity	White Non-Hispanic	Hispanic	Black	Asian/Pacific Islander	American Indian/Alaskan Native
Distribution of Population	75.6%	9.1%	10.8%	3.8%	0.7%
Number in Lung Cancer Clinical Trials	3855	60	316	54	12

a) State the null hypothesis and the alternative hypothesis.

$H_0: \ p_1 = 0.756, \ p_2 = 0.091, \ p_3 = 0.108, \ p_4 = 0.038, \ p_5 = 0.007$

$H_1:$ At least one of the proportions are not equal to the given claimed value

b) Calculate the expected frequency.

Race/Ethnicity	Observed Frequency	Expected Frequency, *E*
White Non-Hispanic	3855	**3248.532**
Hispanic	60	**391.027**
Black	316	**464.076**
Asia/Pacific Islander	54	**163.286**
American Indian/Alaskan Native	12	**30.079**

All the expected frequencies are greater than 5.

c) Calculate the test statistic.

$\chi^2 = 524.7132$

d) Calculate the *p*-value.

P-Value = 0 < 0.01

e) What is the short and full conclusion?

Reject H_0

There is sufficient evidence to warrant rejection of the claim that the distribution of clinical trial participants fits well with the population distribution.

3. A clinical trial tested the effectiveness of bupropion hydrochloride in healing people who want to stop smoking. Results of abstinence from smoking 52 weeks after the treatment are summarized in the table below (based on data from "A Double-Blind, Placebo-Controlled, Randomized Trial of Bupropion for Smoking Cessation in Primary Care," by Fossatti, et al., *Archeives of Internal Medicine*, Vol. 167, No. 16). Use a 0.05 significance level to test the claim whether a subject smokes is independent of whether the subject was treated with bupropion hydrochloride or a placebo.

	Bupropion Hydrochloride	Placebo
Smoking	299	167
Not Smoking	101	26

a) State the null hypothesis and the alternative hypothesis.

H_0 : Smoking is independent of treatments H_1 : Smoking is dependent of treatments

b) Calculate the expected frequencies.

Expected Frequencies	Bupropion Hydrochloride	Placebo
Smoking	314.3339	151.6661
Not Smoking	85.6661	41.3339

c) Calculate the test statistic.

$\chi^2 = 10.7315$

d) Calculate the *p*-value.

P-Value = 0.0011 < 0.05

e) What is the short and full conclusion?

Reject H_0

There is sufficient evidence to warrant rejection of the claim that whether a subject smokes is independent of whether the subject was treated with bupropion hydrochloride or a placebo.

4. In 2006, the NCAA published a report called "Substance Use: NCAA Study of Substance Use of College Student-Athletes." the NCAA reported to investigate the following question: *Does steroid use by student athletes differ for the three NCAA divisions?* The data comes from a random selection of teams in each NCAA division. The NCAA claimed that the proportion of the athletes using the steroids is the same in each of the three NCAA divisions.

Observed Frequency	**Admit Steroid Use**	
	Yes	**No**
Division 1	103	8440
Division 2	52	4289
Division 3	65	6428

a) State the null hypothesis and the alternative hypothesis.

H_0 : The proportion of athletes using steroids is the same in each of the three NCAA divisions.

H_1 : The proportion of athletes using steroids is not same in each of the three NCAA divisions.

b) Calculate the expected frequencies.

Expected Frequency	Admit Steroid Use	
	Yes	No
Division 1	96.9944	8446.0056
Division 2	49.2863	4291.7137
Division 3	73.7194	6419.2806

c) Calculate the test statistic.

$\chi^2 = 1.5704$

d) Calculate the *p*-value.

P-Value = 0.4560 > 0.05

e) What is the short and full conclusion?

Fail to reject H_0

There is not sufficient evidence to warrant the rejection of the claim that proportion of athletes using steroids is the same in each of the three NCAA divisions.

Determine what type of Chi-Square Test you would use. Use the following answer choices for these problems:

a) Test for Independence

b) Test of Homogeneity

c) Test for Goodness of Fit with all probabilities equal

d) Test for Goodness of Fit with all probabilities NOT equal

5. Thai, the manager of a car dealership, did not want to stock cars that were bought less frequently because of their unpopular color. The five colors that he ordered were red, yellow, green, blue, and white. According to Thai, the expected frequencies or number of customers choosing each color should follow the percentages of last year. She felt 20% would choose yellow, 30% would choose red, 10% would choose green, 10% would choose blue, and 30% would choose white. Thai then took a random sample of 150 customers and asked them their color preferences.

Color	Yellow	Red	Green	Blue	White
Observed	35	50	30	10	25

d) Test for Goodness of Fit with all probabilities NOT equal

6. When considering effects from eliminating the penny as a unit of currency in the United States, the author randomly selected 100 checks and recorded the cents portions of those checks. The table below lists those cents portions categorized according to the indicated values. Use a 0.05 significance level to test the claim that the four categories are equally likely.

Cents portion of check	0 – 24	25 – 49	50 – 74	75 – 99
Number	61	17	10	12

c) Test for Goodness of Fit with all probabilities equal

7. The General Social Survey asked a random sample of adults, "Do you favor or oppose the death penalty for persons convicted of murder?" The following table gives the responses of people whose highest education was a high school degree and of people with a bachelor's degree:

	Favor	Oppose
High School	1010	369
Bachelor's	319	185

a) Test for Independence, because "a random sample" NOT "two random samples" in the question.

8. The head of surgery department at a university medical center was concerned that surgical residents in training applied unnecessary blood transfusions at a different rate than the more experienced attending physicians. Therefore, he ordered a study of the 49 attending physicians and 71 residents in training with privileges at the hospital. For each of the 120 surgeons, the number of blood transfusions prescribed unnecessarily in a one-year period was recorded. Based on the number recorded, a surgeon was identified as either prescribing unnecessary blood transfusion Frequently, Occasionally, Rarely, or Never. The following contingency table summarizes the data:

	Frequent	Occasionally	Rarely	Never
Attending	2	3	31	13
Resident	15	28	23	5

b) Test of Homogeneity

9. Nadir is testing an octahedral die to see if it is biased. The results are given in the table below. Test the hypothesis that the die is has equally likely outcomes.

	1	2	3	4	5	6	7	8
Frequency	7	10	11	9	12	10	14	7

c) Test for Goodness of Fit with all probabilities equal

10. Randomly selected nonfatal occupational injuries and illnesses are categorized according to the day of the week that they first occurred, and the results are listed below (based on data from the Bureau of Labor Statistics). Use a 0.05 significance level to test the claim that such injuries and illnesses occur with equal frequency on the different days of the week.

Day	Mon	Tues	Weds	Thurs	Fri
Number	23	23	21	21	19

c) Test for Goodness of Fit with all probabilities equal

11. ToastyOs, a new cereal, was introduced into a local test market last year to appeal to all adults. After a disappointing year on the shelves, there was speculation based on a focus group and panel research that taste preference for ToastyOs may be related to education level, that is, the more educated a person is, the more they might prefer ToastyOs. Before focusing their marketing campaign on this type of consumer, a research firm, Chi-Square Consultants, was called in. The consultants randomly sampled 500 individuals in the test market area who had tried the product, with the following results:

	No College	Some College	College Graduate
Liked ToastyOs	75	90	135
Neutral or disliked	25	60	115

a) Test for Independence