

CHAPTER 11 FORM A

Name _____ Course Number: _____ Section Number: _____

Directions: Answer the questions and solve the problems in the spaces provided, or attach paper. Circle the correct choice for each response set. Where allowed, use computer assistance.

Provide an appropriate response.

1) Describe the test of homogeneity. What characteristic distinguishes a test of homogeneity from a test of independence?

2) Discuss three characteristics of a Chi-Square distribution.

Perform the indicated goodness-of-fit test.

3) A company manager wishes to test a union leader's claim that absences occur on the different week days with the same frequencies. Test this claim at the 0.05 level of significance if the following sample data have been compiled.

Day	Mon	Tue	Wed	Thur	Fri
Absences	37	15	12	23	43

4) Using the data below and a 0.05 significance level, test the claim that the responses occur with percentages of 15%, 20%, 25%, 25%, and 15% respectively.

Response	A	B	C	D	E
Frequency	12	15	16	18	19

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According to Benford's Law, a variety of different data sets include numbers with leading (first) digits that follow the distribution shown in the table below. Test for goodness-of-fit with Benford's Law.

Leading Digit	1	2	3	4	5	6	7	8	9
Benford's law: distribution of leading digits	30.1%	17.6%	12.5%	9.7%	7.9%	6.7%	5.8%	5.1%	4.6%

- 5) When working for the Brooklyn District Attorney, investigator Robert Burton analyzed the leading digits of the amounts from 784 checks issued by seven suspect companies. The frequencies were found to be 0, 9, 0, 70, 485, 189, 8, 23, and 0, and those digits correspond to the leading digits of 1, 2, 3, 4, 5, 6, 7, 8, and 9, respectively. If the observed frequencies are substantially different from the frequencies expected with Benford's Law, the check amounts appear to result from fraud. Use a 0.05 significance level to test for goodness-of-fit with Benford's Law. Does it appear that the checks are the result of fraud?

Use a χ^2 test to test the claim that in the given contingency table, the row variable and the column variable are independent.

- 6) Tests for adverse reactions to a new drug yielded the results given in the table. At the 0.05 significance level, test the claim that the treatment (drug or placebo) is independent of the reaction (whether or not headaches were experienced).

	Drug	Placebo
Headaches	11	7
No headaches	73	91

- 7) Use the sample data below to test whether car color affects the likelihood of being in an accident. Use a significance level of 0.01.

	Red	Blue	White
Car has been in accident	28	33	36
Car has not been in accident	23	22	30

Solve the problem.

- 8) A researcher wishes to test the effectiveness of a flu vaccination. 150 people are vaccinated, 180 people are vaccinated with a placebo, and 100 people are not vaccinated. The number in each group who later caught the flu was recorded. The results are shown below.

	Vaccinated	Placebo	Control
Caught the flu	8	19	21
Did not catch the flu	142	161	79

Use a 0.05 significance level to test the claim that the proportion of people catching the flu is the same in all three groups.

Provide an appropriate response.

- 9) The table below summarizes results from an experiment in which subjects were classified as diabetic or nondiabetic and then given a treatment. After the treatment, they were again classified as diabetic or nondiabetic. Which combinations of before treatment/after treatment categories will yield discordant pairs?

		Before Treatment	
		Diabetic	Nondiabetic
After Treatment	Diabetic	9	6
	Nondiabetic	22	12

- A) Only diabetic/nondiabetic
- B) nondiabetic/nondiabetic and diabetic/diabetic
- C) diabetic/nondiabetic and nondiabetic/diabetic
- D) Only nondiabetic/nondiabetic

- 10) The table below summarizes results from an experiment in which subjects were classified as asthmatic or nonasthmatic and then given a treatment. After the treatment, they were again classified as asthmatic or nonasthmatic. How many subjects were included in the experiment?

		Before Treatment	
		Asthmatic	Nonasthmatic
After Treatment	Asthmatic	9	2
	Nonasthmatic	15	6

- A) 15 B) 8 C) 32 D) 24

- 11) The table below summarizes results from an experiment in which subjects were classified as asthmatic or nonasthmatic and then given a treatment. After the treatment, they were again classified as asthmatic or nonasthmatic. How many subjects changed their asthmatic/nonasthmatic status after the experiment?

		Before Treatment	
		Asthmatic	Nonasthmatic
After Treatment	Asthmatic	9	2
	Nonasthmatic	15	6

- A) 32 B) 15 C) 16 D) 17

Find the test statistic χ^2 by McNemar's test.

- 12) categorical data: a = 72, b = 68, c = 110, d = 50

- A) 9.444 B) 10.388 C) 3.615 D) 7.934

Answer Key

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- 1) The test of homogeneity tests the claim that different populations have the same proportions of some characteristics. In the test of homogeneity, there are predetermined totals for either the rows or columns of the contingency table. In the test of independence, there is one big sample drawn so that the row and column totals are determined randomly. In the test of homogeneity, predetermined sample sizes are used for each population.
- 2) The chi-square distribution is not symmetric. The values of a chi-square distribution can be 0 or positive, but they cannot be negative. The chi-square distribution is different for each number of degrees of freedom.
- 3) H_0 : The proportions of absences are all the same.
 H_1 : The proportions of absences are not all the same.
Test statistic: $\chi^2 = 28.308$. Critical value: $\chi^2 = 9.488$. Reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that absences occur on the different week days with the same frequency.
- 4) H_0 : The responses occur according to the stated percentages.
 H_1 : The responses do not occur according to the stated percentages.
Test statistic: $\chi^2 = 5.146$. Critical value: $\chi^2 = 9.488$. Fail to reject the null hypothesis. There is not sufficient evidence to warrant rejection of the claim that the responses occur according to the stated percentages.
- 5) H_0 : Leading digits are from a population with a distribution that conforms to Benford's Law.
 H_1 : Leading digits are not from a population distributed in accordance with Benford's Law.
Test statistic $\chi^2 = 3763.6406$ (by TI-84+, using high precision & verified by STATDISK). Critical value: $\chi^2 = 15.507$. P-value < 0.005 (by Table A-4); P-value = 0.0000 (by STATDISK). There is sufficient evidence to warrant rejection of the claim that the leading digits are from a population with a distribution that conforms to Benford's Law. It does appear that the checks are the result of fraud.
- 6) H_0 : Treatment and reaction are independent.
 H_1 : Treatment and reaction are dependent.
Test statistic: $\chi^2 = 1.798$. Critical value: $\chi^2 = 3.841$.
Fail to reject the null hypothesis. There is not sufficient evidence to warrant rejection of the claim that treatment and reaction are independent.
- 7) H_0 : Car color and being in an accident are independent.
 H_1 : Car color and being in an accident are dependent.
Test statistic: $\chi^2 = 0.4287$. Critical value: $\chi^2 = 9.210$.
Fail to reject the null hypothesis. There is not sufficient evidence to warrant rejection of the claim that car color and being in an accident are independent.
- 8) H_0 : The proportion of people catching the flu is the same in all three groups.
 H_1 : The proportions are different.
Test statistic: $\chi^2 = 14.966$. Critical value: $\chi^2 = 5.991$.
Reject the null hypothesis. There is sufficient evidence to warrant rejection of the claim that the proportion of people catching the flu is the same in all three groups.
- 9) C
- 10) C
- 11) D
- 12) A