Chapter 11 Practice Multiple Choice Questions

Quiz - AP STATS

11.1 Chi-Square Goodness-of-Fit Tests

Multiple choice: Select the best answer for Exercises 19 to 22.

Exercises 19 to 21 refer to the following setting. Researchers wondered whether the trees in a longleaf pine forest in Georgia are randomly distributed. To find out, they divided the forest into four equal quadrants. Then the researchers took a random sample of 100 trees and counted the number in each quadrant. Here are their data:

EACH QUAD = .25

Quadrant:	1	2	3	4
Count:	18	22	39	21 = 100
Expected	25	25	25	25

19. An appropriate null hypothesis to test whether the trees in the forest are randomly distributed is

(a) $H_0: \mu = 25$, where μ = the mean number of trees in each quadrant.

(b) $H_0: p = 0.25$, where p = the proportion of all trees in the forest that are in Quadrant 1.

(c) $H_0: n_1 = n_2 = n_3 = n_4 = 25$, where n_i is the number of trees from the sample in Quadrant i.

(d) $H_0: p_1 = p_2 = p_3 = p_4 = 0.25$, where p_i is the actual proportion of trees in the forest that are in Quadrant i.

(e) $H_0: \hat{p}_1 = \hat{p}_2 = \hat{p}_3 = \hat{p}_4 = 0.25$, where $\hat{p}_i$ is the proportion of trees in the sample that are in Quadrant i.

20. The chi-square statistic is

(a) $\frac{(18-25)^2}{25} + \frac{(22-25)^2}{25} + \frac{(39-25)^2}{25} + \frac{(21-25)^2}{25}$

(b) $\frac{(25-18)^2}{18} + \frac{(25-22)^2}{22} + \frac{(25-39)^2}{39} + \frac{(25-21)^2}{21}$

(c) $\frac{(18-25)}{25} + \frac{(22-25)}{25} + \frac{(39-25)}{25} + \frac{(21-25)}{25}$

(d) $\frac{(18-25)^2}{100} + \frac{(22-25)^2}{100} + \frac{(39-25)^2}{100} + \frac{(21-25)^2}{100}$

(e) $\frac{(0.18-0.25)^2}{0.25} + \frac{(0.22-0.25)^2}{0.25} + \frac{(0.39-0.25)^2}{0.25} + \frac{(0.21-0.25)^2}{0.25}$

21. The P-value for a chi-square goodness-of-fit test is 0.0129. The correct conclusion is

(a) reject H_0 at $\alpha = 0.05$; there is strong evidence that the trees are randomly distributed.

(b) reject H_0 at $\alpha = 0.05$; there is not strong evidence that the trees are randomly distributed.

(c) reject H_0 at $\alpha = 0.05$; there is strong evidence that the trees are not randomly distributed.

(d) fail to reject H_0 at $\alpha = 0.05$; there is not strong evidence that the trees are randomly distributed.

(e) fail to reject H_0 at $\alpha = 0.05$; there is strong evidence that the trees are randomly distributed.

22. Your teacher prepares a large container full of colored beads. She claims that 1/8 of the beads are red, 1/4 are blue, and the remainder are yellow. Your class will take a simple random sample of beads from the container to test the teacher's claim. The smallest number of beads you can take so that the conditions for performing inference are met is

(a) 15. (b) 16. (c) 30. (d) 40. (e) 80.

Red = 1/8 n = 5
Blue = 1/4
Yellow =
1/8 n = 5
n = 40

T11.1 A chi-square goodness-of-fit test is used to test whether a 0 to 9 spinner is "fair" (that is, the outcomes are all equally likely). The spinner is spun 100 times, and the results are recorded. The degrees of freedom for the test will be

(a) 8. (b) 9. (c) 10. (d) 99. (e) None of these.

# categories = 10
df = 10 − 1 = 9

T10.8. An SRS of size 100 is taken from Population A with proportion 0.8 of successes. An independent SRS of size 400 is taken from Population B with proportion 0.5 of successes. The sampling distribution for the difference (Population A − Population B) in sample proportions has what mean and standard deviation?

(a) mean = 0.3; standard deviation = 1.3

(b) mean = 0.3; standard deviation = 0.40

(c) mean = 0.3; standard deviation = 0.047

(d) mean = 0.3; standard deviation = 0.047

(e) mean = 0.3; standard deviation = 0.0002

.0016

$\mu = .8 - .5 = .3$

$\sigma = \sqrt{\frac{(.8)(.2)}{100} + \frac{(.5)(.5)}{400}}$

$\sigma = .047$

Quiz - AP Stats

11.2 Inference for Relationships

Multiple choice: Select the best answer for Exercises 53 to 58.

The National Longitudinal Study of Adolescent Health interviewed a random sample of 4877 teens (grades 7 to 12). One question asked was "What do you think are the chances you will be married in the next ten years?" Here is a two-way table of the responses by gender:[32]

	Female	Male	Totals
Almost no chance	119	102	221
Some chance, but probably not	172	150	322
A 50–50 chance	516	447	963
A good chance	778	735	1513
Almost certain	1038	1174	2212
Totals	2625	2252	4877

53. The appropriate null hypothesis for performing a chi-square test is that

(a) equal proportions of female and male teenagers are almost certain they will be married in 10 years.

(b) there is no difference between female and male teenagers in this sample in their distributions of opinions about marriage.

(c) there is no difference between female and male teenagers in the population in their distributions of opinions about marriage.

(d) there is no association between gender and opinion about marriage in the sample.

(e) there is no association between gender and opinion about marriage in the population.

54. The expected count of females who respond "almost certain" is

(a) 464.6. (c) 1038.8. (e) None of these.

(b) 891.2. (d) 1174.

55. The degrees of freedom for the chi-square test for this two-way table are

(a) 4. (c) 10. (e) None of these.

(b) 8. (d) 20.

56. The cell in the table that contributes the most to the chi-square statistic is

(a) Female, 50–50 chance.

(b) Male, 50–50 chance.

(c) Female, almost certain.

(d) Male, almost certain.

(e) All the cells contribute equally to the test statistic.

57. Software gives test statistic $\chi^2 = 69.8$ and P-value close to 0. The correct interpretation of this result is

(a) the probability of getting a random sample of 4877 teens that yields a value of χ^2 of 69.8 or larger is basically 0.

(b) the probability of getting a random sample of 4877 teens that yields a value of χ^2 of 69.8 or larger if H_0 is true is basically 0.

(c) the probability of making a Type I error is basically 0.

(d) the probability of making a Type II error is basically 0.

(e) it's very unlikely that these data are true.

58. Which of the following explains why one of the conditions for performing the chi-square test is met in this case?

(a) The sample is large, 4877 teenagers in all.

(b) The sample is random.

(c) All the observed counts are greater than 100.

(d) We used software to do the calculations.

(e) Both variables are categorical.

Exercises T11.4 to T11.6 refer to the following setting. A random sample of traffic tickets given to motorists in a large city is examined. The tickets are classified according to the race of the driver. The results are summarized in the following table:

Race:	White	Black	Hispanic	Other
Number of tickets:	69	52	18	9

The proportion of this city's population in each of the racial categories listed above is as follows:

Race:	White	Black	Hispanic	Other
Proportion:	0.55	0.30	0.08	0.07

We wish to test H_0: The racial distribution of traffic tickets in the city is the same as the racial distribution of the city's population.

T11.4 Assuming H_0 is true, the expected number of Hispanic drivers who would receive a ticket is

(a) 8. (c) 11. (e) 12.
(b) 10.36. (d) 11.84.

T11.5 We compute the value of the χ^2 statistic to be 6.58. Assuming that the conditions for inference are met, the P-value of our test is

(a) greater than 0.20.
(b) between 0.10 and 0.20.
(c) between 0.05 and 0.10.
(d) between 0.01 and 0.05.
(e) less than 0.01.

T11.6 The category that contributes the largest component to the χ^2 statistic is

(a) White. (c) Hispanic.
(b) Black. (d) Other.
(e) The answer cannot be determined since this is only a sample.

Exercises T11.7 to T11.10 refer to the following setting. All current-carrying wires produce electromagnetic (EM) radiation, including the electrical wiring running into, through, and out of our homes. High-frequency EM radiation is thought to be a cause of cancer. The lower frequencies associated with household current are generally assumed to be harmless. To investigate this, researchers visited the addresses of a random sample of children who had died of some form of cancer (leukemia, lymphoma, or some other type) and classified the wiring configuration outside the dwelling as either a high-current configuration (HCC) or a low-current configuration (LCC). Here are the data:

	Leukemia	Lymphoma	Other cancers
HCC	52	10	17
LCC	84	21	31

Computer software was used to analyze the data. The output is given below. It includes the cell counts, some of the expected cell counts, and the value of the χ^2 statistic. In the table, expected counts are printed below observed counts and enclosed within parentheses.

	Leukemia	Lymphoma	Other cancers	Total
HCC	52 (49.97)	10	17 (17.64)	79
LCC	84 (86.03)	21	31 (30.36)	136
Total	136	31	48	215

$$\chi^2 = 0.082 + 0.170 + 0.023 + 0.048 + 0.099 + 0.013 = 0.435$$

T11.7 The appropriate degrees of freedom for the χ^2 statistic is

(a) 1. (b) 2. (c) 3. (d) 4. (e) 5.

T11.8 The expected count of cases with lymphoma in homes with an HCC is

(a) $\frac{79 \cdot 31}{215}$. (b) $\frac{10 \cdot 21}{215}$. (c) $\frac{79 \cdot 31}{10}$. (d) $\frac{136 \cdot 31}{215}$.
(e) None of these.

T11.9 + T11.10 on front

NAME _____

Chapter 11 AP Statistics Practice Test (mc)

ection I: Multiple Choice *Select the best answer for each question.*

T11.1 A chi-square goodness-of-fit test is used to test whether a 0 to 9 spinner is "fair" (that is, the outcomes are all equally likely). The spinner is spun 100 times, and the results are recorded. The degrees of freedom for the test will be

(a) 8. (c) 10. DF = (e) None of these.

(b) 9. (d) 99. 10 CATEGORIES − 1 = 9

Exercises T11.2 and T11.3 refer to the following setting. Recent revenue shortfalls in a midwestern state led to a reduction in the state budget for higher education. To offset the reduction, the largest state university proposed a 25% tuition increase. It was determined that such an increase was needed simply to compensate for the lost support from the state. Separate random samples of 50 freshmen, 50 sophomores, 50 juniors, and 50 seniors from the university were asked whether or not they were strongly opposed to the increase, given that it was the minimum increase necessary to maintain the university's budget at current levels. The results are given in the following table.

	Year			
Strongly Opposed?	Freshman	Sophomore	Junior	Senior
Yes	39	36	29	18
No	11	14	21	32

T11.2 Which hypotheses would be appropriate for performing a chi-square test? χ^2 TEST OF HOMOGENIETY

4 DIFFERENT SAMPLES

(a) The null hypothesis is that the closer students get to graduation, the less likely they are to be opposed to tuition increases. The alternative is that how close students are to graduation makes no difference in their opinion.

(b) The null hypothesis is that the mean number of students who are strongly opposed is the same for each of the four years. The alternative is that the mean is different for at least two of the four years.

(c) The null hypothesis is that the distribution of student opinion about the proposed tuition increase is the same for each of the four years at this university. The alternative is that the distribution is different for at least two of the four years.

(d) The null hypothesis is that year in school and student opinion about the tuition increase in the sample are independent. The alternative is that these variables are dependent.

(e) The null hypothesis is that there is an association between year in school and opinion about the tuition increase at this university. The alternative hypothesis is that these variables are not associated.

T11.3 The conditions for carrying out the chi-square test in exercise T11.2 are

I. Separate random samples from the populations of interest. Y

II. Expected counts large enough. → PUT IN CALC ① MATRIX A

III. The samples themselves and the individual observations in each sample are independent. Y

② χ^2 TEST

③ EXPECTED COUNTS IN MATRIX B

Which of the conditions is (are) satisfied in this case?

(a) I only (d) II and III only

(b) II only (e) I, II, and III

(c) I and II only

GO TO BACK

T11.9 + T11.10 - SEE INSTRUCTIONS ON BACK

T11.9 Which of the following may we conclude, based on the test results? $\chi^2 = .435$ p-value = .80

(a) There is strong evidence of an association between wiring configuration and the chance that a child will develop some form of cancer.

(b) HCC either causes cancer directly or is a major contributing factor to the development of cancer in children.

(c) Leukemia is the most common type of cancer among children. χ^2 very small → FAIL TO REJECT

(d) There is not much evidence of an association between wiring configuration and the type of cancer that caused the deaths of children in the study.

(e) There is weak evidence that HCC causes cancer in children.

T11.10 A Type I error would occur if we conclude that

(a) HCC wiring caused cancer when it actually didn't.

(b) HCC wiring didn't cause cancer when it actually did.

(c) there is no association between the type of wiring and the form of cancer when there actually is an association.

(d) there is an association between the type of wiring and the form of cancer when there actually is no association.

(e) the type of wiring and the form of cancer have a positive correlation when they actually don't.

TYPE I ERROR - IF WE REJECT H_0 - AND MAKE THIS CONCLUSION.