

Chapter 11 Multiple Choice Practice

ANSWER KEY

Directions. Identify the choice that best completes the statement or answers the question. Check your answers and note your performance when you are finished.

1. To test the effectiveness of your calculator's random number generator, you randomly select 1000 numbers from a standard Normal distribution. You classify these 1000 numbers according to whether their values are at most -2 , between -2 and 0 , between 0 and 2 , or at least 2 . The results are given in the following table. The expected counts, based on the 68-95-99.7 rule, are given as well.

	At most -2	Between -2 and 0	Between 0 and 2	At least 2
Observed Count	18	492	468	22
Expected Count	25	475	475	25

To test to see if the distribution of observed counts differs significantly from the distribution of expected counts, we can use a χ^2 goodness of fit test. For this test, the test statistic has approximately a χ^2 distribution. How many degrees of freedom does this distribution have?

- (A) 3
 (B) 4
 (C) 7
 (D) 999
 (E) 1000
- # of categories - 1
2. Refer to problem 1. Which of the following is the component of the χ^2 statistic corresponding to the category "at most -2 "?
- (A) $(43)(1000)/2000$
 (B) $(43)(25)/1000$
 (C) $18/1000$
 (D) $(18-25)^2/25$
 (E) $(18-25)^2/18$
- $\frac{(0-E)^2}{E}$ $\frac{(18-25)^2}{25}$
3. Which of the following statements is true of chi-square distributions?
- (A) As the number of degrees of freedom increases, their density curves look less and less like a normal curve.
 (B) As the number of degrees of freedom increases, their density curves look more and more like a uniform distribution.
 (C) Their density curves are skewed to the left.
 (D) They take on only positive values.
 (E) All of the above are true.

4. A student at a large high school suspects that Mr. Andreasen is grading his students too harshly. Over the past 10 years the proportions of students in *all* sections of statistics (taught by many different teachers) received grades of A, B, C, D, or F in the following proportions: A: 0.20; B: 0.30; C: 0.30; D: 0.10; and F: 0.10. An SRS of 90 students who took statistics with Mr. Andreasen in the past 10 years produces the following information:

Grade	A	B	C	D	F
Number of students	12	26	28	15	9

Which of the following conditions must be met before the student can use the χ^2 procedure in this situation?

- (A) The distribution of grades in all introductory statistics courses must be approximately Normal.
 - (B) The number of categories is small relative to the number of observations.
 - (C) All the observed counts are greater than 5.
 - (D) Each observation was randomly selected from the population of all students.
 - (E) All expected counts are approximately equal.
5. Which of the following expressions represents the expected count of the grade category D?
- (A) 90/5
 - (B) $(0.10)(90)$
 - (C) $(0.1)(15)$
 - (D) $15^2/90$
 - (E) $(15-9)^2/9$

%. · n

6. Anne wants to know if males and females prefer different brands of frozen pizzas. She bakes four dozen pizzas made by each of four manufacturers, which she labels brands A, B, C, and D. She then selects a simple random sample of 48 students, records their gender, gives them one slice of each brand and asks which brand they like best. Here are her results:

	A	B	C	D	Total
Males	2	4	6	7	19
Females	11	5	6	7	29
Total	13	9	12	14	48

If we want to compare the conditional distributions for preferred pizza brand for males to the same distribution for females, which of the following is an appropriate graph to use?

- (A) Parallel dotplots
 - (B) Back-to-back stemplots
 - (C) Segmented bar graphs
 - (D) Side-by-side bar graphs
 - (E) Scatterplot
7. The appropriate null hypothesis for Anne's question in this problem is:
- (A) There is an association between gender and preferred frozen pizza.
 - (B) Gender and pizza preference are independent.
 - (C) The distribution of preferred pizza for each gender is different.
 - (D) The observed count in each cell is equal to the expected count.
 - (E) The males and females subjects in this experiment have the same distribution of pizza brand preference.

** This is a χ^2 test of independence because it is from ONE sample*

8. Are the conditions for a chi-square test of association/independence met?
 (A) Yes, because the sample size is greater than 30. *not a condition*
 (B) Yes, because a simple random sample was selected.
 (C) No, because the distribution for each gender is different.
 (D) No, because not all observed counts are greater than 5.
 (E) No, because 25% of expected counts are less than 5. *expected counts need to be greater than 5*
9. Below is a table of individual components of the chi-square test of association/independence for a study done on amount of time spent at a computer and whether or not a person wears glasses: *↑ put the observed counts in matrix A, do a χ^2 test, look at matrix B - 2 of the 8 expected counts are less than 5*

Amount of Computer Screen Time		Wear Glasses?	
		Yes	No
Above Average		8.7	6.3
Average		0.5	0.3
Below Average		3.1	2.2

- Which of the following statements is supported by the information in this table?
 (A) Above-average screen time individuals wore glasses much less often than expected.
 (B) Average screen time individuals wore glasses much less often than expected.
 (C) Below-average screen time individuals wore glasses about as often as expected.
 (D) You can't determine this without the original observed counts.
 (E) The chi-square statistic for this test is about 3.5.
10. A random sample of 200 Canadian students were asked about their hand dominance and whether they suffer from allergies. Here are the results:

Hand Dominance		Allergies?	
		Yes	No
Ambidextrous		12	7
Left-handed		11	9
Right-handed		95	66

- What can you conclude about the relationship between hand dominance and allergies?
 (A) Using a test for association/independence, there is not enough evidence ($P = 0.13$) to conclude that there is a relationship between hand dominance and allergies.
 (B) Using a test for association/independence, there is enough evidence ($P = 0.87$) to conclude that there is a relationship between hand dominance and allergies.
 (C) Using a test for association/independence, there is not enough evidence ($P = 0.87$) to conclude that there is a relationship between hand dominance and allergies.
 (D) Using a test for association/independence, there is not enough evidence ($P = 0.13$) to conclude that there is a relationship between hand dominance and allergies.
 (E) We cannot perform a chi-square test on these data.

*put the table in matrix A, do a χ^2 test
 $p = .87$*

1. A 2. D 3. D 4. D 5. B
 6. D 7. B 8. E 9. D 10. C

FRAPPY! Free Response AP® Problem, Yay!

The following problem is modeled after actual Advanced Placement Statistics free response questions. Your task is to generate a complete, concise response in 15 minutes. After you generate your response, view two example solutions and determine whether you feel they are “complete”, “substantial”, “developing” or “minimal”. If they are not “complete”, what would you suggest to the student who wrote them to increase their score? Finally, you will be provided with a rubric. Score your response and note what, if anything, you would do differently to increase your own score.

A study was performed to determine whether or not the name of a course had an effect on student registrations. A statistics course in a large school district was given 4 different names in a course catalog. Each name corresponded to the exact same statistics course. A random sample of student registrations was recorded and the results are given below:

Course Name	Number of Registrations
Statistical Applications	25
Statistical Reasoning	22
Statistical Analysis	30
The Practice of Statistics	40
Total	117

Do these data suggest the name of the course has an effect on student registrations? Conduct an appropriate statistical test to support your conclusion.

H_0 : The distribution of registrations is the same for each course name

H_a : at least one of the courses is different than expected.

We will use a χ^2 GOF test with $\alpha = .05$

CONDITIONS

- * It is stated as a random sample which we will assume means SRS.
- * The expected count for each category is 29.25 which is ≥ 5
- * for independence, we assume that $10(117)$ is less than 10% of the population of all students.

$$\chi^2 = 6.38$$

$$p = .094$$

$$df = 3$$

since $p > \alpha$ we fail to reject H_0 . we do not have convincing evidence that the name of the course has an effect on student registrations.