Lesson #52 · Topic 3H · Practice

Name _____

1. A school nutritionist collects independent random samples of students from the middle school and high school in her district and records whether each student eats breakfast at home, eats breakfast at school, or skips breakfast.

   a. How many samples were selected?

   b. Clearly define the populations from which the samples were selected.

   c. How many variables are being measured? Identify the variables.

2. A school counselor from a large high school with over 3,000 students selects independent random samples of 40 freshmen, 40 sophomores, and 40 juniors and records each student's club participation (no clubs, one club, two or more clubs). The results are shown in the table:

	Freshmen	**Sophomore**	**Junior**	**Total**
No clubs	28	18	14	60
One club	10	19	22	51
Two or more clubs	2	3	4	9
Total	40	40	40	120

The counselor will perform a chi-square test for homogeneity to determine if there is a difference in the distributions of club participation across the grade levels.

a. Is the random condition met? Explain.

b. Is the 10% condition met? Explain.

c. Is the Large Counts condition met? Explain.

3. A retail analyst wants to determine whether the proportion of customers who pay with cash differs between Store A and Store B, two locations of the same retail chain. Independent random samples of 100 customers are selected from each store, and each customer's payment method is recorded. The data are summarized in the table.

	Store A	**Store B**	**Total**
Cash	22	18	40
Not cash	78	82	160
Total	100	100	200

a. Write the appropriate null and alternative hypotheses for a chi-square test for homogeneity.

b. Using technology, calculate the χ^2 test statistic, degrees of freedom, and p -value for this test.

c. Suppose the analyst wanted to perform a two-sample z -test for the difference in population proportions of customers who pay with cash between Store A and Store B. Write the appropriate null and alternative hypotheses. Be sure to define the parameter.

d. Using technology, calculate the z test statistic and p -value for this test.

e. Compare the results from parts (b) and (d). How are the test statistics and p -values related between the chi-square test and the two-proportion z -test?

4. A study investigates the preferred opening strategies among novice and expert chess players. Novice chess players are defined as those with ratings below 1200, while expert chess players have ratings above 2000. The preferences for three defenses to the King's Pawn Opening (1...e4) are collected from two independent random samples of novice and expert chess players. The defenses studied are: the Sicilian (1...c5), the Caro-Kann (1...c6), and the Queen's Indian (1...d6). The results are summarized in the table:

	Sicilian	**Caro Kahn**	**Queen's Indian**
Novice	37	32	7
Expert	26	22	16

Is there convincing statistical evidence at $\alpha = 0.05$ that there is a difference in the distribution of preferred defenses to the King's Pawn Opening between novice and expert chess players? Perform the appropriate inference procedure.

5. A high school principal believes that lowerclassmen and upperclassmen will feel differently about the new school attendance policy. The principal selects separate random samples of 40 lowerclassmen and 50 upperclassmen and asks them whether they are in favor, not in favor, or neutral toward the new policy. She then performs a chi-square test for homogeneity to investigate her claim. Assume that the conditions for performing this test are met. Which of the following statements is true?

A) The null hypothesis is that the proportions of students who answer “in favor”, “not in favor”, and “neutral” are equal.

B) The alternative hypothesis is that the proportion of lowerclassmen who favor the policy is higher than the proportion of upperclassmen who favor the policy.

C) The value of χ^2 will be small if lowerclassmen and upperclassmen feel similarly about the new policy.

D) The number of degrees of freedom for this test is 3.

6. A researcher was interested in determining if knowledge of languages differs by geographical region. The researcher selected three independent random samples of adults living in the west, east, and central U.S. and asked each person whether they spoke 1, 2, 3, or 4 or more world languages. Determine the correct degrees of freedom for the chi-square test that could be used to investigate this question.

A) 3

B) 6

C) 7

D) 12