Unit 10 Review

Chi-Squared Tests

**10.1 Learning Target** • **Chi-Squared Test for Goodness of Fit**

1. At HHS, students can choose to enter one of 5 sets of doors. Custodians noticed that the first door is often broken and they suggest more students use it because it has a hands free opener. To test this, they counted the number of students that entered each door.

 A. If students are equally likely to enter any door, fill in the expected values:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Door 1 | Door 2 | Door 3 | Door 4 | Door 5 | TOTAL |
| Students Observed | 220 | 205 | 180 | 195 | 200 | 1000 |
| Students Expected |  |  |  |  |  |  |

B. Create segmented bar graphs showing the observed and the expected values. Do these appear different?

C. Do a Chi-Squared Test for Goodness of Fit to determine if students are equally likely to use any door.

 Show ALL steps.

1. A student wanted to decide if M&Ms peanut candies followed the color distribution that it claimed. They counted a random sample of peanut M&Ms and recorded the observed values in the table below:

 A. Fill in the expected value of each color of M&Ms in the table:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Color | Brown | Yellow | Red | Green | Blue | Orange | Total |
| Percent of each color | 12% | 15% | 12% | 15% | 23% | 23% | 100% |
| Observed | 16 | 18 | 15 | 20 | 25 | 26 | 120 |
| Expected |  |  |  |  |  |  |  |

B. Create segmented bar graphs showing the observed and the expected values. Do these appear different?

C. Do a Chi-Squared Test for Goodness of Fit to determine if the M&Ms follow the expected distribution.

 Show ALL steps.

**10.2 Learning Target** • **Chi-Squared Test for Two-Way Tables**

1. A recent debate about where in the United States skiers believe the skiing is best prompted the following survey.

A. Find the row and column totals.

B. Determine the expected values of each ski area and ski level. Enter these in the table next to the observed values (in parentheses).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Beginner | Intermediate | Advanced | Total |
| New Hampshire | 121 | 112 | 85 |  |
| Utah | 115 | 145 | 152 |  |
| Colorado | 109 | 187 | 194 |  |
| Total |  |  |  |  |

C. Create segmented bar graphs for each level of skiing (observed values only). Comment on the graphs (does there appear to be any differences in ski areas for each level?).

D. Conduct a Chi-Square test to determine if there is any difference in ski areas preferred by ski level:

1. Some travel agents claim that honeymoon hot spots vary according to age of the bride and groom. Suppose that a SRS of recent brides shared where they spent their honeymoon.

A. Find the row and column totals.

B. Determine the expected values of each honeymoon location for each age group. Enter these in the table next to the observed values (in parentheses).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 20-29 years old | 30-39 years old | 40-49 years old | Total |
| Niagara Falls | 15 | 25 | 25 |  |
| Caribbean | 35 | 25 | 20 |  |
| Europe | 10 | 25 | 30 |  |
| Mexico | 35 | 25 | 25 |  |
| Total |  |  |  |  |

C. Create segmented bar graphs for each age (observed values only). Comment on the graphs (does there appear to be any relationship between age and honeymoon preference?).

D. Conduct a Chi-Square test to determine if there is any relationship of honeymoon location based on age:

True or False?

1. T or F: The degrees of freedom for a Test for Independence are equal to the sample size minus 1.
2. T or F: The Test for Goodness of Fit uses a table of observed and expected data values.
3. T or F: For two-way tables, the expected value is equal to the row total multiplied by the column total divided by the total surveyed.
4. T or F: In a Test for Independence, if the p-value is 0.0113, do not reject the null hypothesis.
5. T or F: The degrees of freedom in a two-way table is (r -1)(c – 1)

Multiple Choice:

Use the following table to answer the next 4 questions:

A study of accident records at a large company reported the following number of injuries on each shift for 1 year. They want to determine if the number of injuries are equally likely on each shift:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Shift | Morning | Afternoon | Evening | Total |
| Number of Injuries | 1000 | 750 | 1250 | 3000 |

1. What is the expected value for each shift?

 A. 3000

 B. 1500

 C. 1000

 D. 850

1. What is the Chi-Squared value?

 A. 0

 B. 0.50

 C. 62.5

 D. 125

1. How many degrees of freedom?

 A. 1

 B. 2

 C. 3

 D. 2999

1. The correct decision is:

A. Reject the Ho; accidents do not occur equally likely on each shift

B. Reject the Ho; accidents do occur equally likely on each shift

C. Fail to reject the Ho, accidents do not occur equally likely on each shift

D. Fail to reject the Ho; accidents do occur equally likely on each shift

1. The best way to graph data in a Chi-Squared test is:

 A. Pie Chart

 B. Normal Curves

 C. Histogram

 D. Segmented Bar Graphs

Use the following table to answer the next 4 questions.

A car dealership collects data to determine whether customer satisfaction is related to gender and age. They obtain the following information:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Males under 40 | Females under 40 | Males 40 and over | Females 40 and over | Total |
| Satisfied | 25 | 30 | 135 | 112 | 302 |
| Not Satisfied | 8 | 16 | 22 | 37 | 83 |
| Total | 33 | 46 | 157 | 149 | 385 |

1. What is the expected value for Females under 40 that are satisfied?

 A. 30

 B. 36

 C. 65

 D. None of the above

1. What is the expected value for Males 40 and over that are not satisfied?

A. 22

B. 30

C. 34

D. None of the above

1. How many degrees of freedom are there?

A. 6

B. 5

C. 4

D. 3

1. The Chi-Squared value = 11.12, what is your conclusion at α = 0.05?

A. Reject the Ho; customer satisfaction is not related to gender and age

B. Reject the Ho; customer satisfaction is related to gender and age

C. Fail to reject the Ho, customer satisfaction is not related to gender and age

D. Fail to reject the Ho; customer satisfaction is related to gender and age

19. Fill in the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Ʃ X 2*** | ***Degrees of Freedom*** | ***P-Value*** | ***Decision at α = 0.05*** |
| a. | 12.26 | 10 |  |  |
| b. | 1.27 | 9 |  |  |
| c. | 32.96 | 5 |  |  |
| d. | 16.15 | 3 |  |  |