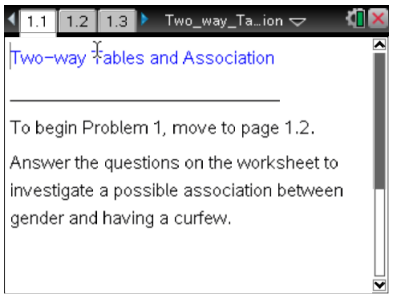
Two-Way Tables and Association

Student Activity

Name _____

Class _____

Open the TI-Nspire document *Two_Way_Tables_and_Association.tns.*



Is it more likely that a female high school student will have a curfew than a male student? This activity will explore whether or not there is a connection or association between gender and curfew for high school students based on a sample.

Do you think the same rules apply to teenage females and teenage males? Many of the female students at Rufus King High School felt their parents or guardians set a curfew for them while the parents or guardians of most male students did not set a curfew for them.

A group of stats students decided to randomly select 100 student-ID numbers from the 1200 students in the school and ask them to complete a survey. One of the questions on the survey was "Do you have a curfew?" Let's look at the results of the 100 completed surveys at Rufus King to determine if there might be some truth to the claim that more females than males had a curfew.

Move to page 1.2.

1. The responses from the 100 students are summarized in a two-way frequency table on Page 1.2.
   a. Why do you think these 100 students would be a good sample to study?

   b. How many males were selected in the sample? How many females were selected? How would you explain the difference in the number of males and females?

2. How many of the 100 students sampled had a curfew?

3. Look at the data in the table, and answer the questions below.
   a. What percent of the males had a curfew?

   b. What percent of the females had a curfew?

   c. Do you think it is accurate to conclude that males at Rufus King are more likely to have a curfew than females? Explain your answer.

4. Suppose that approximately the same percent of females as males had a curfew at Rufus King. If our sample had shown that an approximately equal percent of each gender had a curfew, how many females and how many males would have a curfew?

Move to page 1.3.

5. Use the graph to answer the following questions.
   a. What do you observe from the graph about the difference between females and males with curfews?

   b. How would the graph look if the percent of males and females with a curfew were approximately the same? Develop a sketch of a graph that would show about the same percentages for males and females with curfews.

6. Move the cursor over the bars of the graph, and answer the following questions:
   a. What percent of the males indicated they have a curfew?

   b. What percent of the females indicated they have a curfew?

7. A student was identified from Rufus King. This student might or might not have completed the survey.
   a. Do you think this student has a curfew? Explain.

   b. If the student selected in question 7a is a male, do you think this student has a curfew? Explain.

Move to page 2.1.

A Rufus King student is selected. This student might or might not have completed our survey. Would our estimate of whether or not this student has a curfew depend on the gender of this student? The answer to this question indicates whether or not there is an association between the gender of a Rufus King student and having a curfew.

8. Page 2.1 contains two tables.
   - Rows 1 and 2 make up the first table—a **frequency table**—and give a breakdown of the number of males or females who have a curfew along with the number of males or females who do not have a curfew.
   - Rows 4 and 5 are a **conditional probability table.** Row 4 shows the probabilities that a female has a curfew or does not have a curfew. Row 5 shows the probabilities that a male has a curfew or does not have a curfew.

   a. Note the 20 in the shaded cell of the frequency table. What does it represent?

   b. What does the cell with the value 0.625 represent in the conditional probability table?

   c. What does the value of 0.515 represent in the conditional probability table?

9. Enter a 5 into the shaded cell (replacing 20). Assume that 32 of the 100 students are male and 53 of the students have a curfew.

   a. What does the 5 indicate?

   b. What is the relative frequency of males with a curfew?

   c. What is the number of females with a curfew?

   d. A student is selected from the sample in which 5 males out of the 32 males have a curfew. If the gender of the selected student were known, what would be your estimate of the student having a curfew?

e. Do you think there is a connection or association between gender and curfew based on 5 males with a curfew in the sample in which 32 students are male and 53 students have a curfew? Explain.

10. Fill in the table below by entering the given value of 'males with curfew' into the shaded cell of the frequency table on your handheld spreadsheet. Assume that the total number of male students remains at 32 students, and that the total number of students with a curfew remains at 53.
    a. In the table below, record the percent of the males who have a curfew, the percent of females who have a curfew, and what you can observe from the graphs.
    b. Also, indicate whether you think the value would suggest an association between gender and having a curfew.

Males with curfew	Percent males with curfew	Percent females with curfew	Describe the bar graphs	Does there seem to be an association? Explain.
5				
17				
30				

11. Assume that the probability of a female having a curfew and the probability of a male having a curfew is approximately the same.
    a. If a sample has 32 males, 68 females, and 53 students with a curfew, estimate the number of males who have a curfew.

    b. Is the answer '20 males who had a curfew' from our sample close to or very different from the estimates you made in part a? Explain your answer.

The next part of this activity involves generating a number of random samples from a population. In order to avoid having your results be identical to those of another student in the room, it is necessary to "seed" the random number generator. Read the instructions on Page 2.2 for seeding your random number generator.

Move to page 3.1.

12. Select the arrow to draw one sample. Fifty-three (53) students are randomly selected from a sample of 100 students in which 68 students are female and 32 are male. Notice the plot displays the number of males from the 53 students selected.
    a. Who do the 53 students represent in this investigation?

    b. How many males in the sample you drew had a curfew?

    c. Complete the following frequency table based on the numbers from the sample you drew:

	Curfew	No curfew
Females		
Males		

    d. Complete the following conditional probability table based on the numbers you obtained:

	Curfew	No curfew
Females		
Males		

If you select the arrow again, another sample of 53 students is randomly selected from the 100 students with the same gender break-down as before. The number of males in the sample is plotted on the graph. Continue to select the arrow. After ten selections, the number of samples drawn per selection increases to groups of ten until you reach 100 samples. Generate 100 samples, and examine the resulting dot plot.

13. Describe the dot plot of the 100 simulated samples.

14. Assume the percentage of males with a curfew was approximately the same as the percentage of females with a curfew when each of the samples was drawn. Determine an interval from the dot plot representing the number of males with a curfew that includes approximately 95 of the 100 samples. What does this interval represent?

15. Based on your interval found in Question 14, are the 20 male students with a curfew observed in our original sample inside or outside this new interval? Explain what it means if 20 is within the interval. Also, explain what it means if 20 is outside the interval.

16. Do the 20 males with a curfew described in the opening sample give a strong indication that males are more likely to have a curfew than females? Explain.