2

Relatively Speaking

Relative Frequency Distribution

Warm Up

Convert each ratio to a percent.

1. $\frac{39}{100}$
2. $\frac{3}{8}$
3. $\frac{7}{12}$
4. $\frac{13}{25}$
5. $\frac{77}{80}$

Learning Goals

- Construct and interpret relative frequency distribution and marginal relative frequency distributions displayed in two-way tables for categorical data.
- Analyze and use marginal relative frequency distributions to make decisions for a problem situation.

Key Terms

- relative frequency distribution
- marginal relative frequency distribution

You have organized and analyzed data using marginal frequency distribution tables. How can you use percents to analyze the same data set?

Sour Statements

Grade Level	Favorite Drink: Lemonade
9th	7
10th	7

A sample of 9th and 10th grade students at Valley High School were surveyed about their favorite things to drink on a hot day. There were a total of five groups recorded for the variable *favorite drink*, including *water, sports drinks, iced coffee, lemonade,* and *iced tea*. The frequency distribution shows the results for the group *lemonade*.

Two students used the table to make the following statements.

Chris
Seven percent of 9th graders and seven percent of 10th graders prefer lemonade.

Brad
Since 7 = 7, the same percent of 9th and 10th graders prefer lemonade.

1. Explain why each student is incorrect.

ACTIVITY 2.1

Relative Frequency Distribution

The Northpointe community outreach director wants to plan special summer activities for the members of Northpointe. He selects a random sample of members of the community, and each of those members responds to his survey. Participants identify their age and then chose from four given activities. The responses gathered from the survey are shown.

Think about:

Is there an association between a person's age and their preferred activity?

Activities Preferred During Hot Weather

Age Group	Sports	Movies	Reading	Walking	Total
Students Age 18 Years Old and Under	20	30	22	8	80
Adults Age 19 Through 50 Years Old	10	32	25	43	110
Adults Over 50 Years Old	5	20	35	30	90
Total	35	82	82	81	280

While the raw data provide some information, it is often more efficient to use percents when analyzing data. The relative frequencies of each data entry can provide that information. Representing the relative frequencies for joint data displayed in a two-way table is called a *relative frequency distribution*. The **relative frequency distribution** provides the ratio of occurrences for each category to the total number of occurrences. Displaying the relative frequencies for the rows or columns is called a *marginal relative frequency distribution*. The **marginal relative frequency distribution** provides the ratio of total occurrences for each category to the total number of occurrences.

1. **Construct a marginal relative frequency distribution of the data. Represent each ratio as a percent.**

Activities Preferred During Hot Weather

Age Group	Sports	Movies	Reading	Walking	Total
Students Age 18 Years Old and Under					
Adults Age 19 Through 50 Years Old					
Adults Over 50 Years Old					
Total					

2. **Five students in Mr. Thomas's class made the given statements. For each statement explain why the student is correct or incorrect. If the student is incorrect, tell what the correct statement should be.**

Isaac
58.6% of participants in the survey prefer watching movies or reading in the hot weather.

Shane
1.07% of adults over age 50 prefer walking in the hot weather.

Marie
Out of all survey participants that prefer playing sports in the hot weather, 7.1% of those are students age 18 years old and under.

Olivia
More adults over 50 responded to the survey than any other age group.

Aaron
Playing sports is the least popular activity in the hot weather according to the survey results.

3. **Which age group made up the smallest percent of people surveyed?**

4. **Which activity was preferred by the largest percent of people surveyed?**

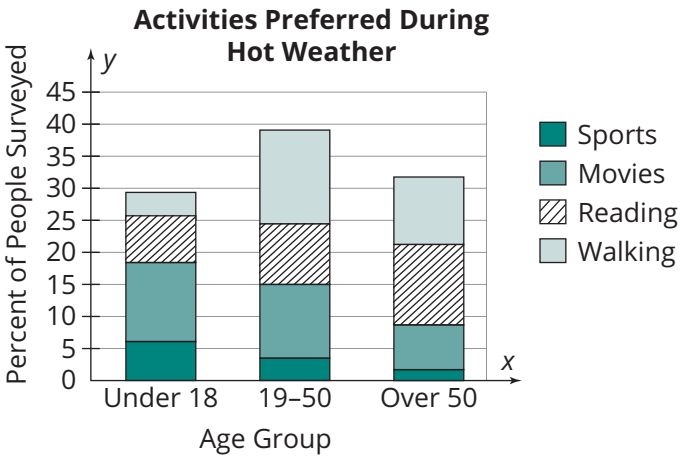
5. **Does there appear to be an association between age and preferred activity? If so, explain what trends you notice in these data.**

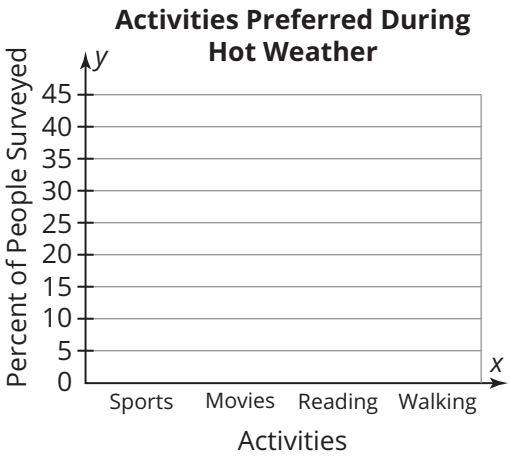
ACTIVITY 2.2

Analyzing Data Ratios

Previously, you have used a bar graph to visually represent data. Another way to represent data is to use a stacked bar graph in which the bars are stacked on top of each other as opposed to sitting next to each other. Consider the marginal relative frequency distribution from the previous activity. The stacked bar graph shown represents the activities preferred during hot weather by age group.

1. Construct a stacked bar graph using the marginal relative frequency distribution by activities. Be sure to include a legend.





2. How do the graphs compare to the relative frequency distribution table you completed in the previous activity?

3. What conclusions can you draw by examining the graphs?

4. Name some advantages of graphing the data by age group. Name some advantages of graphing the data by activity.

ACTIVITY 2.3

Interpreting Data Ratios

Now that the community outreach director has gathered the data about preferred activities in hot weather, he wants to use them to plan different activities for the summer.

1. **Analyze each of the given activities. Determine whether you think the activity would be a good idea to have during the summer. Use the data to justify your answer.**

   a. **A walking club for community members aged 19 to 50**

   b. **A soccer tournament for community members over the age of 50**

   c. **An ultimate Frisbee league for community members aged 18 or younger**

The community outreach director wants to offer one summer activity each week that will appeal to all ages of the community.

2. **Write a letter to the community outreach director recommending one activity and tell why the other activities may not be the best activities during the summer. Use the data to support your idea.**

NOTES

TALK the TALK

A Hot Topic

Men and women were surveyed to determine their favorite drink on a cold day. The results are shown in the table.

Favorite Drink on a Cold Day

Gender	Coffee	Tea	Hot Cocoa	Total
Men	10	2	4	16
Women	5	7	4	16
Total	15	9	8	32

1. Construct a marginal relative frequency distribution of the data.

Favorite Drink on a Cold Day

Gender	Coffee	Tea	Hot Cocoa	Total
Men				
Women				
Total				

2. Write a paragraph interpreting the marginal relative frequency distributions for the data.

3. Does there appear to be an association between gender and favorite drink on a cold day? Justify your answer.

Assignment

Write

Write a brief explanation of the difference between a relative frequency distribution and a marginal relative frequency distribution.

Remember

A relative frequency distribution table provides the ratio of occurrences in each category to the total number of occurrences and allows you to use percents to analyze categorical data in two variables. You can use a stacked bar graph to visually represent the marginal relative frequencies of a data set.

Practice

1. The principal of Umber Elementary School (grades K – 4) would like to reward his students for recent good test scores on a standardized test. He thinks of four different types of assemblies. In order to please the most students, the principal asks his teachers to survey the students in their classes. The students from each grade are asked which assembly they would most want to see. The table shows the responses gathered from the surveys.

	Wild Animals	Hip Hop Show	Magic Show	Puppet Show
Kindergarten	18	5	8	33
Grade 1	26	10	21	15
Grade 2	21	19	17	12
Grade 3	22	28	20	8
Grade 4	19	44	7	2

a. Construct a marginal relative frequency distribution of the data.

b. The principal wants to choose one assembly that he can show to all of the students. Construct two stacked bar graphs of the marginal relative frequency distribution. Then tell which assembly he should choose for the students. Explain how you determined your answer.

c. The principal has come up with an idea to hold a hip hop assembly for Grades 1 through 4 and a puppet show for Kindergarten. Do you think this is a good idea? Explain your reasoning.

Stretch

1. A teacher at the Umber Elementary School decides to organize the data from the students differently. She decides to calculate percentages of the assembly types the students want within each grade, not out of the total.

   a. Use the data from Umber Elementary School to show the percentages for each assembly type by grade.

	Wild Animals	Hip Hop Show	Magic Show	Puppet Show	Total
Kindergarten	$\frac{18}{64} \approx 28.1\%$				
Grade 1					
Grade 2					
Grade 3					
Grade 4					

b. Construct a stacked bar graph of the percentages for each grade. How does this graph compare to the stacked bar graph of the marginal relative frequency distribution that you constructed in the Practice to show the assembly choice by grade?

Review

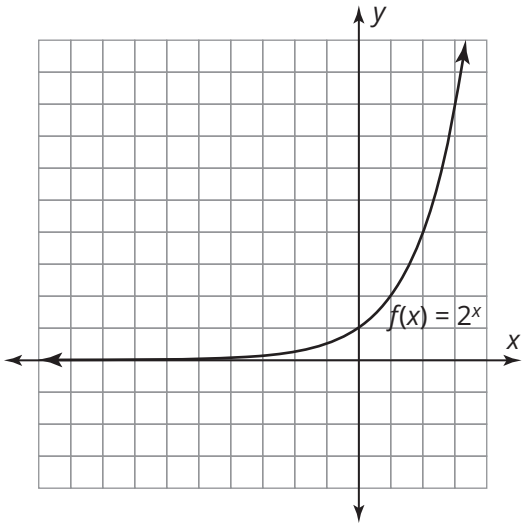
1. A company conducts a study to find out how much time employees spend on their smart phones doing non-work related things doing work hours. The table displays the data collected from surveying 20 employees.

Create an appropriate data display. Use statistics appropriate to the shape of the data distribution to describe the measure of center and spread. Write a report to summarize your findings.

Employee	Time on Phone (minutes)	Employee	Time on Phone (minutes)
1	45	11	52
2	35	12	60
3	68	13	58
4	55	14	20
5	43	15	30
6	59	16	55
7	37	17	44
8	75	18	40
9	41	19	65
10	48	20	25

2. For each function $f(x)$, sketch a graph of the given transformation, $g(x)$, and describe the transformation from the graph of $f(x)$ to $g(x)$.

a. $g(x) = \frac{1}{3} \cdot f(x) - 1$



b. $g(x) = 2 \cdot f(x) + 4$