

Chapter 3 – Graphical and Tabular Displays of Data  
Section 1 – Frequency Tables, Relative Frequency Tables, and Bar Graphs

Materials Needed:

Objectives

1. Identify categorical variables and numerical variables.
2. Construct and interpret frequency tables and relative frequency tables.
3. Construct and interpret frequency bar graphs and relative frequency bar graphs.
4. Describe the meanings of AND and OR.
5. Use a relative frequency bar graph to find proportions.
6. Interpret multiple bar graphs.

Vocabulary

1. categorical/qualitative variable
2. numerical/quantitative variable
3. frequency of a category
4. table
5. frequency distribution of a categorical variable
6. relative frequency of a category
7. relative frequency distribution of a categorical variable
8. bar graph
9. AND
10. OR

Lesson/Activity

OBJECTIVE 1 – Identify categorical variables and numerical variables.

**Definition: Categorical variable**

A **categorical variable** (or **qualitative variable**) consists of names or labels of groups of individuals.

**Definition: Numerical variable**

A **numerical variable** (or **quantitative variable**) consists of measurable quantities that describe individuals.

1. Identify whether the variable is categorical or numerical.
  - a. The salary (in dollars) of a person
  - b. The state where a person lives
  - c. The ZIP code of a home in Illinois
  - d. A variable consisting of zeroes and ones, where 0 stands for a full-time student and 1 stands for a part-time student

OBJECTIVE 2 – Construct and interpret frequency tables and relative frequency tables.

**Definition: Frequency of a category**

The **frequency of a category** is the number of observations in that category.

A **frequency table** for a categorical variable is a table that lists all the categories and their frequencies.

2. The music genres of the 20 top-selling singles during the week ending on September 5, 2015, are shown in the following table. Construct a frequency table.

R & B	Dance	Electronic	Pop	Pop	Dance	Pop
Pop	Pop	Pop	Alternative	Hip-Hop/Rap	Dance	Dance
Hip-Hop/Rap	Pop	Pop	Pop	Alternative	Pop	

Source: AT40

**Definition: Frequency distribution of a categorical variable**

The **frequency distribution of a categorical variable** is the categories of the variable together with their frequencies.

The frequency table we constructed in Problem 2 describes the frequency distribution of the categorical variable music genre.

**Definition: Relative frequency**

The **relative frequency of a category** is given by

$$\frac{\text{frequency of the category}}{\text{total number of observations}}$$

For Problem 2, the relative frequency of dance category is  $4/20 = 1/5$ .

**A relative frequency is a proportion.**

A **relative frequency table** of a categorical variable is a list of the categories and their relative frequencies.

3. Refer to the frequency table we constructed in Problem 2.
- What is the relative frequency of the hip-hop/rap category?
  - Construct a relative frequency table.
  - Which category has the largest relative frequency? What is that relative frequency? What does it mean in this situation?

We agree to round relative frequencies and proportions to the third decimal place.

**Definition: Relative frequency distribution of a categorical variable**

The relative frequency distribution of a categorical variable is the categories of the variable together with their relative frequencies.

4. Use StatCrunch to construct a frequency and relative frequency table of the music distribution.

**Sum of Relative Frequencies**

For a categorical variable, the sum of the relative frequencies of all the categories is equal to 1.

OBJECTIVE 3 – Construct and interpret frequency bar graphs and relative frequency bar graphs.

A **frequency bar graph** is a graph that uses heights of bars to describe the frequencies of categories.

5. Construct a bar graph of the music distribution.

A **relative frequency bar graph** is a graph that uses heights of bars to describe the relative frequencies of categories.

6. Construct a relative frequency bar graph of the music distribution.

OBJECTIVE 4 – Describe the meanings of AND and OR.

- When "**AND**" is used with two categories, this means to consider the observations that the categories have in common.
- When "**OR**" is used with two categories, this means to consider the observations in the categories all together.

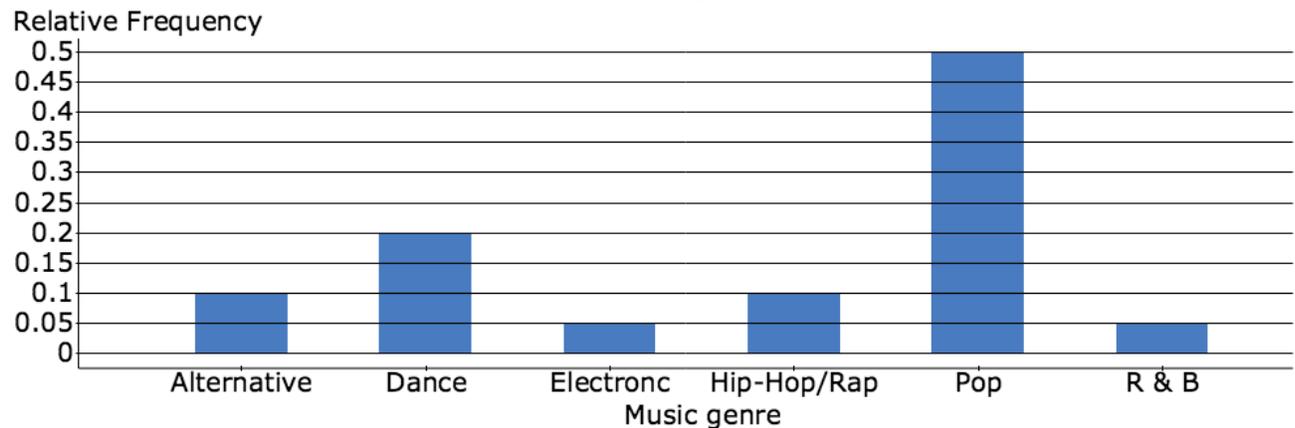
7. The dates of September 2016 are shown in the following table.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

- Find the dates that are in the fourth week.
- Find the dates that are Wednesdays.
- Find the dates that are in the fourth week AND are Wednesdays.
- Find the dates that are in the fourth week OR are Wednesdays.

OBJECTIVE 5 – Use a relative frequency bar graph to find proportions.

8. A relative frequency bar graph of the music distribution is shown in the following figure.  
Genres of Best Selling Music Singles



Source: AT40

Find the proportion of the observations that

- fall in the electronic category.
- do NOT fall in electronic category.
- fall in the alternative category OR fall in the pop category.
- fall in the alternative category AND fall in the pop category.

Note that in Problem 8(b), we used the proportion of the rest property (Section 1.3).

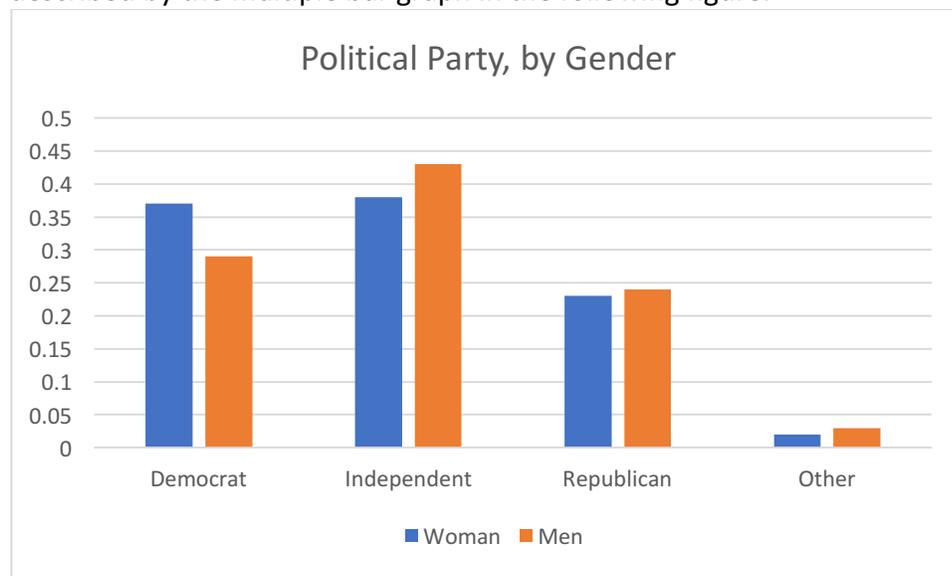
### Proportion of the Rest

Let  $a/b$  be the proportion of the whole that has a certain characteristic.  
Then the proportion of the whole that does NOT have that characteristic is  
 $1 - a/b$

OBJECTIVE 6 – Interpret multiple bar graphs.

A **multiple bar graph** is a graph that has two or more bars for each category of the variable described on the horizontal axis.

9. In a survey in 2012, 1960 adults were asked the following question: “Generally speaking, do you usually think of yourself as a Republican, Democrat, Independent, or what?” The results of the survey are described by the multiple bar graph in the following figure.



- What proportion of women thought of themselves as Democrats?
- To which political party did the greatest proportion of men choose?
- Compare the proportion of women who thought of themselves as Independents to the proportion of men who thought of themselves as Independents.
- A total of 1081 women and 879 men responded to the survey. Were there more women or men who thought of themselves as Independents? How is this possible, given there was a smaller proportion of women who thought of themselves as Independents than men?
- On the basis of the multiple bar graph, a student concludes that 24% of all American men are Republicans. What would you tell the student?

**For a multiple bar graph, it is more meaningful for the vertical axis to describe relative frequencies rather than frequencies.**

### Homework/Assessment

1, 3, 9, 11, 13, 21, 23, 27, 29, 31, 33, 35, 39, 43, 51