

## LESSON 8 - STATISTICS

### INTRODUCTION

In this lesson, we will learn the basic language and concepts related to a branch of mathematics that deals with collecting, organizing, and interpreting data. This branch of mathematics is called *statistics*. In addition, the word *statistics* is often used to denote the data and information that are being collected and interpreted.

The table below shows the specific objectives that are the achievement goal for this lesson. Read through them carefully now to gain initial exposure to the terms and concept names for the lesson. Refer back to the list at the end of the lesson to see if you can perform each objective.

Lesson Objective	Related Examples
Define and compute three different <i>measures of central tendency</i>	1, YT2
Define and compute <i>weighted averages</i>	3, 4, YT5
Discuss data <i>variability</i> and compute the <i>range</i> of a data set	6, 7, YT8
Compute <i>measures of central tendency</i> with data sets that contain <i>outliers</i>	9
Use <i>tables and graphs</i> to interpret and analyze data	10, 11, YT12, 13, YT14

### KEY TERMS

The key terms listed below will help you keep track of important mathematical words and phrases that are part of this lesson. Look for these words and circle or highlight them along with their definition or explanation as you work through the MiniLesson.

- Average
- Measures of Central Tendency
- Mean
- Median
- Mode
- Weighted Average
- Variation
- Range
- Outlier

### LESSON CHECKLIST

Use this page to track required components for your class and your progress on each one.

Component	Required? Y or N	Comments	Due	Score
Mini-Lesson				
Online Homework				
Online Quiz				
Online Test				
Practice Problems				
Lesson Assessment				

## MINILESSON

## MEASURES OF CENTRAL TENDENCY

When we are given a set of data points, particularly if that set is very large, we want to get a feel for the data by getting a sense of what single number most accurately represents that data. To do that, we compute one or more of the following *Measures of Central Tendency* or *Averages*.

- *Mean* is the sum of a set of values divided by the number of values.

$$\text{mean} = \frac{\text{sum of all values}}{\text{total number of values}}$$

- *Median* is the number in the middle of a set of numbers arranged in numerical order. If there are two numbers in the middle (i.e. an even number in the set) then find the mean of just the two numbers in the middle.
- *Mode* is the number (or numbers) that occurs most frequently in the set. If no number or numbers occur more than once, there is no mode.

Note that all of the above are numerical definitions of “*average*” for a given data set. However, each is computed differently and will often give different results. When the word “*average*” is utilized within our daily lives it is most often associated with the *mean*. Do not assume that the *mean* is the only *average* of a set of values.



**Example 1:** Find the mean, median, and mode of the following data sets. Begin by writing the set in increasing order.

a. 5, 1, 4, 5, 3, 1, 5

b. 6 0 6 3 2 2 6 2

## YOU TRY

2. Find the mean, median, and mode of the data set 5 2 7 11 6 0 3 3.  
Begin by writing the data set in increasing order.

Mean

Median

Mode

## WEIGHTED AVERAGE

A *weighted average* (which is another kind of mean) is used when some values in the number set count more heavily than others. The following examples illustrate this idea.



**Example 3:** A given Biology class contains 20 students. The 8 female students in the class are enrolled in an average of 14 semester credits. The 12 male students are enrolled in an average of 8 semester credits. Compute the average number of semester credits for the class as a whole. [To begin, circle the GIVENS and underline the GOAL].



**Example 4:** Grade point average is a classic example of a weighted average. Last term, a student's grades were as indicated in the table below. Compute the student's GPA for the term.

Course	Credits	Grade	Grade Pts	Grade Pt. Totals
Philosophy	3	C		
English	3	B		
P.E.	1	A		
Biology	5	B		
Total				

**YOU TRY**

5. Compute the student's GPA for the term.

Course	Credits	Grade
MAT082	3	A
ENG071	4	B
PSY 100	3	C
RDG 061	3	A

## VARIATION, RANGE, &amp; OUTLIERS

*Measures of Central Tendency* are concerned with finding the most accurate center point or representative point for a given data set. If we want to understand how spread out the data are, then we need to look at the *variation* in the given data.



**Example 6:** Order the following from least to most variation.

- The weights of all adults
- The weights of all adult women
- The weights of all 20-year-olds
- The weights of all 20-year-old women

*Range* is the difference between the largest and smallest value in the set and provides the most information about how spread out the data are. Be sure to write the data set in order before computing the range.

$$\text{Range} = \text{Highest Value} - \text{Lowest Value}$$



**Example 7:** Determine the range of the following data set:

24, 32, 12, 14, 3, 7, 12, 43, 1, 5

## YOU TRY

8. Find the range of the following data set 5 2 7 11 6 0 3 3. Start by writing the data set in increasing order.



**Example 9:** Find the mean, median, mode, and range for the following data sets.

a. 2, 2, 3, 5, 6

b. 2, 2, 3, 5, 20

*Outliers* are values that are far removed from the other values in a data set. In the above example, data set b has an outlier of 20. Notice how the measures of central tendency and variability are impacted.

### TABLES & GRAPHS

Tables and Graphs are often used to display and organize data as illustrated in the examples below. Look for a legend or headers to understand what the different parts of the table or graph represent.



**Example 10:** A table presents information in rows and columns as shown in this example.

#### Birth Rates and Populations around the World in 2011

Country	Birth Rate (per 1000 population per year)	Population
French Polynesia	15.53	294,935
Brazil	17.79	203,429, 800
Australia	12.33	21,766,710
Sudan	36.12	45,047,500
Russia	11.05	138,739,900
India	20.97	1,189,173,000
Bulgaria	9.32	7,093,635

Source: <http://www.indexmundi.com/g/>

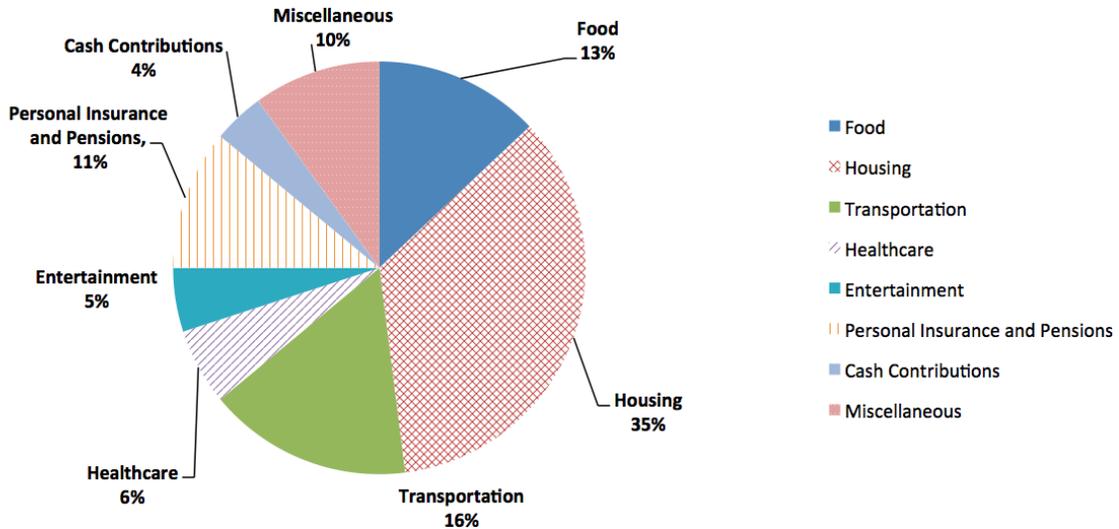
Which country has a birth rate of 17.79? \_\_\_\_\_

Which country has the smallest birth rate? \_\_\_\_\_

Which country has the largest population? \_\_\_\_\_

**Example 11:** A **Circle Graph** (also called a Pie Graph) is used to show how the whole amount is broken up into parts. (Source: *Consumer Expenditure Survey, U.S. Bureau of Labor Statistics, October, 2010*)

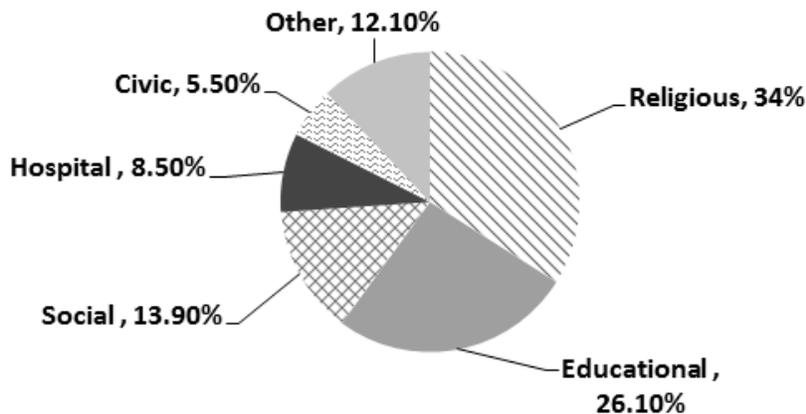
**Spending as a Percentage of Income by Category**



- How much of their income does the average American spend on healthcare? \_\_\_\_\_
- For the average person, what is the single biggest category of expense? \_\_\_\_\_
- Suppose your monthly salary is \$2200. How much should you be spending on Food? \_\_\_\_\_

**YOU TRY**

12. In 2009, the Bureau of Labor Statistics reported a surge in volunteerism. At this time, there were a reported 63,361 volunteers in the U.S. The pie chart below shows the different categories in which these people volunteered.



Find the number of people who volunteered in an Educational capacity. Round your answer to the nearest whole number.



**Example 13: Bar Graph**

<div style="text-align: center; border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <b>Midterm Exam Grades</b> </div> <table border="1" style="margin-top: 10px; width: 100%; border-collapse: collapse;"> <caption>Data for Example 13 Bar Graph</caption> <thead> <tr> <th>Grade</th> <th>Number of Students</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>4</td> </tr> <tr> <td>B</td> <td>7</td> </tr> <tr> <td>C</td> <td>9</td> </tr> <tr> <td>D</td> <td>3</td> </tr> <tr> <td>F</td> <td>2</td> </tr> </tbody> </table>	Grade	Number of Students	A	4	B	7	C	9	D	3	F	2	<p>a. How many students made a B on the Midterm?</p> <p>b. How many students were in the class?</p> <p>c. What percentage of the class made a B on the midterm? Round to hundredths.</p> <p>d. What percentage of students made a passing grade (A, B, or C) on the Midterm? Round to hundredths.</p>
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