

Questionnaires and Surveys: Analyzing Data

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Where We Left Off

- We've identified a **target population**
- We randomly selected names from the **target population**
- We have distributed the questionnaire to members of our target population
- We have retrieved the questionnaire; the returned questionnaires become our **sample population**.

Now, we need to analyze our results.

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Analyzing Data: What We Care About

The goal of a statistical questionnaire is to attempt to understand **patterns** and **trends** within the data. We also want to be able to offer **predictions about the total population**.

We will calculate the following values in order to look for these patterns:

- Mean
- Median
- Standard Deviation
- Normal Distribution

- Plotting Data

Warning: **Math Ahead!**

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Analyzing Data: Our Example

We will use our backpack example in order to understand how to analyze data.



We sent out **384** questionnaires, but received back only **20** of them (**n=20**). We asked various questions in order to determine what people generally carry around with them, and their backpack preferences.

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Analyzing Data: Applying Confidence

Recall Confidence **Interval** and Confidence **Level** from last class.



How much would you expect to pay for this backpack?

9.99, 19.99, 29.99, 39.99, 49.99

our data: 9.99, 9.99, 9.99, 9.99, 9.99, 19.99, 19.99, 19.99, 19.99, 19.99, 19.99, 19.99, 29.99, 29.99, 29.99, 29.99, 29.99, 29.99, 39.99, 39.99, 39.99

7 of 20 (or 35%) respondents selected 19.99; thus, we are **95%** sure that between **14%** and **56%** of all 15.5 million college students will pay 19.99 for our backpack.

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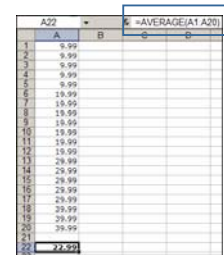
Analyzing Data: Mean

The **mean** is the numerical average of a set of numbers.

To calculate the mean:

1. Add up the values
2. Divide by the number of values

In excel, you can use **=AVERAGE()**



A22	=	B
1	9.99	
2	9.99	
3	9.99	
4	9.99	
5	9.99	
6	19.99	
7	19.99	
8	19.99	
9	19.99	
10	19.99	
11	19.99	
12	19.99	
13	29.99	
14	29.99	
15	29.99	
16	29.99	
17	29.99	
18	39.99	
19	39.99	
20	39.99	
21		
22		22.35

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Analyzing Data: Mean



How much would you expect to pay for this backpack?
9.99, 19.99, 29.99, 39.99, 49.99

our data: 9.99, 9.99, 9.99, 9.99, 9.99, 19.99, 19.99, 19.99, 19.99, 19.99, 19.99, 29.99, 29.99, 29.99, 29.99, 29.99, 29.99, 39.99, 39.99, 39.99

mean value: 22.99

We **can't** say, "Most people would pay \$22.99 for this backpack".

We **can** say, "Our sample population would pay on average \$22.99 for this backpack".

Analyzing Data: Median

The **median** is the number located directly in the center of our data set; that is, half of the values are located above and half of the values are located below it.

To calculate the median:

1. Display the values in ascending order
2. Determine how many total values exist
3. Find the value located halfway through the data set

In excel, you can use `=MEDIAN()`

	A	B
1	9.99	
2	9.99	
3	9.99	
4	9.99	
5	9.99	
6	19.99	
7	19.99	
8	19.99	
9	19.99	
10	19.99	
11	19.99	
12	19.99	
13	29.99	
14	29.99	
15	29.99	
16	29.99	
17	29.99	
18	29.99	
19	29.99	
20	29.99	
21	29.99	
22		19.99

Analyzing Data: Median



How much would you expect to pay for this backpack?
9.99, 19.99, 29.99, 39.99, 49.99

our data: 9.99, 9.99, 9.99, 9.99, 9.99, 19.99, 19.99, 19.99, 19.99, 19.99, 19.99, 29.99, 29.99, 29.99, 29.99, 29.99, 29.99, 39.99, 39.99, 39.99

mean value: 22.99

median value: \$19.99

We **can** say, "The median value in our data set is \$19.99, which is slightly lower than the mean value in our data set (\$22.99)".

Analyzing Data: Standard Deviation

The **standard deviation** is the variability present in the values.

To calculate the standard deviation:

1. Find the mean.
2. Find the deviation of each value from the mean (**value-mean**)
3. Square the deviations
4. Add the squared deviations
5. Divide the sum by (n-1), which results in the variance
6. Take the square root of the variance

In excel, you can use `=STDEV()`

	A	B
1	9.99	
2	9.99	
3	9.99	
4	9.99	
5	9.99	
6	19.99	
7	19.99	
8	19.99	
9	19.99	
10	19.99	
11	19.99	
12	19.99	
13	29.99	
14	29.99	
15	29.99	
16	29.99	
17	29.99	
18	29.99	
19	29.99	
20	29.99	
21	29.99	
22		10.31

Analyzing Data: Standard Deviation



How much would you expect to pay for this backpack?
9.99, 19.99, 29.99, 39.99, 49.99

our data: 9.99, 9.99, 9.99, 9.99, 9.99, 19.99, 19.99, 19.99, 19.99, 19.99, 19.99, 29.99, 29.99, 29.99, 29.99, 29.99, 29.99, 39.99, 39.99, 39.99

mean value: 22.99

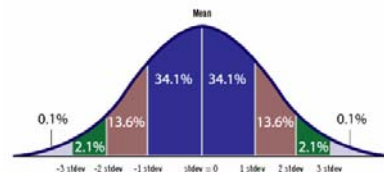
median value: \$19.99

standard deviation: \$10.31

We **can** say, "The standard deviation is \$10.31". This doesn't mean much, however, until we understand normal distribution.

Analyzing Data: Normal Distribution

The **normal distribution** is the bell-shaped curve that generally illustrates the normal sampling of the population. In a normal distribution, the mean and median are the same.



Analyzing Data: Normal Distribution



How much would you expect to pay for this backpack?

9.99, 19.99, 29.99, 39.99, 49.99

our data: 9.99, 9.99, 9.99, 9.99, 9.99, 9.99, 19.99, 19.99, 19.99, 19.99, 19.99, 19.99, 29.99, 29.99, 29.99, 29.99, 29.99, 29.99, 39.99, 39.99, 39.99, 39.99

mean value: \$22.99
median value: \$19.99
standard deviation: \$10.31



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Analyzing Data: Normal Distribution



How much would you expect to pay for this backpack?

9.99, 19.99, 29.99, 39.99, 49.99

Thus, if our sample population adequately represents a normal distribution, **68%** of all college students would expect to pay between **\$12.68** and **\$35.67** for our backpack.



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Analyzing Data: Summary

The goal of a statistical questionnaire is to attempt to understand **patterns** and **trends** within the data. We also want to be able to offer **predictions about the total population**.

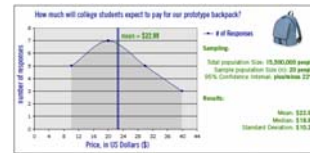
We calculated these values in order to look for patterns:

- Mean
- Median
- Standard Deviation
- Normal Distribution

Now, we want to visualize this data.

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Visualizing Data : An Example

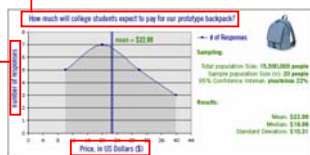


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Visualizing Data : An Example

A succinct title that clearly explains what is being visualized

(y) axis labeled to clearly explain what is shown on this axis



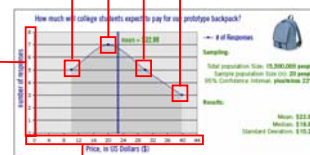
(x) axis labeled to clearly explain what is shown on this axis; include unit label (\$) as appropriate

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Visualizing Data : An Example

Each data point is well articulated and placed on the graph

units are clearly labeled

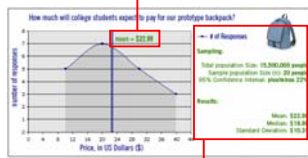


units are clearly labeled

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Visualizing Data : An Example

Include the **mean** on the graph

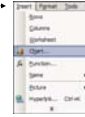


A key, that includes your **total population size**, your **sample population size** (n), your **95% Confidence Interval**, **Mean**, **Median** and **Standard Deviation**.

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Visualizing Data : How do you make it?

1. Start with Excel.
 - a. Enter your Data
 - b. Organize you Data (generally, into Quantity of Responses vs. Variable Being Responded To)
 - c. Create a XY Scatter Plot Chart
2. Revise and extend your Chart in Photoshop
 - a. Add color, as appropriate
 - b. Add key, including **total population size**, your **sample population size** (n), your **95% Confidence Interval**, **Mean**, **Median** and **Standard Deviation**.
3. Repeat for each question in your questionnaire that has yielded relevant data



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Let's try it.

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