DESCRIPTIVE STATISTICS & DATA PRESENTATION*

Instructions: This is a practice review, based on Ch. 18 which must be read and understood first.

Have a pencil and some scratch paper on hand as you go through this.

When you see a statement or question in blue, try to answer or anticipate the information before you bring it onscreen.

You can use the right-pointing arrow key on your keyboard to move forward and the left-pointing arrow to move back.

At the top menu in Acrobat Reader, select Window > Show bookmarks. A menu bar will appear on the left and permit you to directly access a section - useful for review.

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  Central tendency
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Descriptive statistics for **continuous** outcomes
  Central tendency
  Variability, dispersion
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Descriptive statistics for **continuous** outcomes
  Central tendency
  Variability, dispersion
  What is a standard deviation?
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Descriptive statistics for **categorical** outcomes
  Percentages based on contingency tables

Descriptive statistics for **continuous** outcomes
  Central tendency
  Variability, dispersion
  What is a standard deviation?

Why bother with descriptive statistics?

To provide a **quantitative** description of a SAMPLE
DEFINITIONS
DEFINITIONS

group of interest to researcher
DEFINITIONS

group of interest to researcher

POPULATION
DEFINITIONS

- group of interest to researcher
- subset of a population
DEFINITIONS

POPULATION

GROUP OF INTEREST TO RESEARCHER

SAMPLE

SUBSET OF A POPULATION
DEFINITIONS

- group of interest to researcher
- subset of a population
- quantitative characteristic of a population
DEFINITIONS

GROUP OF INTEREST TO RESEARCHER

POPULATION

SUBSET OF A POPULATION

SAMPLE

QUANTITATIVE CHARACTERISTIC OF A POPULATION

PARAMETER
DEFINITIONS

POPULATION

group of interest to researcher

SAMPLE

subset of a population

PARAMETER

quantitative characteristic of a population

quantitative characteristic of a sample
DEFINITIONS

- **GROUP**: group of interest to researcher
- **POPULATION**: subset of a population
- **SAMPLE**: quantitative characteristic of a population
- **PARAMETER**: quantitative characteristic of a sample
- **STATISTIC**:
DEFINITIONS

- **POPULATION**: group of interest to researcher
- **SAMPLE**: subset of a population
- **PARAMETER**: quantitative characteristic of a population
- **STATISTIC**: quantitative characteristic of a sample

Commit these to memory right now.
Define:

STATISTIC
Define:

**STATISTIC**

quantitative characteristic of a sample
Define:

STATISTIC  
quantitative characteristic of a sample

SAMPLE
Define:

**STATISTIC**  quantitative characteristic of a sample

**SAMPLE**  subset of a population
Define:

**STATISTIC**  quantitative characteristic of a sample

**SAMPLE**  subset of a population

**POPULATION**
Define:

**STATISTIC**  
quantitative characteristic of a sample

**SAMPLE**  
subset of a population

**POPULATION**  
group of interest to researcher
Define:

**STATISTIC**  quantitative characteristic of a sample

**SAMPLE**  subset of a population

**POPULATION**  group of interest to researcher

**PARAMETER**
Define:

**STATISTIC**  
quantitative characteristic of a sample

**SAMPLE**  
subset of a population

**POPULATION**  
group of interest to researcher

**PARAMETER**  
quantitative characteristic of a population
Choosing the correct descriptive statistics - KEY question
Choosing the correct descriptive statistics - KEY question

Is the OUTCOME (Dependent variable) categorical or continuous?
Choosing the correct descriptive statistics - KEY question

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If the levels/values of the variable in question differ in quality or kind, then it is a ____?____ variable.
Choosing the correct descriptive statistics - KEY question

Is the OUTCOME (Dependent variable) categorical or continuous?

If the levels/values of the variable in question differ in quality or kind, then it is a ____?____ variable.

Ans: CATEGORICAL
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Examples:
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Choosing the correct descriptive statistics - KEY question

Is the OUTCOME (Dependent variable) categorical or continuous?

If the levels/values of the variable in question differ in quality or kind, then it is a ____?____ variable.

Ans: CATEGORICAL

Examples:

♀️ or YES

♂️
Choosing the correct descriptive statistics - KEY question

Is the OUTCOME (Dependent variable) categorical or continuous?

If the levels/values of the variable in question differ in quality or kind, then it is a ____?____ variable.

Ans: CATEGORICAL

Examples:

or

YES

or

NO
Choosing the correct descriptive statistics - KEY question

Is the OUTCOME (Dependent variable) categorical or continuous?

If the levels/values of the variable in question differ in quality or kind, then it is a ____?____ variable.

Ans: CATEGORICAL

Examples:

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
<th>DON'T KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Male</td>
<td></td>
</tr>
</tbody>
</table>
CONTINUOUS VARIABLES are those whose levels or values vary ________.
CONTINUOUS VARIABLES are those whose levels or values vary ________ .

Ans: along a quantitative dimension
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Ans: along a quantitative dimension

Examples:
CONTINUOUS VARIABLES are those whose levels or values vary \underline{along a quantitative dimension}.

Ans: along a quantitative dimension

Examples:

Number of hours spent watching TV
CONTINUOUS VARIABLES are those whose levels or values vary ________.

Ans: along a quantitative dimension

Examples:

Number of hours spent watching TV

Enjoyment - on a scale of 1 to 10
EXAMPLE: the Reasoner Hypothesis: A woman crosses her legs within 30 seconds of sitting down.
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Examine hypothesis or question and specify variables
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Examine hypothesis or question and specify variables

The hypothesis implies that men do **not** cross their legs within 30 seconds of sitting down.
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The hypothesis implies that men do **not** cross their legs within 30 seconds of sitting down.

**The condition in question (the predictor or independent variable) is . . .**
EXAMPLE: the Reasoner Hypothesis: A woman crosses her legs within 30 seconds of sitting down.

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GENDER
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GENDER

Levels?
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<table>
<thead>
<tr>
<th>GENDER</th>
<th>Levels?</th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td>female</td>
</tr>
</tbody>
</table>
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The hypothesis implies that men do **not** cross their legs within 30 seconds of sitting down.

The condition in question (the predictor or independent variable) is . . .

**GENDER**

Levels? male female

Dependent Variable (outcome)?
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GENDER Levels? male female

Dependent Variable (outcome)? LEG CROSS
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<table>
<thead>
<tr>
<th>GENDER</th>
<th>Levels?</th>
<th>male</th>
<th>female</th>
</tr>
</thead>
</table>

Dependent Variable (outcome)? **LEG CROSS**

Levels?
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Examine hypothesis or question and specify variables

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The condition in question (the predictor or independent variable) is . . .

<table>
<thead>
<tr>
<th><strong>GENDER</strong></th>
<th>Levels?</th>
<th>male</th>
<th>female</th>
</tr>
</thead>
</table>

Dependent Variable (outcome)? **LEG CROSS**

Levels?

- **Yes** *(within 30 seconds)*
- **No** *(> 30 seconds or not at all)*
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Examine hypothesis or question and specify variables

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The condition in question (the predictor or independent variable) is . . .

**GENDER**

Levels?

- male
- female

Dependent Variable (outcome)? **LEG CROSS**

Levels?

- Yes *(within 30 seconds)*
- No *(> 30 seconds or not at all)*

Note: these are operational definitions
Is the independent (predictor) variable *categorical* or *continuous*?
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The levels of gender are male and female. These are discrete categories, therefore gender is categorical.
Is the independent (predictor) variable **categorical** or **continuous**?

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Is the dependent variable (outcome) **categorical** or **continuous**?
Is the independent (predictor) variable *categorical* or *continuous*

The levels of gender are male and female. These are discrete categories, therefore gender is categorical.

Is the dependent variable (outcome) *categorical* or *continuous*

The levels of leg cross are yes and no. These are discrete categories, therefore in this example, the dependent variable, leg cross, is categorical.
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The levels of gender are male and female. These are discrete categories, therefore gender is categorical.

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The levels of leg cross are yes and no. These are discrete categories, therefore in this example, the dependent variable, leg cross, is categorical.

What if the outcome were measured in time (minutes and seconds) rather than YES vs. NO?
Is the independent (predictor) variable **categorical** or **continuous**?

The levels of gender are male and female. These are discrete categories, therefore gender is categorical.

Is the dependent variable (outcome) **categorical** or **continuous**?

The levels of leg cross are yes and no. These are discrete categories, therefore in this example, the dependent variable, leg cross, is categorical.

What if the outcome were measured in time (minutes and seconds) rather than YES vs. NO?

In that case the dependent variable would be a **continuous** measure.
Your research assistant has collected observational data. Now it is up to you to make sense of it.
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The first step is to enter each COUNT in the appropriate cell on a CONTINGENCY TABLE. Here is an example:
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<table>
<thead>
<tr>
<th>GENDER</th>
<th>female</th>
<th>male</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROSS</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>within 30 seconds</td>
<td>No</td>
<td></td>
</tr>
</tbody>
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<th></th>
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<th>male</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROSS within 30 seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>232</td>
<td></td>
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<tr>
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<td></td>
<td></td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>GENDER</th>
<th>CROSS within 30 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>Yes: 232, No:</td>
</tr>
<tr>
<td>male</td>
<td></td>
</tr>
<tr>
<td></td>
<td>96</td>
</tr>
</tbody>
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<thead>
<tr>
<th></th>
<th>GENDER</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>female</td>
<td>male</td>
</tr>
<tr>
<td>CROSS within 30</td>
<td>Yes</td>
<td>232</td>
</tr>
<tr>
<td>seconds</td>
<td></td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>129</td>
</tr>
</tbody>
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Put the independent variable (predictor) along the top, and the dependent variable (outcome) along the side.

<table>
<thead>
<tr>
<th></th>
<th>female</th>
<th>male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>232</td>
<td>96</td>
</tr>
<tr>
<td>No</td>
<td>129</td>
<td>251</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>GENDER</th>
<th>CROSS within 30 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>Yes: 232  No: 129</td>
</tr>
<tr>
<td>male</td>
<td>Yes: 96  No: 251</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th></th>
<th>female</th>
<th>male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross within 30 seconds</td>
<td>232</td>
<td>96</td>
</tr>
<tr>
<td>No</td>
<td>129</td>
<td>251</td>
</tr>
<tr>
<td><strong>361</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cells | Margins (totals)
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Put the independent variable (predictor) along the top, and the dependent variable (outcome) along the side.

<table>
<thead>
<tr>
<th>GENDER</th>
<th>CROSS within 30 seconds</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>232</td>
<td>129</td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>96</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td></td>
<td>361</td>
<td>347</td>
<td></td>
</tr>
</tbody>
</table>

**margins** (totals)
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Put the independent variable (predictor) along the top, and the dependent variable (outcome) along the side.

<table>
<thead>
<tr>
<th>GENDER</th>
<th>Yes</th>
<th>No</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>232</td>
<td>129</td>
<td>361</td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>96</td>
<td>251</td>
<td>347</td>
<td></td>
</tr>
</tbody>
</table>

328

margins (totals)

cells
Your research assistant has collected observational data. Now it is up to you to make sense of it.

The first step is to enter each COUNT in the appropriate cell on a CONTINGENCY TABLE. Here is an example:

Put the independent variable (predictor) along the top, and the dependent variable (outcome) along the side.

```
<table>
<thead>
<tr>
<th>GENDER</th>
<th>CROSS within 30 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>232</td>
</tr>
<tr>
<td>male</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>96</td>
</tr>
<tr>
<td>female</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>129</td>
</tr>
<tr>
<td>male</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>251</td>
</tr>
</tbody>
</table>
```

361 347 328 380

cells

margins (totals)
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<table>
<thead>
<tr>
<th>GENDER</th>
<th>CROSS within 30 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>Yes: 232</td>
</tr>
<tr>
<td>male</td>
<td>Yes: 96</td>
</tr>
<tr>
<td></td>
<td>Total: 328</td>
</tr>
</tbody>
</table>

N = 708 (check to see that the marginal totals add up correctly)
The General Case - contingency tables can have 2 or more columns and rows. Beyond 4 or 5 of either makes interpretation difficult.
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On the table below, indicate a cell.
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On the table below, indicate a cell.
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On the table below, indicate a cell.

And a margin.
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On the table below, indicate a cell.

And a margin.
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On the table below, indicate a cell.

And a margin.

Where does the independent (or predictor) variable and its levels belong?
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On the table below, indicate a cell.

And a margin.

Where does the independent (or predictor) variable and its levels belong?

```
<table>
<thead>
<tr>
<th>PREDICTOR Variable (INDEPENDENT Variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
</tr>
<tr>
<td>cell</td>
</tr>
</tbody>
</table>
```

margins
The General Case - contingency tables can have 2 or more columns and rows. Beyond 4 or 5 of either makes interpretation difficult.

On the table below, indicate a cell.

And a margin.

Where does the independent (or predictor) variable and its levels belong?

And the outcome (dependent variable)?

PREDICTOR Variable (INDEPENDENT Variable)

Level 1  Level 2

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>cell</td>
<td></td>
</tr>
</tbody>
</table>

margins
**The General Case** - contingency tables can have 2 or more columns and rows. Beyond 4 or 5 of either makes interpretation difficult.

On the table below, indicate a cell.

And a margin.

Where does the independent (or predictor) variable and its levels belong?

And the outcome (dependent variable)?

<table>
<thead>
<tr>
<th>OUTCOME (Dependent variable)</th>
<th>PREDICTOR Variable (INDEPENDENT Variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Level 1</td>
</tr>
<tr>
<td>Level 2</td>
<td>cell</td>
</tr>
<tr>
<td>Level 3</td>
<td>margins</td>
</tr>
</tbody>
</table>
Returning to the Reasoner data  \( N = 708 \)
Returning to the Reasoner data $N = 708$

<table>
<thead>
<tr>
<th></th>
<th>GENDER</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>female</td>
<td>male</td>
<td></td>
</tr>
<tr>
<td>CROSS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>within 30 seconds</td>
<td>232</td>
<td>96</td>
<td>328</td>
</tr>
<tr>
<td></td>
<td>129</td>
<td>251</td>
<td>380</td>
</tr>
<tr>
<td>No</td>
<td>361</td>
<td>347</td>
<td></td>
</tr>
</tbody>
</table>

$N = 708$
Returning to the Reasoner data \( N = 708 \)

<table>
<thead>
<tr>
<th>CROSS within 30 seconds</th>
<th>GENDER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>female</td>
</tr>
<tr>
<td>Yes</td>
<td>232</td>
</tr>
<tr>
<td>No</td>
<td>129</td>
</tr>
</tbody>
</table>

328 380

361 347

The contingency table shows the raw data. You need to refine it a bit more for presentation.
A good way to summarize counts such as these is to transform them into __?__.
A good way to summarize counts such as these is to transform them into __?__

PERCENTAGES
A good way to summarize counts such as these is to transform them into ___?___.

PERCENTAGES

Make a table showing the results using percentages (calculate from preceding slide).
A good way to summarize counts such as these is to transform them into **percentages**.

Make a table showing the results using percentages (calculate from preceding slide).

Table 1
Percentage of women and men who crossed their legs within 30 seconds of sitting down.

<table>
<thead>
<tr>
<th></th>
<th>Women (n = 361)</th>
<th>Men (n = 347)</th>
</tr>
</thead>
<tbody>
<tr>
<td>64.3%</td>
<td>27.7%</td>
<td></td>
</tr>
</tbody>
</table>
A good way to summarize counts such as these is to transform them into __?__.

PERCENTAGES

Make a table showing the results using percentages (calculate from preceding slide).

Table 1  
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<table>
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Note: The percentages are the descriptive statistics.
A good way to summarize counts such as these is to transform them into __?__

PERCENTAGES

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Note: The percentages are the **descriptive statistics**.

A descriptive statistic is ________________.
A good way to summarize counts such as these is to transform them into __?__.

PERCENTAGES

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<table>
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</table>

Table 1
Percentage of women and men who crossed their legs within 30 seconds of sitting down.

Note: The percentages are the **descriptive statistics**.

A descriptive statistic is ____________.

Ans: A quantitative characteristic of a sample.
A narrative description can be used within report or talk. State the results in words.
A narrative description can be used within report or talk. State the results in words.

Sixty-four percent of the women \((n = 361)\) and 28 percent of the men \((n = 347)\) crossed their legs within 30 seconds of sitting down.
Draw a graph of the results.
Draw a graph of the results.
Draw a graph of the results.
Draw a graph of the results.
Draw a graph of the results.

Figure 1. Percent of women (n=361) and men (n=347) crossing within 30 seconds.
Draw a graph of the results.

Figure 1. Percent of women \((n=361)\) and men \((n=347)\) crossing within 30 seconds.

Note: Using APA style, table titles are placed above the table, and figure titles are placed below the figure.
You would not use all three in a single report. Pick the one that best illustrates your findings.
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Here is another example using additional data.
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Here is another example using additional data.

Table 2
Of those who crossed their legs, percentage showing each type of cross, by gender.

<table>
<thead>
<tr>
<th>Type</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women (n=252)</td>
<td>Men (n=122)</td>
</tr>
<tr>
<td>Knee-to-knee</td>
<td>50.4</td>
</tr>
<tr>
<td>Ankle-to-ankle</td>
<td>17.1</td>
</tr>
<tr>
<td>Ankle-to-knee</td>
<td>10.3</td>
</tr>
<tr>
<td>Cross-legged</td>
<td>19.8</td>
</tr>
<tr>
<td>Other</td>
<td>2.4</td>
</tr>
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</tr>
<tr>
<td>Other</td>
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</tr>
</tbody>
</table>

Note that the sample sizes (n) are provided so that the reader could reconstruct the actual numbers.
When outcome variable is CONTINUOUS,
When outcome variable is CONTINUOUS,
for example, enjoyment - on a scale of 1 to 10, or score on an exam,
When outcome variable is CONTINUOUS, for example, enjoyment - on a scale of 1 to 10, or score on an exam, what two major aspects of the data need to be described [in addition to the sample size (N)]?
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Hint: One begins with “central”
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Hint: One begins with “central”

Ans: central tendency and variability.
When outcome variable is CONTINUOUS, for example, enjoyment - on a scale of 1 to 10, or score on an exam, what two major aspects of the data need to be described [in addition to the sample size (N)]?

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What are the three measures of central tendency?
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Mean
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Mean
Median
When outcome variable is CONTINUOUS, for example, enjoyment - on a scale of 1 to 10, or score on an exam,

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What are the three measures of central tendency?

Mean
Median
Mode
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3
EXAMPLE:  Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

X
10
8
6
4
3
2
2
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

X
10
8
6
4
3
2
2

Calculate the following and also show the appropriate statistical symbol.
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

\[
\begin{array}{c}
X \\
10 \\
8 \\
6 \\
4 \\
3 \\
2 \\
2 \\
\end{array}
\]

Calculate the following and also show the appropriate statistical symbol.

Sample size
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

\[
\begin{array}{c}
X \\
10 \\
8 \\
6 \\
4 \\
3 \\
2 \\
2 \\
\end{array}
\]

Calculate the following and also show the appropriate statistical symbol.

Sample size

\[N = 7\]
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

\[
\begin{array}{c}
\text{X} \\
10 \\
8 \\
6 \\
4 \\
3 \\
2 \\
2 \\
\end{array}
\]

Calculate the following and also show the appropriate statistical symbol.

Sample size \hspace{1cm} \text{Mode (no symbol)}

N = 7
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

\[
\begin{array}{c}
\text{X} \\
10 \\
8 \\
6 \\
4 \\
3 \\
2 \\
2 \\
\end{array}
\]

Calculate the following and also show the appropriate statistical symbol.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Mode (no symbol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N = 7)</td>
<td>(= 2)</td>
</tr>
</tbody>
</table>
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

\[
\begin{array}{c}
X \\
10 \\
8 \\
6 \\
4 \\
3 \\
2 \\
2 \\
\end{array}
\]

Calculate the following and also show the appropriate statistical symbol.

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Mode (no symbol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 7</td>
<td>= 2</td>
</tr>
</tbody>
</table>

Median
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

\[
\begin{array}{r}
X \\
10 \\
8 \\
6 \\
4 \\
3 \\
2 \\
2 \\
\end{array}
\]

Calculate the following and also show the appropriate statistical symbol.

Sample size \hspace{2cm} Mode (no symbol)
\[
\begin{array}{ll}
N \hspace{0.5cm} = \hspace{0.5cm} 7 & \hspace{2cm} = \hspace{0.5cm} 2 \\
\end{array}
\]

Median
\[
\begin{array}{l}
Mdn \hspace{0.5cm} = \hspace{0.5cm} 4 \\
\end{array}
\]
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

<table>
<thead>
<tr>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
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Calculate the following and also show the appropriate statistical symbol.

<table>
<thead>
<tr>
<th>Sample size</th>
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</tr>
</thead>
<tbody>
<tr>
<td>N = 7</td>
<td>= 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Median</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mdn = 4</td>
<td></td>
</tr>
</tbody>
</table>
EXAMPLE: Scores on a 10-point quiz: Scores are 2, 10, 6, 2, 4, 8, 3

Put them in order with the proper label at the top.

<table>
<thead>
<tr>
<th>X</th>
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<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
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<tr>
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<tbody>
<tr>
<td>N = 7</td>
<td>= 2</td>
</tr>
<tr>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>Mdn = 4</td>
<td>M or $\bar{X}$ = 5</td>
</tr>
</tbody>
</table>
Here is another set of scores. These have frequencies \((f)\) listed -- meaning that there might be more than one of any given score.

<table>
<thead>
<tr>
<th>(X)</th>
<th>(f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
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</tr>
<tr>
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<td>1</td>
</tr>
<tr>
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<td>0</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
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<tr>
<td>4</td>
<td>1</td>
</tr>
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<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Median?  
\[ \text{Mdn} = 4 \]
Here is another set of scores. These have frequencies \((f)\) listed -- meaning that there might be more than one of any given score.

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<tr>
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<tr>
<td>10</td>
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</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
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</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Median?

Median = 4

If you didn’t get it right, make a list of all of the individual scores.
Here is another set of scores. These have frequencies \((f)\) listed -- meaning that there might be more than one of any given score.

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<tr>
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<tr>
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Median? Mdn = 4

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<td>4</td>
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<tr>
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<td>0</td>
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Median?

\(\text{Mdn} = 4\)

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<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
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</table>

Find the middle score.
That will be the median.
Here is another set of scores. These have frequencies \((f)\) listed -- meaning that there might be more than one of any given score.

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Median?

Mdn = 4

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Recap: We are reviewing necessary descriptive statistics for continuous variables. The first aspect of describing quantitative findings along a continuous variable is central tendency.
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The other important aspect is
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The other important aspect is VARIABILITY.
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The other important aspect is VARIABILITY

Variability refers to the ______ of the scores.
Recap: We are reviewing necessary descriptive statistics for continuous variables. The first aspect of describing quantitative findings along a continuous variable is central tendency.

The other important aspect is **VARIABILITY**

Variability refers to the ______ of the scores. **SPREAD** or **DISPERSION**
Recap: We are reviewing necessary descriptive statistics for continuous variables. The first aspect of describing quantitative findings along a continuous variable is central tendency.

The other important aspect is VARIABILITY.

Variability refers to the ______ of the scores. SPREAD or DISPERSION.

Two indicators of variability are
Recap: We are reviewing necessary descriptive statistics for continuous variables. The first aspect of describing quantitative findings along a continuous variable is central tendency.

The other important aspect is **VARIABILITY**

Variability refers to the ______ of the scores. **SPREAD** or **DISPERSION**

Two indicators of variability are
- Range
- Standard Deviation (SD)
Recap: We are reviewing necessary descriptive statistics for continuous variables. The first aspect of describing quantitative findings along a continuous variable is central tendency.

The other important aspect is **VARIABILITY**

Variability refers to the ______ of the scores. SPREAD or DISPERSION

Two indicators of variability are

Range
Standard Deviation (SD)

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Calculate the range of these scores.
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Calculate the range of these scores.

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Range  = 10 - 2 = 8
What is so special about the standard deviation?
What is so special about the standard deviation?

It shows how closely scores group around the mean.
What is so special about the standard deviation?

It shows how closely scores group around the mean.

As a set of scores become more spread out from the mean, the standard deviation _____ (increases or decreases?)
What is so special about the standard deviation?

It shows how closely scores group around the mean.

As a set of scores become more spread out from the mean, the standard deviation _____ (increases or decreases?)

Increases.
Larger SD = greater variability
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.*
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\[ M = 5 \]
What is the Standard Deviation? Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.

\[
\begin{align*}
\text{\underline{X}} & \text{ \underline{(X-M)}} \\
10 - 5 &= 5 \\
8 \\
6 \\
4 \\
3 \\
2 \\
2 \\
\end{align*}
\]

\[M = 5\]
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.*

\[
\begin{array}{c|c}
X & (X-M) \\
10 & -5 = 5 \\
8 & -5 = 3 \\
6 & \\
4 & \\
3 & \\
2 & \\
2 & \\
\end{array}
\]

\[M = 5\]
What is the Standard Deviation? Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.

\[
\begin{align*}
X & \quad (X - M) \\
10 & \quad 5 \\
8 & \quad 3 \\
6 & \quad 1 \\
4 & \\
3 & \\
2 & \\
2 & \\
\end{align*}
\]

\[M = 5\]
What is the Standard Deviation? Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.

\[ X \quad (X-M) \]
\[
10 - 5 = 5 \\
8 - 5 = 3 \\
6 - 5 = 1 \\
4 - 5 = -1 \\
3 \\
2 \\
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\]

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$M = 5$
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from)*. Using the formula is easier.

\[
\begin{array}{c|c}
X & (X-M) \\
10 & 5 \\
8 & 3 \\
6 & 1 \\
4 & -1 \\
3 & -2 \\
2 & -3 \\
\end{array}
\]

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**Note** that each individual score is being subtracted from the mean. We can’t do much with these numbers because if we add them, they will total 0. That is the nature of the mean. A solution is to square each difference score, and then add them.

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\[
\frac{(X-M)^2}{25}
\]
What is the Standard Deviation? Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.

\[
\begin{array}{c|c}
X & (X-\bar{X}) \\
10 & 5 \\
8 & 3 \\
6 & 1 \\
4 & -1 \\
3 & -2 \\
2 & -3 \\
2 & -3 \\
\end{array}
\]

Note that each individual score is being subtracted from the mean. We can’t do much with these numbers because if we add them, they will total 0. That is the nature of the mean. A solution is to square each difference score, and then add them.

\[
\begin{align*}
\left(\frac{X-\bar{X}}{\bar{X}}\right)^2 & = 25 \\
& = 9
\end{align*}
\]
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.*

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\[
\begin{array}{c|c}
X & (X-M) \\
10 & 5 \\
8 & 3 \\
6 & 1 \\
4 & -1 \\
3 & -2 \\
2 & -3 \\
2 & -3 \\
\end{array}
\]

\[
M = 5
\]

\[
\frac{(X-M)^2}{25} \\
9 \\
1
\]
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.*

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$M = 5$

$$
\frac{(X-M)^2}{5} = 25 \quad 9 \quad 1 \quad 1 \quad 4
$$
What is the Standard Deviation? Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.

\[
\begin{array}{c|c}
X & (X-M) \\
\hline
10 & 5 \\
8 & 3 \\
6 & 1 \\
4 & -1 \\
3 & -2 \\
2 & -3 \\
2 & -3 \\
\end{array}
\]

\[\text{Note} \text{ that each individual score is being subtracted from the mean.}\]

We can’t do much with these numbers because if we add them, they will total 0. That is the nature of the mean. A solution is to square each difference score, and then add them.

\[
M = 5
\]

\[
\frac{(X-M)^2}{(X-M)^2}
\]

\[
\begin{array}{c}
25 \\
9 \\
1 \\
1 \\
4 \\
9 \\
\end{array}
\]
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.*

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\[
\overline{M} = 5
\]

\[
\frac{(X-M)^2}{n}
\]

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\[
(M = 5)
\]

\[
\frac{(X-M)^2}{25}
\]

\[
\frac{9}{9}
\]

\[
\frac{1}{1}
\]

\[
\frac{1}{1}
\]

\[
\frac{4}{4}
\]

\[
\frac{9}{9}
\]

\[
\frac{9}{9}
\]

\[
58
\]
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.*

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\[
\frac{\sum (X-M)^2}{n} = \frac{58}{7}
\]
What is the Standard Deviation? Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.

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\[ M = 5 \]

\[ \frac{(X-M)^2}{\sum} = \frac{58}{7} = 8.286 \]
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from).* Using the formula is easier.

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\[
\frac{58}{7} = 8.286
\]

This is a sort of average of the spread (squared).
What is the Standard Deviation? *Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.*

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\[
\frac{\sum (X-M)^2}{n-1} = \frac{58}{7} = 8.286
\]

This is a sort of average of the spread (squared).

Unsquare it (take square root) \[
\sqrt{8.286} = \]

What is the Standard Deviation? Here is the long way to calculate it (so you can see where it comes from). Using the formula is easier.

\[
\begin{array}{c|c}
 X & (X-M) \\
 10 & 5 \\
 8 & 3 \\
 6 & 1 \\
 4 & -1 \\
 3 & -2 \\
 2 & -3 \\
 2 & -3 \\
 \hline
 M = 5
\end{array}
\]

\[
\begin{array}{c|c}
 (X-M)^2 \\
 25 & \\
 9 & \\
 1 & \\
 1 & \\
 4 & \\
 9 & \\
 9 & \\
 \hline
 58 & \frac{58}{7} = 8.286
\end{array}
\]

This is a sort of average of the spread (squared).

Unsquare it (take square root) \[\sqrt{8.286} = 2.88 = SD\]
Some Greek
Some Greek

Σ =
Some Greek

$\Sigma = \text{Sum of}$
Some Greek

\[ \Sigma = \text{Sum of} \]

\[ \sigma = \]
Some Greek

\[ \sum = \text{Sum of} \]
\[ \sigma = \text{standard deviation for the population} \]
Some Greek

Σ = Sum of

σ = standard deviation for the population

Standard deviation can also be abbreviated as SD or StDev
Some Greek

\[ \Sigma = \text{Sum of} \]

\[ \sigma = \text{standard deviation for the population} \]

Standard deviation can also be abbreviated as SD or StDev

Formula for the standard deviation
Some Greek

\[ \Sigma = \text{Sum of} \]
\[ \sigma = \text{standard deviation for the population} \]

*Standard deviation can also be abbreviated as SD or StDev*

Formula for the standard deviation

\[
\sqrt{\frac{\sum X^2 - (\sum X)^2}{N}} \]

\[
\frac{N-1}{N}
\]
Some Greek

\[ \Sigma = \text{Sum of} \]
\[ \sigma = \text{standard deviation for the population} \]

*Standard deviation can also be abbreviated as* **SD** *or* **StDev**

Formula for the standard deviation

\[
\sqrt{\frac{\sum X^2 - (\sum X)^2}{N}} \div \frac{N-1}{N}
\]

Calculators often have 2 formulas for the Standard Deviation, one for the sample (shown as N or s) and the other for the population (shown as N-1 or \( \sigma \)).

Use the population (N-1 or \( \sigma \)) formula.
List three symbols or abbreviations for the standard deviation.
List three symbols or abbreviations for the standard deviation

\( \sigma \)

*SD*

*StDev*
List three symbols or abbreviations for the standard deviation

\[ \sigma \]

SD

StDev

Describe each of the following arithmetic operations (i.e., how do you calculate these?).
List three symbols or abbreviations for the standard deviation

σ

SD

StDev

Describe each of the following arithmetic operations (i.e., how do you calculate these?)

ΣX
List three symbols or abbreviations for the standard deviation

\( \sigma \)

\( SD \)

\( StDev \)

Describe each of the following arithmetic operations (i.e., how do you calculate these?).

\( \sum X \)

Add up the scores.
List three symbols or abbreviations for the standard deviation

\( \sigma \)

\( SD \)

\( StDev \)

Describe each of the following arithmetic operations (i.e., how do you calculate these?).

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\( \sum X^2 \)

Square each score and then add them.

\( (\sum X)^2 \)

Add the scores and then square the total.
Fill-in the proper statistic.
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When describing an outcome based on a continuous variable, always include ____.
Fill-in the proper statistic.

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N (sample size)
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When describing an outcome based on a continuous variable, always include ____.

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In most cases, also provide the ____ and the ____.
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Mean . . . Standard Deviation
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Mean . . . Standard Deviation

If the distribution of scores is skewed (see textbook), then use the____ and the ____.
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Mean . . . Standard Deviation

If the distribution of scores is skewed (see textbook), then use the ____ and the ____.

Median . . . Range
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N (sample size)

In most cases, also provide the____ and the ____.

Mean . . . Standard Deviation

If the distribution of scores is skewed (see textbook), then use the____ and the ____.

Median . . . Range

Only use the Standard Deviation when presenting the Mean (no SD with the Median or Mode).
Here are the students’ results for a 10-point quiz described earlier.

N = 7
M = 5
SD = 2.88
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\[ N = 7 \]
\[ M = 5 \]
\[ SD = 2.88 \]

How would you state these results in a research report?
Here are the students’ results for a 10-point quiz described earlier.

N = 7  
M = 5  
SD = 2.88

How would you state these results in a research report?

Seven students took a 10-point quiz (M=5, SD = 2.88).

or

The mean for the 10-point quiz was 5 (N=7, SD = 2.88)
REVIEW

Examine outcome variable (dependent variable) and select the proper descriptive statistics.
**REVIEW**

Examine outcome variable (dependent variable) and select the proper descriptive statistics.

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Always include Ns (sample sizes)

End

Please send comments or suggestions to Barbara Sommer basommer@ucdavis.edu