**Biased (Yes) or Unbiased (No)?**

1) Eight citizens are asked their opinions about what trash should be collected.

2) A phone-in survey is taken by a radio station to see how many listeners enjoy jazz in the morning.

3) Every fortieth student who enters the school is asked to name their favorite sport.

4) Ten students are randomly selected to participate in a survey about home computer usage.

5) Each math class randomly selects two students do represent their class on an advisory panel being assembled by the principal.

6) A shirt manufacturer wants to check quality control of their products. The plant manager decides to check every $5^{th}$ shirt inspected by Inspector D. There are 15 inspectors in the plant.

7) A survey is conducted at the local shopping mall about household products used on a daily basis.

**Biased (Yes) or Unbiased (No)?**                                    **Answer Key**

1) Eight citizens are asked their opinions about what trash should be collected.

   **Yes, Biased, sample size too small**

2) A phone-in survey is taken by a radio station to see how many listeners enjoy jazz in the morning.

   **Yes, Biased, response are only from listeners who decide to call in**

3) Every fortieth student who enters the school is asked to name their favorite sport.

   **No, Unbiased, systematic**

4) Ten students are randomly selected to participate in a survey about home computer usage.

   **No, Unbiased, random**

5) Each math class randomly selects two students do represent their class on an advisory panel being assembled by the principal.

   **No, Unbiased, random**

6) A shirt manufacturer wants to check quality control of their products. The plant manager decides to check every 5$^{th}$ shirt inspected by Inspector D. There are 15 inspectors in the plant.

   **Yes, Biased, only Inspector D's shirts are being checked**

7) A survey is conducted at the local shopping mall about household products used on a daily basis.

   **Yes, Biased, only customers at the shopping mall have an opportunity to be surveyed**

**Representative Sample Scenarios**

Are these samples representative?

1.  To determine the percentage of teenage girls with long hair, *Teen* magazine published a mail-in questionnaire.  Of the 500 respondents, 85% had hair shoulder length or longer (*USA Today*, July 1, 1985).

2.  A college psychology professor needs subjects for a research project to determine which colors average American adults find restful.  From the list of all 743 students taking introductory psychology at her school, she selects 25 students using a random number table.

3.  To evaluate the reliability of cars owned by its subscribers, *Consumer Reports* magazine publishes a yearly list of automobiles and their frequency-of-repair records.  The magazine collects the information by mailing a questionnaire to subscribers and tabulating the results from those who return it.

4.  Oranges from an orchard need to be samples to see if they are sweet enough for juice.  The orchard has 25,000 orange trees.  Each tree has at least 500 oranges.  Claire decides to randomly choose 800 trees and test one orange from each tree.

5.  For a survey of student opinions about school athletic programs, a member of the school board obtains a sample of students by listing all students in the school and using a random number table to select 30 of them.  Six of the students say that they don't have time to participate, and they are eliminated from the sample.

6.  There are fifteen boys and fifteen girls in a math class.  Each student's name is placed in a hat and the names are thoroughly mixed.  Seven names are drawn and all names correspond to the boys in the class.

**Representative Sample Scenarios                    Answer Key**

1. To determine the percentage of teenage girls with long hair, *Teen* magazine published a mail-in questionnaire. Of the 500 respondents, 85% had hair shoulder length or longer (*USA Today*, July 1, 1985).

   **No (only teenagers who read *Teen* and choose to write would represent al teens)**

2. A college psychology professor needs subjects for a research project to determine which colors average American adults find restful. From the list of all 743 students taking introductory psychology at her school, she selects 25 students using a random number table.

   **No (only includes students which would not include many "average American adults"; students are often young so many ages would not be represented)**

3. To evaluate the reliability of cars owned by its subscribers, *Consumer Reports* magazine publishes a yearly list of automobiles and their frequency-of-repair records. The magazine collects the information by mailing a questionnaire to subscribers and tabulating the results from those who return it.

   **No (men would probably be better represented than women; only people who read *Consumer Reports* and choose to respond would be represented)**

4. Oranges from an orchard need to be samples to see if they are sweet enough for juice. The orchard has 25,000 orange trees. Each tree has at least 500 oranges. Claire decides to randomly choose 800 trees and test one orange from each tree.

   **yes**

5. For a survey of student opinions about school athletic programs, a member of the school board obtains a sample of students by listing all students in the school and using a random number table to select 30 of them. Six of the students say that they don't have time to participate, and they are eliminated from the sample.

   **No (1/6 of the chosen sample was eliminated which is not representative to the entire school)**

6. There are fifteen boys and fifteen girls in a math class. Each student's name is placed in a hat and the names are thoroughly mixed. Seven names are drawn and all names correspond to the boys in the class.

   **No (only boys are represented)**

**Simple random sample:**
1. Each member of the population is equally likely to be chosen and
2. The members of the sample are chosen independently of one another


Does this sampling method produce a simple random sample from a class of 30 students?

1. A teacher selects the first five students that enter the room.

2. A teacher wants to select ten students from the class. She lists students in alphabetical order, then selects every third student.

3. A teacher wants to select five students from the class. Suppose that the classroom has six rows of chairs with five chairs in each row. The teacher assigns the rows the digits 1 through 6. She throws a die and selects all the students in the row corresponding to the number on the die in the sample.

4. Assign each student a number from 1 to 30. The girls get the numbers 1 to 15 and the boys the numbers from 16 to 30. Use a random number table to select six two-digit numbers between 1 and 30, and select the corresponding students in the sample.

5. There are fifteen boys and fifteen girls in a math class. Each student's name is placed in a hat and the names are thoroughly mixed. Seven names are drawn and all names correspond to the boys in the class.

**Simple Random Sample**                                **Answer Key**

1.  A teacher selects the first five students that enter the room.

    **No  (each student does not have an equally likely chance of being chosen)**

2.  A teacher wants to select ten students from the class.  She lists students in alphabetical order, then selects every third student.

    **No (every student does not have a chance to be chosen)**

3.  A teacher wants to select five students from the class.  Suppose that the classroom has six rows of chairs with five chairs in each row.  The teacher assigns the rows the digits 1 through 6.  She throws a die and selects all the students in the row corresponding to the number on the die in the sample.

    **No  (each student does not have an equally likely chance to be chosen and the students picked on dependent on each other)**

4.  Assign each student a number from 1 to 30.  The girls get the numbers 1 to 15 and the boys the numbers from 16 to 30.  Use a random number table to select six two-digit numbers between 1 and 30, and select the corresponding students in the sample.

    **yes**

5.  There are fifteen boys and fifteen girls in a math class.  Each student's name is placed in a hat and the names are thoroughly mixed.  Seven names are drawn and all names correspond to the boys in the class.

    **yes**

**More Practice with Samples**          Name: _____

I.  Read each scenario and determine if each sample is biased or unbiased.  If the sample is biased, explain why it is biased.

1)  A company is interested in opening a gym on its premises for all employees. They ask all 3rd shift workers (11 pm – 7 am) if they would use the gym, and what hours they would like the gym to be open.

2)  Republicans send out a survey to 500 registered republicans in 3 states to determine the issues that should be focused on for the next election..

3)  Each week a teacher randomly selects one student from each class to review homework answers with the rest of the class.

II.  Read each scenario and determine if each sample is a representative sample.  If the sample is not representative, explain why it is not representative.

4)  To obtain a sample of households, a television rating service dials numbers taken at random from telephone directories.

5)  In 1984, Ann Landers conducted a poll on the marital happiness of women by asking women to write to her.

6)  A clothing company wants to know what color leggings teenagers will buy.  The company decides to spend one day in the junior departments of five randomly selected stores in randomly selected cities and ask every teenager who enters what color leggings they buy.

III.  Read each scenario and determine if each sample is a simple random sample.  If the sample is not a simple random sample, explain why it is not a simple random sample.

7)  A teacher selects those students whose phone numbers end with the digit 4.

8)  There are fifteen boys and fifteen girls in a history class.  A teacher selects a sample of six students by using a random number table to choose 1 of the 15 boys, then 1 of the 15 girls, then a boy, then a girl, and so on until she has chosen 6 students.

9)  A teacher wants to select six students from the class.  She writes each student's name on an index card, places the index cards in a box, mixes the cards, then chooses six cards from the box.

**More Practice with Samples**       Name: _**Answer Key**_____

I.  Read each scenario and determine if each sample is biased or unbiased.  If the sample is biased, explain why it is biased.

1)   A company is interested in opening a gym on its premises for all employees. They ask all 3$^{rd}$ shift workers (11 pm – 7 am) if they would use the gym, and what hours they would like the gym to be open.

   **Biased, convenient, not all workers have a chance to give their input.**

2)   Republicans send out a survey to 500 registered republicans in 3 states to determine the issues that should be focused on for the next election.

   **Biased, voluntary.  There is not a sample from every state.**

3)   Each week a teacher randomly selects one student from each class to review homework answers with the rest of the class.

   **Unbiased, simple random sample.**

II.  Read each scenario and determine if each sample is a representative sample.  If the sample is not representative, explain why it is not representative.

4)   To obtain a sample of households, a television rating service dials numbers taken at random from telephone directories.

   **No  (some households may have unlisted telephone numbers)**

5)   In 1984, Ann Landers conducted a poll on the marital happiness of women by asking women to write to her.

   **No  (only women who read Ann Landers and choose to write would represent all women)**

6)   A clothing company wants to know what color leggings teenagers will buy.  The company decides to spend one day in the junior departments of five randomly selected stores in randomly selected cities and ask every teenager who enters what color leggings they buy.

   **Yes**

III.  Read each scenario and determine if each sample is a simple random sample.  If the sample is not a simple random sample, explain why it is not a simple random sample.

7)  A teacher selects those students whose phone numbers end with the digit 4.

**No (every student doe not have a chance to be chosen)**

8)  There are fifteen boys and fifteen girls in a history class.  A teacher selects a sample of six students by using a random number table to choose 1 of the 15 boys, then 1 of the 15 girls, then a boy, then a girl, and so on until she has chosen 6 students.

**No (one event depends on the previous event)**

9)  A teacher wants to select six students from the class.  She writes each student's name on an index card, places the index cards in a box, mixes the cards, then chooses six cards from the box.

**Yes**

**Biased/Unbiased Extension Activity**          **Name:** _____

For each scenario below:
- Determine the sample and population you would need to survey to obtain a representative sample.
- Determine how you would survey the population to obtain a simple random sample.
- Design two survey questions which are free of bias.

1) Suppose you want to know if a manufacturing plant is discharging contaminants into the Chesapeake Bay.

2) Suppose you want to know the issues most important to teachers at your school.

**Warm-Up #2**

1. Find the mean, median, and mode for the data set

   5, 12, 7, 14, 8, 9, 5

2. A survey of 20 students was conducted to find out how many books they had read during the past four months. The results from those 20 students are shown below. Find the mean, median and mode for this data.

   3, 4, 6, 1, 2, 2, 5, 6, 1, 3, 4, 3, 5, 11, 12, 10, 2, 9, 6, 7

3. Movies R Us keeps a record of how many movies are rented on each day of the week.

| Mon | Tues | Wed | Thurs | Fri | Sat | Sun |
|-----|------|-----|-------|-----|-----|-----|
| 420 | 260 | 220 | 430 | 700 | 660 | 410 |

Find the mean, median, and mode for this data (rounded to the nearest whole number).

Warm-Up #2                                          **Answer Key**

1. Find the mean, median, and mode for the data set

    5, 12, 7, 14, 8, 9, 5

    **Mean = 8.6, Median = 8, Mode = 5**

2. A survey of 20 students was conducted to find out how
   many books they had read during the past four months.
   The results from those 20 students are shown below.
   Find the mean, median and mode for this data.

    3, 4, 6, 1, 2, 2, 5, 6, 1, 3, 4, 3, 5, 11, 12, 10, 2, 9, 6, 7

    **Mean = 5.1, Median = 4.5, Mode = 2, 3, 6**
    **(none because more than 2 values)**

3. Movies R Us keeps a record of how many movies are
rented on each day of the week.

| Mon | Tues | Wed | Thurs | Fri | Sat | Sun |
|-----|------|-----|-------|-----|-----|-----|
| 420 | 260  | 220 | 430   | 700 | 660 | 410 |

Find the mean, median, and mode for this data (rounded to the nearest whole number).

    **Mean = 443, Median = 4**20**, Mode = non**e

**Misleading Advertising**                          Name: _____

Advertisers, who want you to buy their products, present information about their products in ways that make their product more appealing than it might actually be.  They are very persuasive with their facts, manipulating data reports to their advantage.  They use the measures of central tendency that best represent their product, rather than the one that may more accurately represent their product.

Nutrition is currently an important trend.  Eating right makes you feel good, and it reduces your risk for some diseases.  Americans are trying to eat healthier.  To eat healthier, we avoid fats, added sugars, and salt.  We also try to limit the number of calories we consume.

Sunshine's Brilliant Bistro is opening in one week.  The owner, Mr. Sunshine, wants to advertise so that he has a successful opening week.  Mr. Sunshine thinks his restaurant will be successful if he advertises that his food is healthy and low in cost.

The table below displays the calories, fat, and cost of the entrees.

| Entrees | Calories | Total Fat (g) | Cost |
|---|---|---|---|
| Hamburger | 375 | 10 | $7.95 |
| Cheeseburger | 475 | 14 | $8.95 |
| Grilled Chicken Sandwich | 450 | 13 | $8.95 |
| Asian Salad with Vinegrette Dressing | 130 | 6 | $8.00 |
| Caesar Salad with Grilled Chicken | 380 | 24 | $8.95 |
| Vegetarian Delight | 300 | 3 | $6.50 |
| Meatball Marinara Sub | 610 | 28 | $6.95 |
| Grilled Tuna Sandwich | 450 | 10 | $12.95 |

1. Calculate the mean, median, and mode of the calories and total fat for the entrees.

|  | **Calories** | **Total Fat (g)** |
|---|---|---|
| Mean | _____ | _____ |
| Median | _____ | _____ |
| Mode | _____ | _____ |

2. Based on calories, which measure of central tendency should Mr. Sunshine use to demonstrate that his restaurant is a healthy choice?  Justify your answer.

_____

_____

_____

3.  Based on total fat, which measure of central tendency should Mr. Sunshine use to demonstrate that his restaurant is a healthy choice?  Justify your answer.

_____

_____

_____

Mr. Sunshine's advertising group created the ad below to demonstrate that the restaurant is low in cost.

---

### Sunshine's Brilliant Bistro

GRAND OPENING:  June 21

A healthful bistro at a reasonable cost.
Eat for a bargain.
Entrees average less than $8.50 per person!

---

4. Is this ad correct?


5. Which measure of central tendency allows the advertising group to honestly use this ad?  Justify your answer.

_____

_____

_____

**Misleading Advertising**                                         Name: _**Answer Key**_____

Advertisers, who want you to buy their products, present information about their products in ways that make their product more appealing than it might actually be. They are very persuasive with their facts, manipulating data reports to their advantage. They use the measures of central tendency that best represent their product, rather than the one that may more accurately represent their product.

Nutrition is currently an important trend. Eating right makes you feel good, and it reduces your risk for some diseases. Americans are trying to eat healthier. To eat healthier, we avoid fats, added sugars, and salt. We also try to limit the number of calories we consume.

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The table below displays the calories, fat, and cost of the entrees.

| Entrees | Calories | Total Fat (g) | Cost |
|---|---|---|---|
| Hamburger | 375 | 10 | $7.95 |
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| Vegetarian Delight | 300 | 3 | $6.50 |
| Meatball Marinara Sub | 610 | 28 | $6.95 |
| Grilled Tuna Sandwich | 450 | 10 | $12.95 |

1. Calculate the mean, median, and mode of the calories and total fat for the entrees.

<div align="center">

**Calories**    **Total Fat (g)**

Mean ___**396.25**___   ___**13.5**___

Median ____**415**___   ____**11.5**____

Mode ____**450**___   _____**10**_____

</div>

2. Based on calories, which measure of central tendency should Mr. Sunshine use to demonstrate that his restaurant is a healthy choice? Justify your answer.

**Mr. Sunshine should use the mean to demonstrate that his restaurant is a healthy choice because the mean is the smallest average. A healthy restaurant should serve food that is low in calories.**

3. Based on total fat, which measure of central tendency should Mr. Sunshine use to demonstrate that his restaurant is a healthy choice? Justify your answer.

**Mr. Sunshine should use the mode to demonstrate that his restaurant is a healthy choice because the mode is the smallest average. A healthy restaurant should serve food that is low in fat.**

Mr. Sunshine's advertising group created the ad below to demonstrate that the restaurant is low in cost.

---

### Sunshine's Brilliant Bistro

GRAND OPENING: June 21

A healthful bistro at a reasonable cost.
Eat for a bargain.
Entrees average less than $8.50 per person!

---

4. Is this ad correct? Mean = 8.65, mode = 8.95, median = 8.48

**yes**

5. Which measure of central tendency allows the advertising group to honestly use this ad? Justify your answer.

**The advertising group is using the median is an average for the ad. The median is $8.48, which is less than $8.50. (The mean is $8.65 and the mode is $8.95).**

**Representative Central Tendency**          Name: _____

Mr. Sunshine sent his restaurant manager, Clark Cloudy, to poll people about food costs. Clark visited various cities and multiple restaurants in each city. He asked every 10th customer: "What do you think is a reasonable price for a tasty and healthy meal?" The results from Clark's inquiry are below:

| | | | | |
|---|---|---|---|---|
| $9.50 | $6.50 | $6.50 | $7.00 | $5.50 |
| $5.50 | $6.50 | $7.50 | $4.50 | $5.00 |
| $7.00 | $6.00 | $7.00 | $20.00 | $9.00 |
| $8.50 | $6.00 | $6.00 | $7.50 | $7.50 |
| $7.00 | $9.50 | $8.00 | $6.50 | $8.00 |

1. Find the mean, median, and mode of the prices.

2. Create a frequency table from the data above.

3. Look at your frequency table. The sum of which column determines the total number of data values?

4. What is the total number of data values?

5. Calculate the mean without using the lists on your calculator.
   a) Calculate the sum of all the data values:

   b) Divide the sum by the total number of data values. This will be the mean.

   c) Compare your answer with the mean you calculated in problem #1. Did you get the same answer?

6. Find the median without using the lists on your calculator.
   a) To find the placement of the median (the "middle" number) take the total number of data values and divide by two.

   b) The median is located in place _____.

   c) Find the data value located in the middle spot. This is your median.

   d) Compare your answer with the median you calculated in problem #1. Did you get the same answer?