

Today: Start Ch. 4

**ESSENTIAL QUESTION** *How do we collect data that allows for inference about a population or inference about cause and effect?*

**PACING 11 days**

**Chapter 4: Collecting Data**

4.1 Sampling and Surveys	3 Days
4.2 Experiments	4 Days
4.3 Using Studies Wisely	2 Days
Review, FRAPPY, and Test	2 Days

← Next test  
TUES OCT 24  
or Wed Oct 25  
=

What is different about Ch.4 ?

~ Not so "mathematical"

~ Lots of vocabulary

↑  
• Vocabulary list

### Learning Targets

Identify the population and sample in a survey

How To Sample Badly ?

How To Sample Well ?

## Pick up the Warm Up.

- In a telephone survey of 1006 U.S. adults, 96% said they always wash their hands after using a public restroom.
- A study suggests that lack of sleep increases the risk of catching a cold.
- The National Highway Traffic Safety Administration (NHTSA) reports that seat belt use in passenger vehicles increased from 88.5% in 2015 to 90.1% in 2016.

Can we trust the results? \_\_\_\_\_

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Can we trust the results?

*It depends on how the data were collected*

1. *What is a difference between a population and a sample?*

The population in a statistical study is the entire

group of individuals we want information about.

A \_\_\_\_\_ collects data from every individual in the population.

A \_\_\_\_\_ is a subset of individuals in the population from which we collect data.

1. *What is a difference between a population and a sample?*

The population in a statistical study is the entire

group of individuals we want information about.

A census collects data from every individual in the population.

A sample is a subset of individuals in the population from which we collect data.

**1. Cars and Twitter** --Identify the *population* and the *sample* in each of the following settings.

(a) An assembly line at a factory produces about 500 cars a day. Each day, quality control managers inspect 25 cars at the factory and perform an in-depth review of each car.

(b) A politician uses a Twitter poll to find out whether his followers agree with a recent bill that was passed and 432 people respond to the poll.

**1. Cars and Twitter** --Identify the *population* and the *sample* in each of the following settings.

(a) An assembly line at a factory produces about 500 cars a day. Each day, quality control managers inspect 25 cars at the factory and perform an in-depth review of each car.

The population is all the cars produced on a given day in this factory. The sample is the 25 cars selected from the assembly line.

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**1. Cars and Twitter** --Identify the *population* and the *sample* in each of the following settings.

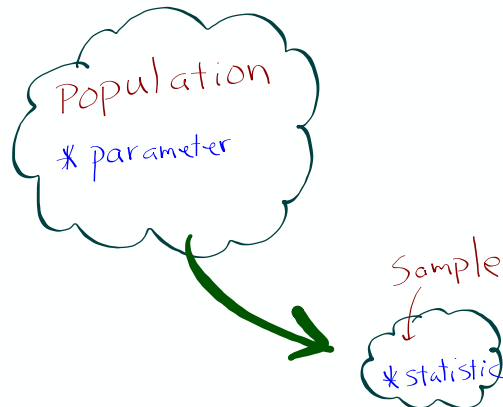
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The population is all the cars produced on a given day in this factory. The sample is the 25 cars selected from the assembly line.

(b) A politician uses a Twitter poll to find out whether his followers agree with a recent bill that was passed and 432 people respond to the poll.

The population is all the politician's Twitter followers.

The sample is the 432 people who responded.



3. A **sample survey** is a Study that collects data from a Sample that is chosen to represent a specific population.

4. *Beyoncé* was one of the main three members of the group, Des'ny's Child. In fact, it is known that she wrote just about all of their songs. When she went out on her own, she wrote a song called "Crazy in Love". However, some people questioned whether or not she truly had written the lyrics for "Crazy In Love". Did *Beyoncé* really write the lyrics, like she claimed, for her hit song "Crazy In Love"?

Did she really write it?

After all, she had written 7 or 8 #1 songs with Destiny's child.

So how can we use statistics to determine if she wrote the lyrics?

It is well known that different authors use different styles and word choice. It turns out that the average word choice for each author is pretty consistent. So let's analyze hers.

So get ready...



You have 20 seconds  
to circle any  
5 words

**Lesson 4.1: What's the average word length of a Beyoncé song?**

**BEYONCÉ**

CRAZY IN LOVE

A. Quickly circle a random sample of 5 words. Write them below. How many letters in each word?

B. What is the average word length of your sample?

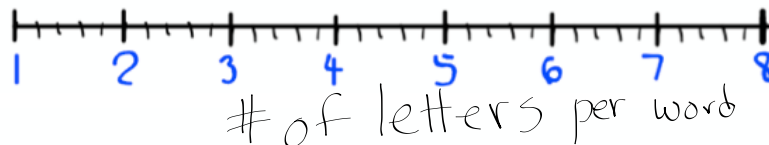
\_\_\_\_\_.



round to  
nearest 0.2

ie... 2.0 2.2 2.4 etc

C. Put your average on the dotplot on the white board at the front of the room. Copy the class dotplot below.



D. What does the dot plot represent? (we'll answer this together)

a sample of 5 words and an average from that sample

what does a dot represent?

A sample of 5 words and an average from that sample.

E. Find a **new sample** of 5 words using a **random number generator**. Put your average on the dotplot on the white board at the front of the room. Copy the class dotplot below.



### SEEDING THE RANDOM NUMBER GENERATOR

Your calculator generates random numbers from a massive list of digits arranged in a list. Here is the cool part. You can pick where in the list you want your calculator to start generating random numbers. It is called seeding your random number.

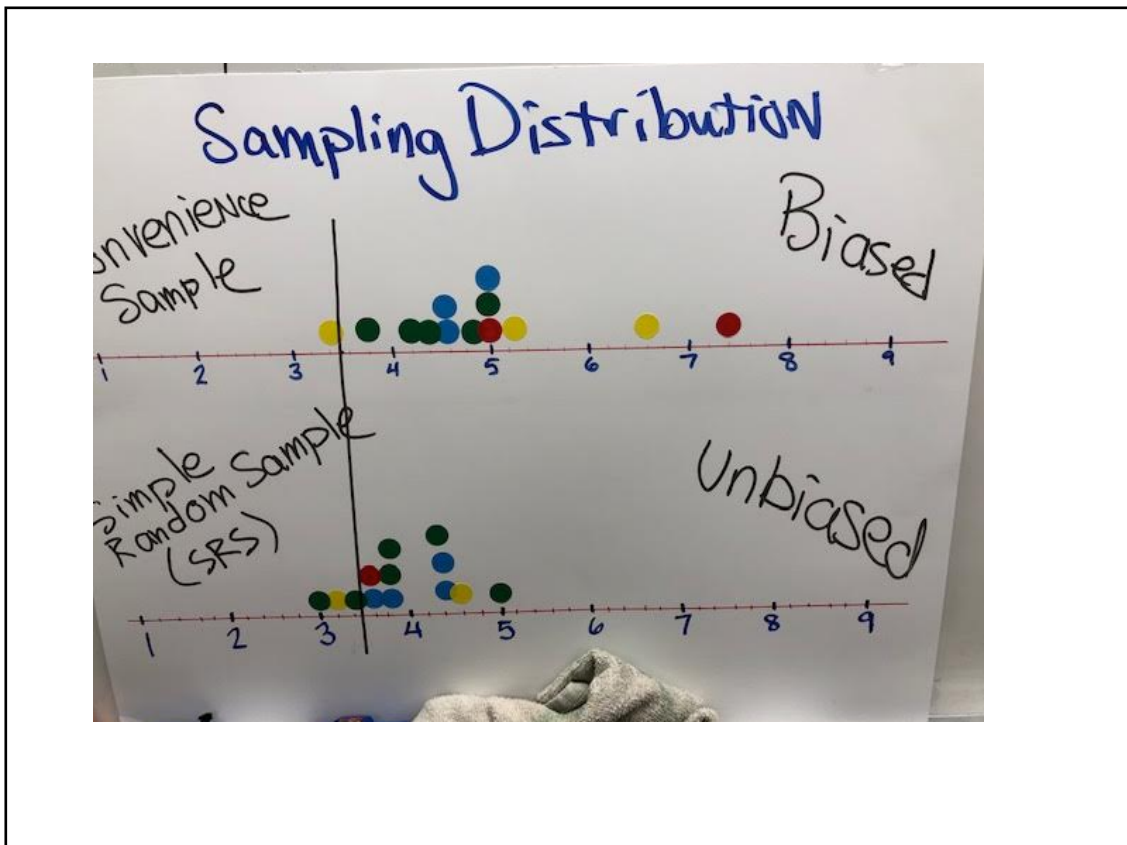
- 1 Enter the number you are using to seed your calculator.  
**16286**. Of course, you could use any real number to seed your calculator.
- 2 Press  
[STO▶]
- 3 To insert the rand command, press  
[MATH][◀][◀][ENTER]
- 4 Press [ENTER] to seed your calculator.  
See the first line in the second screen. *rand*

After seeding:  $\text{randInt}(1, 297)$

F. How is the dotplot from C different than the dotplot for D?  
Which do you think is a better estimator of the true mean word length?

G. What do you think the true mean word length is for "Crazy in Love"?

| 3.53



H. It is known that Beyonce wrote the lyrics for all of the *Destiny's Child* songs. The average word length for these songs is 3.5 letters. Based on your samples, do you have good evidence that Beyonce did not write the lyrics for "Crazy in Love". Explain.

3.64

### How to Sample Badly.

- Choosing individuals from the population who are easy to reach results in a \_\_\_\_\_
- The design of a statistical study shows \_\_\_\_\_ if it is very likely to underestimate or very likely to overestimate the value you want to know.
- **Volunteer response sampling** allows people to \_\_\_\_\_ the sample by responding to a general invitation.

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#### CAUTION:

Convenience sampling  
often produces  
unrepresentative data.

### How to Sample Badly.

- Choosing individuals from the population who are easy to reach results in a Convenience Sample
- The design of a statistical study shows bias if it is very likely to underestimate or very likely to overestimate the value you want to know.
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#### CAUTION:

Bias is not just bad luck in one sample.



**CAUTION:**

Bias is not just bad luck in one sample.

Convenience sampling will almost result in bias but so can other methods.

**How to Sample Badly.**

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- The design of a statistical study shows bias if it is very likely to underestimate or very likely to overestimate the value you want to know.
- **Volunteer response sampling** allows people to choose to be in the sample by responding to a general invitation.



Most Internet polls, along with call-in, text-in, and write-in polls, rely on voluntary response sampling. *People who self-select to participate in such surveys are usually not representative of some larger population of interest.*

American Idol

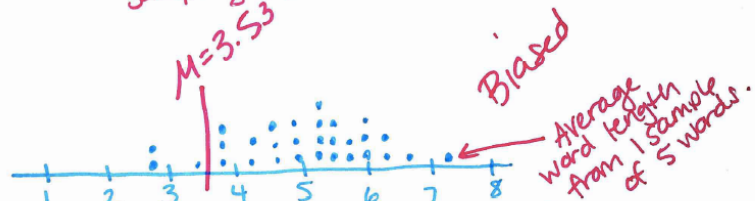
Recap  
Activity

# Samples from another class

3. Put your average on the dotplot on the white board at the front of the room. Copy the class dotplot below.

*Convenience Sample*

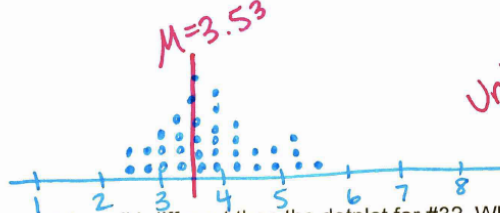
*Sampling Distribution*



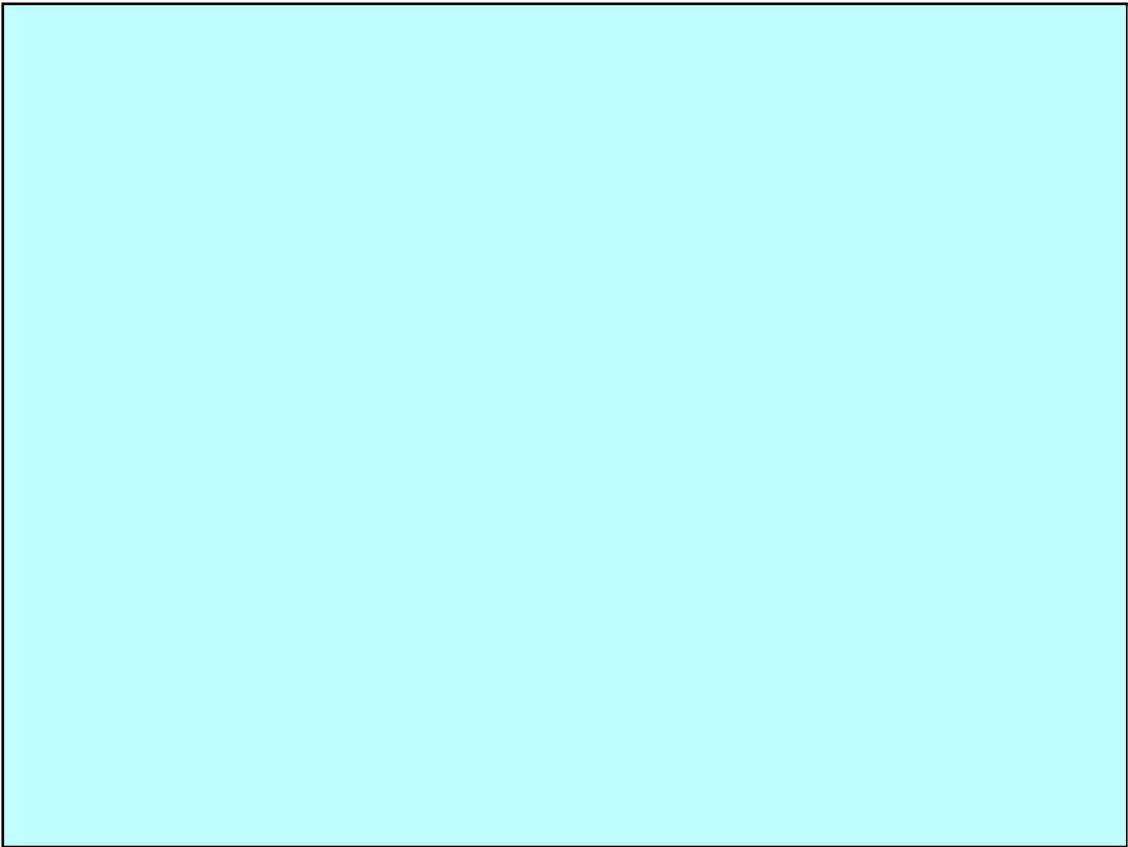
4. Find a new sample of 5 words using a random number generator. Put your average on the dotplot on the white board at the front of the room. Copy the class dotplot below.

*Simple Random Sample (SRS)*

*M=3.53*



5. How is the dotplot from #4 different than the dotplot for #3? Which do you think is a



**6. What is the average GPA? *Biased sampling methods***

An AP<sup>®</sup> Statistics teacher was curious about the average grade point average (GPA) of students at his school. He used the 32 students in his second-period AP<sup>®</sup> Statistics class as a sample and concluded that the average GPA of students at his school is about 3.85.

What type of sampling did the teacher use? Explain how bias in this sampling method could have affected the results.

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Convenience Sampling - The 2<sup>nd</sup> period class was an easy way to collect data. Because it was an Advanced Placement class, they are probably more dedicated to their schoolwork than the general population overall, and thus are more likely to have a higher GPA. 1

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**Convenience Sampling** - The 2<sup>nd</sup> period class was an easy way to collect data. Because it was an Advanced Placement class, they are probably more dedicated to their schoolwork than the general population overall, and thus are more likely to have a higher GPA. The GPA from the sample is likely to be greater than the average GPA of all students.

**Tip**

refer to Sampling method as "showing bias"

rather than the results as "showing bias."

### How to Sample Well

A sample chosen by chance rules out both favoritism by the sampler and self-selection by respondents.

**Random Sampling** involves using a \_\_\_\_\_ process to determine which members of a population are included in the sample.

A **simple random sample (SRS)** of size,  $n$ , is chosen in such a way that every group of  $n$  individuals in the population has an \_\_\_\_\_ chance to be selected as the sample.

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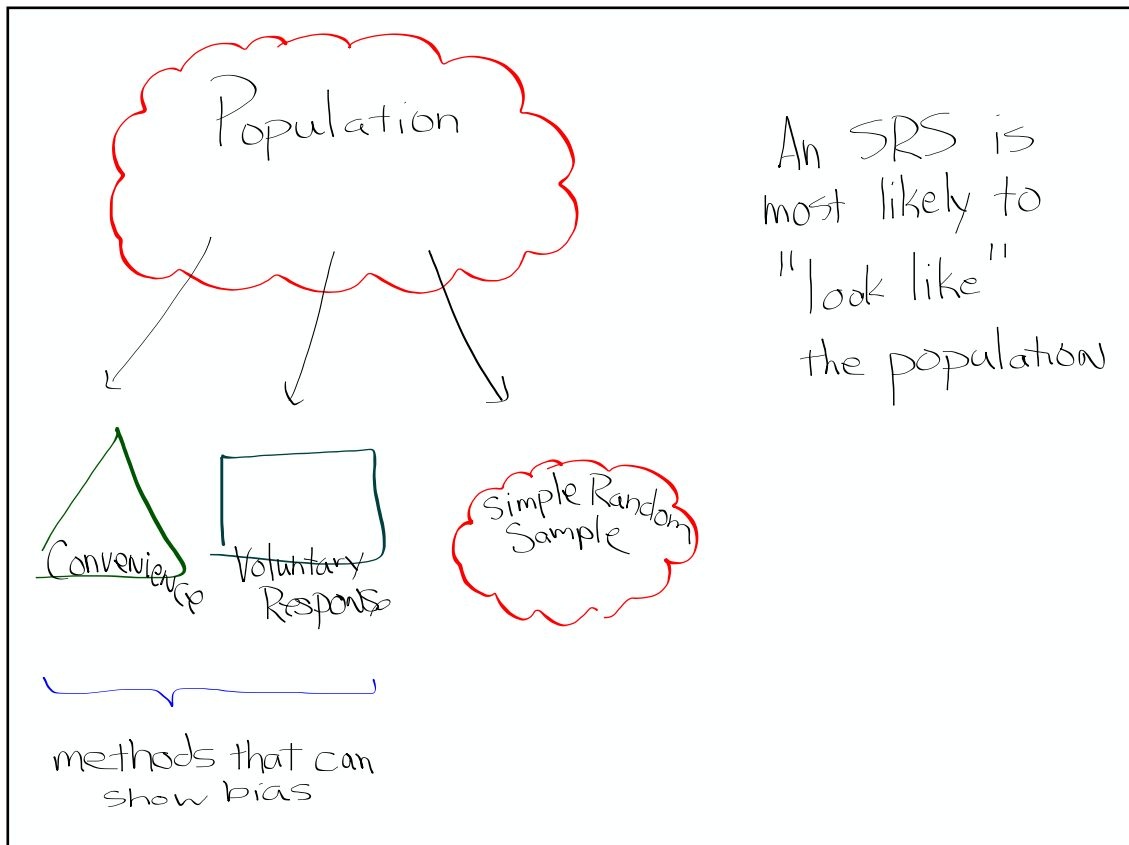
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## How to Choose an SRS

### How to Choose an SRS with Technology


- **Label.** Give each individual in the population a distinct numerical label from 1 to  $N$ , where  $N$  is the number of individuals in the population.

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random.org  
or TI-84



# How to Choose an SRS

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- **Select.** Choose the individuals that correspond to the randomly selected integers.

## How to Choose an SRS with Table D

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JUST  
Watch

Use line 130 of Table D to choose an SRS of 4 hotels.

- |                 |                 |               |                      |
|-----------------|-----------------|---------------|----------------------|
| 01 Aloha Kai    | 08 Captiva      | 15 Palm Tree  | 22 Sea Shell         |
| 02 Anchor Down  | 09 Casa del Mar | 16 Radisson   | 23 Silver Beach      |
| 03 Banana Bay   | 10 Coconuts     | 17 Ramada     | 24 Sunset Beach      |
| 04 Banyan Tree  | 11 Diplomat     | 18 Sandpiper  | 25 <u>Tradewinds</u> |
| 05 Beach Castle | 12 Holiday Inn  | 19 Sea Castle | 26 Tropical Breeze   |
| 06 Best Western | 13 Lime Tree    | 20 Sea Club   | 27 Tropical Shores   |
| 07 Cabana       | 14 Outrigger    | 21 Sea Grape  | 28 Veranda           |

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**69051 64817 87174 09517 84534 06489 87201 97245**

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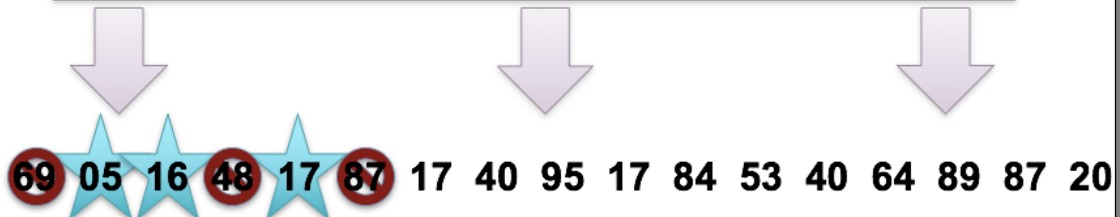
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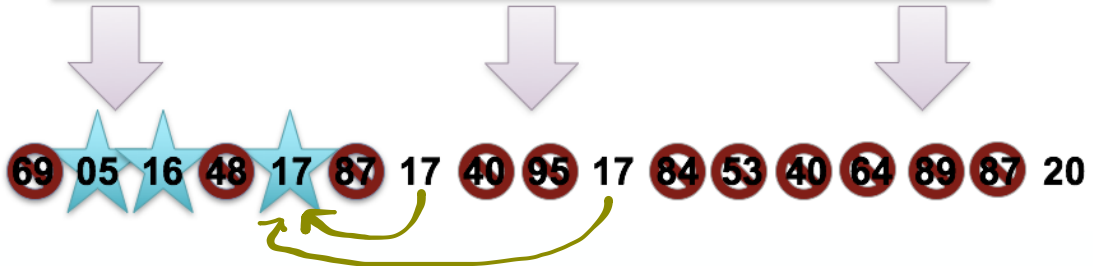
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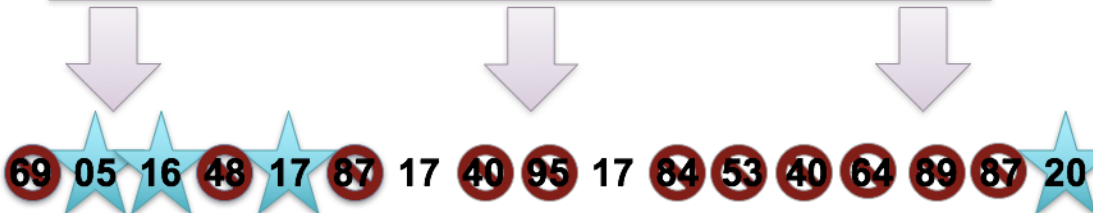
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Our SRS of 4 hotels is:  
 05 Beach Castle, 16 Radisson, 17 Ramada, and 20 Sea Club.

AP tip

TABLE D is not a universal designation

Use "Table of Random Values".



Let's do #7  
together

**7. Good news - Choosing an SRS with Table D**

To promote positive classroom culture, Mr. Wilcox often asks his students to share “Good News.” Because he doesn’t have time to let every student share each day, he takes a sample of students who will share.

(a) Describe how to use a random number generator to select an SRS of 5 students from the following list of 29 students.

Allison	Amarl	Benjamin
Danijal	Kevin D.	Kevin H.
Damarlo	Emiley	Kayla
Tessa	Geneva	Micaela
Gabe L.	Anh	Sean
Kirah	Thai	Harrison
Turner	Bernard	Daejynae
Brandon	Jarrod	Kim
Emily	Jenny	Jackelyn
Gabe Y.	Luz	

Correspond to this page

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(a) Describe how to use a random number generator to select an SRS of 5 students from the following list of 29 students.

Allison	Amari	Benjamin
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Tessa	Geneva	Micaela
Gabe L.	Anh	Sean
Kirah	Thai	Harrison
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1) Label the students 1 to 29 in the order that they are written. (across rows).

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1) Label the students 1 to 29 in the order that they are written. (across rows).

2) Use a random number generator to obtain 5 different integers from 1 to 29 (ignore repeats).

3) Choose the students who correspond to the integers

AP  
TIP

Many students forget to address what to do with repeated numbers.

(b) The random number generator at [www.random.org](http://www.random.org) was used to get the following random integers between 1 and 29. Use these integers to choose the sample.

for example: ●

4 14 21 19 14 12 25 2

The 5 students are: ●

4	Danijal
14	Anh
21	Daejynae
19	Turner
12	Micala

Move on to the  
Check Your Understanding.

1. In June 2008 *Parade* magazine posed the following question: "Should drivers be banned from using all cell phones?" Readers were encouraged to vote online at [www.parade.com](http://www.parade.com). The July 13, 2008, issue of *Parade* reported the results: 2407 (85%) said "Yes" and 410 (15%) said "No."
  - a. What type of sample did the *Parade* survey obtain?
  
  
  
  
  
  
  
  
  
  
  - b. Explain why this sampling method is biased.
  
  
  
  
  
  
  
  
  
  
  - c. Is 85% likely to be greater than or less than the percentage of all adults who believe that cell-phone use while driving should be banned? Why?

1. In June 2008 *Parade* magazine posed the following question: "Should drivers be banned from using all cell phones?" Readers were encouraged to vote online at [www.parade.com](http://www.parade.com). The July 13, 2008, issue of *Parade* reported the results: 2407 (85%) said "Yes" and 410 (15%) said "No."

a. What type of sample did the *Parade* survey obtain?

Voluntary response

b. Explain why this sampling method is biased.

Only people who are very passionate about the ban will call in. They don't represent the population.

c. Is 85% likely to be greater than or less than the percentage of all adults who believe that cell-phone use while driving should be banned? Why?

Likely greater because people who call in feel strongly that they should be banned. People who don't care wouldn't call.

2. To help eliminate bias, a reporter from *Parade* decides she will go out and ask people in person if they think drivers should be banned from using cell phones. She lives close to the local high school so she goes to the parking lot at 3:00 pm and asks the first 100 people she sees.

a. What type of sample did the reporter obtain?

convenience sample

b. Explain why this sampling method is biased.

The sample doesn't represent the population. Most of the people she talks to are probably students.

3. How could *Parade* magazine avoid the bias described above?

They should have done a simple random sample from the population.

# 4.1 .....1, 3, 5, 7, 11, 13, 15

and study.... pp 220-227

"My AP"  
assignment  
during Ch. 4

Unit 1 Progress Check: MCQ Part B

Unit 1 Progress Check: FRQ  
(turn in hard copy)

finish by  
Sunday  
Oct. 27

both will go in the  
LCQ category