



Welcome  
to  
Trimester  
2

Pick Up the Warm Up

**Identify the population, parameter, sample, and statistic in each of the following settings.**

- (a) A high school student was interested in finding the mean annual tuition at a 4-year U.S. college. The student randomly selected 23 U.S. colleges and found a mean annual tuition of \$19,800.

Population:

Parameter:

Sample:

Statistic:

Identify the population, parameter, sample, and statistic in each of the following settings.

- (a) A high school student was interested in finding the mean annual tuition at a 4-year U.S. college. The student randomly selected 23 U.S. colleges and found a mean annual tuition of \$19,800.

Population: All 4-year U.S. Colleges

Parameter:  $\mu =$  mean annual tuition

Sample: The 23 selected colleges

Statistic:  $\bar{x} =$  the mean annual tuition in the sample = \$19,800

#### AP® Exam Tip

Many students lose credit on the AP® Statistics exam when defining parameters because their description refers to the sample instead of the population or because the description isn't clear about which group of individuals the parameter is describing. When defining a parameter, we suggest including the word **all** or the word **true** in your description to make it clear that you aren't referring to a sample statistic.

Identify the population, parameter, sample, and statistic in each of the following settings.

- (a) A high school student was interested in finding the mean annual tuition at a 4-year U.S. college. The student randomly selected 23 U.S. colleges and found a mean annual tuition of \$19,800.

Population: All 4-year U.S. Colleges

Parameter:  $\mu = \overset{\text{true}}{\wedge}$  mean annual tuition

Sample: The 23 selected colleges

Statistic:  $\bar{x} =$  the mean annual tuition in the sample = \$19,800

- (b) During World War II, the United States captured several tanks from the German army. Based on the serial numbers on the tanks, statisticians estimated that the German army produced 7168 tanks during the war.

Population:

Parameter:

Sample:

Statistic:

- (b) During World War II, the United States captured several tanks from the German army. Based on the serial numbers on the tanks, statisticians estimated that the German army produced 7168 tanks during the war.

Population: All German tanks produced during WWII.

Parameter: The true total # of German tanks.

Sample: The several captured tanks.

Statistic: The estimated total number of German tanks based on the sample  
= 7168

## about Trimester #2

Ch 7 to 11, and 12

← already did 12.2

There may be, or may not be, a project.

Start AP Exam Review the last two weeks of Tri 2

There may be a Final (cumulative) exam.

Plan for review after Trimester 2 ends

Once again, I will drop 1/3 of LCQ scores.

I am concerned about "taking a chapter off" that may come with allowing one Test to be dropped.

However, I have decided to allow it, BUT, it will come with some strings attached.

- You should strive to do your HW as you do your classwork as far as level of detail. You get good at what you practice.
- Try to use good notation.
- It should not just be a copy of the answers in the back of the book.

purpose of Personal Progress Checks

to help with **review** and **retention**

Each chapter there will be a set assigned.

They will go in the LCQ category.

Personal Project Check (PPC) assignments

-MCQ (probably around 10 to 12 questions assigned)

-FRQ - printed out and handed in.

**-I recommend you use your notes. (text if needed)**

-Generally Due before the next Ch. Starts, but I don't recommend you wait to start the very night you take a test.

-An Additional PPC could be assigned if there is a snow day.

**Unit 2 - MCQ A**

**Unit 2 - MCQ B**

**Unit 2 - FRQ #1 and #2**

**-Each will count in the LCQ category, separately.**

**-Due before the next Ch. Starts.**

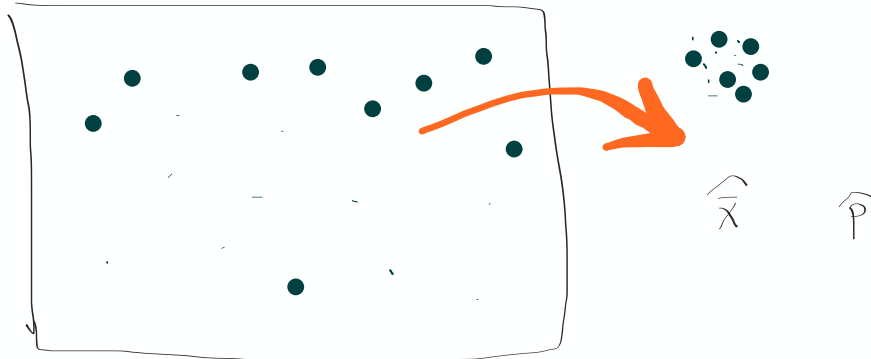
### The Big Picture: Where Chapter 7 Fits

Chapters 5 to 7 cover much of AP Statistics Topic Outline III: Anticipating Patterns: Exploring random phenomena using probability and simulations.

Chapter 5      Probability: What Are the Chances?

Chapter 6      Random Variables

Chapter 7      Sampling Distributions



ESSENTIAL QUESTIONS *How far will our estimates typically vary from the truth? What values of a statistic should be considered unusual?*

## PACING

7.1	What is a Sampling Distribution?	2 days
7.2	Sample Proportions	2 days
10.1		
	Extra Cumulative Review Day	1 day
7.3	Sample Means	3 days
10.2		
	Review, FRAPPY, and Test	2 days
		<hr/> 10 days



Next Test

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Mon. Dec 16<sup>th</sup>

From a huge population of  
PENNIES

A person selects a penny, looks at  
the date, records the age, and puts  
the penny back.

This is repeated over and over  
for days.

We'll peek in on some data  
from another class.

from data taken  
over  $\lambda$  <sup>max</sup> weeks



skewed right  
range is abo

Gives us an idea of the Distribution of the Population.



skewed right  
range is ab

Population distribution  
of age of penny

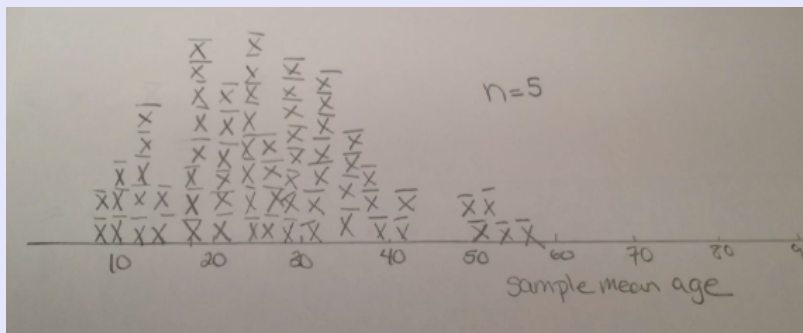
What if we don't have that  
kind of time?

2

## So we look at a Sampling Distribution

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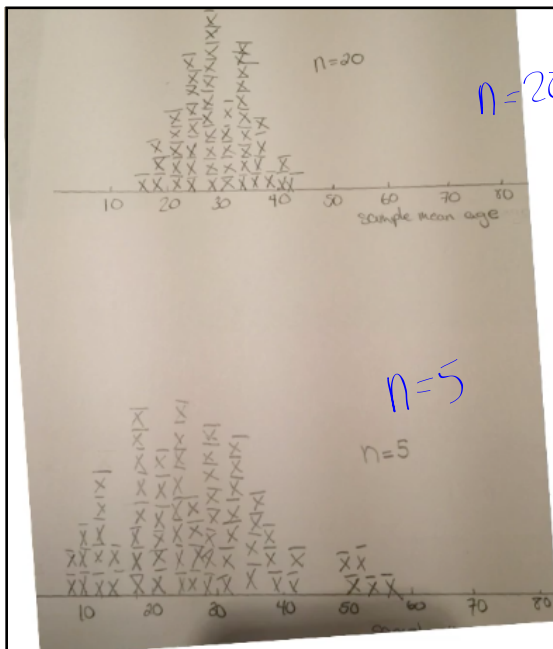
Each person selects a SRS  
of 5 pennies, finds the average  
age,  $\bar{x}$ , plots  $\bar{x}$ .  
(Returns the pennies.)



Simulated Sampling Distribution  
of  $\bar{x}$  ↪ of the sample means

Next each person selects an  
SRS of 20 pennies,  
finds the sample mean,  $\bar{x}$ .

$$n=20$$



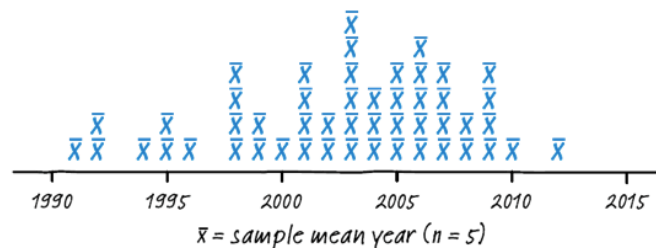
- ✓ All three distributions have the same center.
- ✓ The simulated sampling distributions have a smaller spread than the population distribution.
- ✓ As the sample size increases the variability decreases.
- ✓ The shape of the sampling distribution is still skewed right when  $n = 5$ , but less so when  $n = 20$ .

**Sampling variability** refers to the fact that different random samples of the same size from the same population produce different values for a statistic.



Sampling  
Distributions

**Sampling variability** refers to the fact that different random samples of the same size from the same population produce different values for a statistic.



The **sampling distribution** of a statistic is the distribution of values taken by the statistic in all possible samples of the same size from the same population.

A goal is for you to be able to anticipate the shape, center, and variability of a sampling distribution w/o doing a simulation.

### Lesson 7.1: Day 1: What was the average for the Chapter 6 test?



How did the Chapter 6 test go? Today, we will be taking a **sample** from a **population**. We will use the average from the **sample** to estimate the average for the **population**.

Let's start with a very simple example. My 5<sup>th</sup> hour is very small. There were only 4 people who took the chapter 6 test. Their scores were: 60 70 80 90.

1. Make a dotplot of the population distribution.

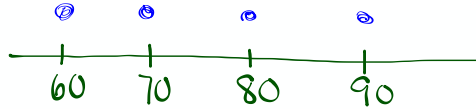
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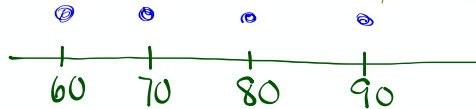
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1. Make a dotplot of the population distribution.

*shows all individuals*

*1 individual with a score of 90*





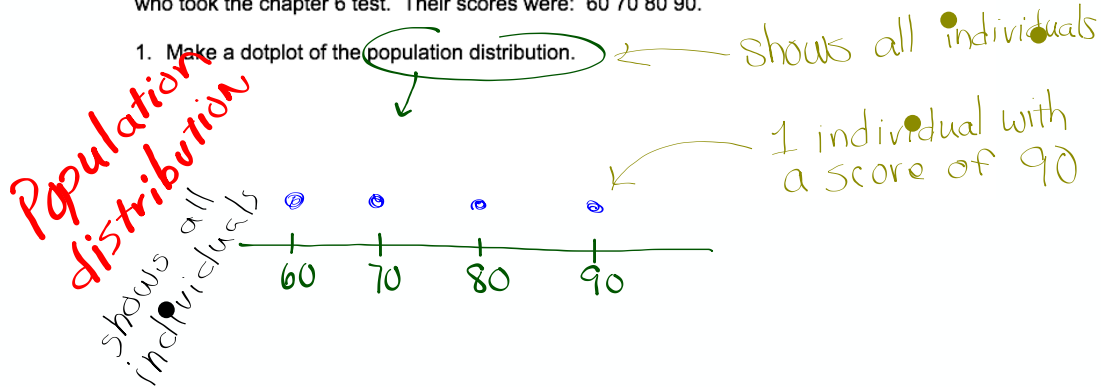
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1. Make a dotplot of the population distribution.



$$\mu = \bar{x} =$$

2. Take a sample of any 2 of the scores. Find the mean of your sample.

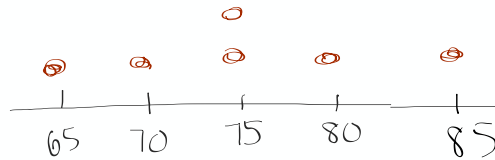
for example 60 and 70  $\bar{x} = \frac{60+70}{2} = 65$   
↑ sample mean

3. Figure out all of the possible samples of size 2. Calculate a sample mean for each sample of 2.

60, 70	$\bar{x} = 65$	70, 80	$\bar{x} = 75$
60, 80	$\bar{x} = 70$	70, 90	$\bar{x} = 80$
60, 90	$\bar{x} = 75$	80, 90	$\bar{x} = 85$

4. Make a dotplot using each of the means you found in #3.

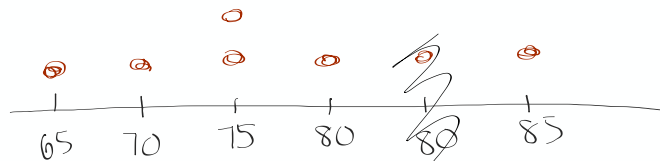
## Sampling Distribution of $\bar{x}$



5. What is the mean of the population? Label this on the dotplot above.

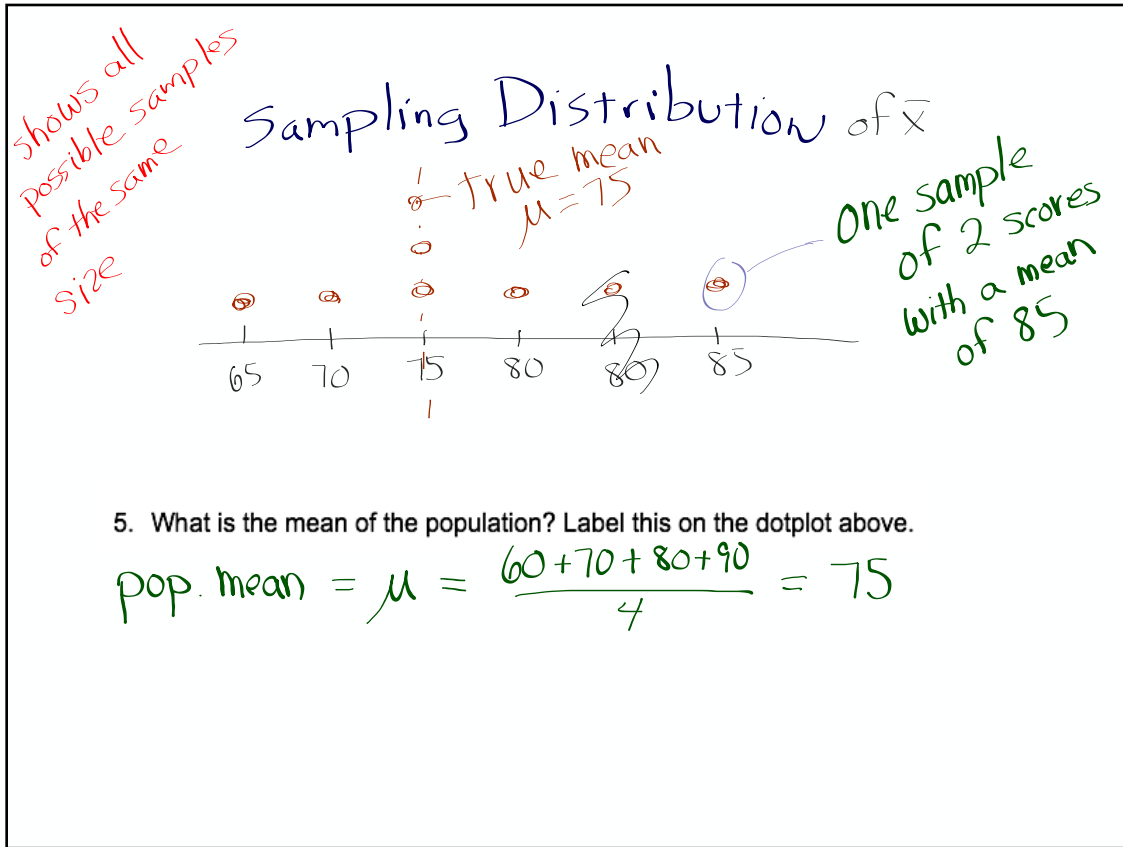
*shows all possible samples of the same size of 2*

## Sampling Distribution of $\bar{x}$



5. What is the mean of the population? Label this on the dotplot above.

$$\text{pop. mean} = \mu = \frac{60+70+80+90}{4} = 75$$



### What is a Sampling Distribution?

Important ideas:

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PARAMETERS & STATISTICS

Sampling Distribution

### What is a Sampling Distribution?

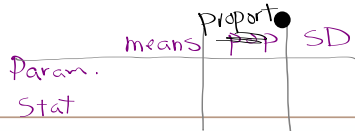
Important ideas:

PARAMETERS & STATISTICS

Sampling Distribution

STATISTIC • Number that describes a sample.

Parameter • Number that describes a pop.



## What is a Sampling Distribution?

Important ideas:

### PARAMETERS & STATISTICS

**STATISTIC** • Number that describes a sample.

**Parameter** • Number that describes a pop.

	means	pop	SD
Param.	$\mu$	$\rho$	$\sigma$
Stat	$\bar{x}$	$\hat{\rho}$	$S$

**Sampling Distribution**  
- Shows that statistic found in all possible samples of size  $n$



diff from Population Distrib shows all individuals

### AP® Exam Tip

**Terminology matters.** Never just say “the distribution.” Always say “the distribution of [blank],” being careful to distinguish the **distribution of the population**, the **distribution of sample data**, and the **sampling distribution of a statistic**.

Likewise, don't use ambiguous terms like "**sample distribution**," which could refer to the **distribution of sample data** or to the sampling distribution of a statistic. You will lose credit on free response questions for misusing statistical terms.

The \_\_\_\_\_ distribution gives the values of the variable for \_\_\_\_ individuals in the population.

The distribution of \_\_\_\_\_ shows the values of the variable for the individuals in a sample.

The \_\_\_\_\_ distribution of the sample proportion displays the values of  $\hat{p}$  from all possible samples of the same size.

The Population distribution gives the values of the variable for All individuals in the population.

The distribution of a sample shows the values of the variable for the individuals in a sample.

The Sampling distribution of the sample proportion displays the values of  $\hat{p}$  from all possible samples of the same size.

**HOMEWORK:** To determine how much homework time students will get in class, Mrs. Lin has a student select an SRS of 20 chips from a large bag. The number of red chips in the SRS determines the number of minutes in class students get to work on homework. Mrs. Lin claims that there are 200 chips in the bag and that 100 of them are red. When Jenna selected a random sample of 20 chips from the bag (without looking), she got 7 red chips. Does this provide convincing evidence that less than half of the chips in the bag are red?

1. Identify the population, parameter, sample and statistic.

Population: 200 chips Parameter:  $P$

Sample: 20 chips Statistic:  $\hat{p}$

2. What is the evidence that less than half of the chips in the bag are red?

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1. Identify the population, parameter, sample and statistic.

Population: 200 chips Parameter:  $p = \frac{100}{200} = 0.5$   
 Sample: 20 randomly chosen chips Statistic:  $\hat{p} = \frac{7}{20} = 0.35$  ←

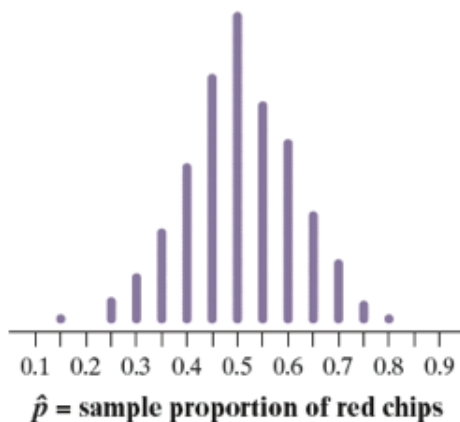
2. What is the evidence that less than half of the chips in the bag are red?

The sample had only 7 of 20 chips (35%) that were red. This is less than 50%.

3. Provide two explanations for the evidence described in part (a).

- (A) We got 35% by chance  
 (B) There are less than 50% red chips in the bag.

We used technology to simulate choosing 500 SRSs of size  $n = 20$  from a population of 200 chips, 100 red and 100 blue. The dotplot shows  $\hat{p}$  = the sample proportion of red chips for each of the 500 samples.



Is this... ●●●

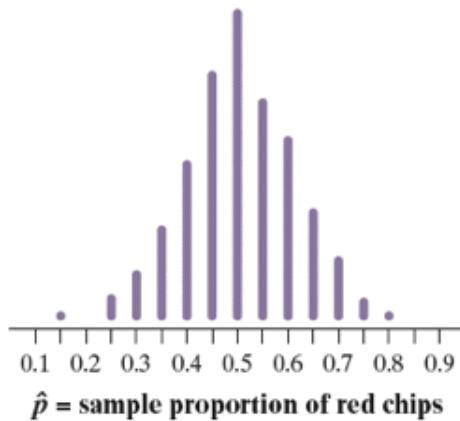
Population Distrib.?

Distrib. of a sample?

Sampling Distrib.?



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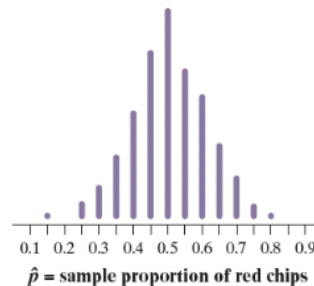
→ Distrib. of a sample?

Sampling Distrib.?

↑  
doesn't include  
all possible samples  
of size  $n=20$

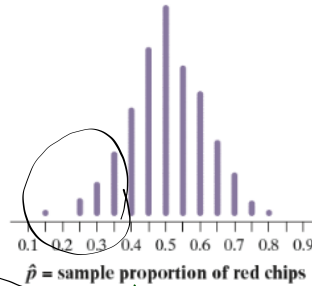
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4. There is one dot on the graph at 0.80.  
Explain what this value represents.



5. Would it be surprising to get a sample proportion of  $\hat{p} = 7/20 = 0.35$  or smaller in an SRS of size 20 when  $p = 0.5$ ? Justify your answer. (Since the graph is hard to read, assume that there are 55 values that are less than 35%)

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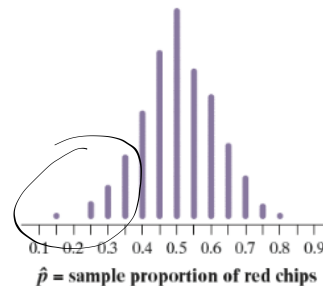
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One sample of 20 chips that contained 16 red chips (80% of 20)

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$$55/500 = 0.11$$

11% is not that unusual  
so it is not a surprise.

6. Based on your previous answers, is there convincing evidence that less than half of the chips in the large bag are red? Explain your reasoning.

6. Based on your previous answers, is there convincing evidence that less than half of the chips in the large bag are red? Explain your reasoning.

No. There is a large enough chance (11%) that we get a sample proportion of 0.35 purely by chance.  
( > 5% )

See your  
Ch. 6  
Test

When calculating  
probabilities

$$p(X=5) = \text{binom pdf} \left( \overset{17}{n}, \overset{1/6}{p}, \overset{5}{k} \right)$$

Need this  
descriptor

E  
↑  
tiny

**7.1** ..... 1-9 (odds), 32 Study pp. 442-447

## **Personal Project Check (PPC) assignments**

Unit 2 - MCQ A

Unit 2 - MCQ B

Unit 2 - FRQ #1 and #2

79.4  
79.5 80

Each will count in LCQ category  
due before Ch. 8 Starts.

### **AP Statistics - Period 1 AP Stats**

Share this code so students can sign in and enroll in this section.

**GW2ZAR**

<https://myap.collegeboard.org/>

## AP Statistics - Period 5 AP Stats

Share this code so students can sign in and enroll in this section.

**34V2PQ**

<https://myap.collegeboard.org/>