Learning Outcomes: During the session, participants will
- Participate in several classroom-tested, hands-on activities that illustrate the logic of statistical inference.
- Discuss how to incorporate these activities in their Statistics or Algebra 2/Math 3 course.
- Learn how to use technology to enhance hands-on simulations.

Activity 1: Hiring Discrimination   *Adapted from The Practice of Statistics 6e*

An airline has just finished training 25 pilots—15 male and 10 female—to become captains. Unfortunately, only eight captain positions are available right now. Airline managers announce that they will use a lottery to determine which pilots will fill the available positions. The names of all 25 pilots will be written on identical slips of paper, placed in a hat, mixed thoroughly, and drawn out one at a time until all eight captains have been identified. A day later, managers announce the results of the lottery. Of the 8 captains chosen, 5 are female and 3 are male. Some of the male pilots who weren't selected suspect that the lottery was not carried out fairly. Do these results provide *convincing* evidence of discrimination?

Activity 1: Hiring Discrimination

What is the evidence of discrimination?

- In the population, only 10/25 = 40% were female.
- In the sample chosen, 5/8 = 62.5% were female.
- 62.5% > 40%

Activity 1: Hiring Discrimination

What are the two explanations for this evidence?

1. There was no discrimination and the higher-than-expected number of females happened by chance alone.
2. There was discrimination against the male pilots.

Activity 1: Hiring Discrimination

How can we determine if the evidence of discrimination is convincing?

- Evaluate Explanation #1 by estimating how likely it is to get the observed results by chance alone, assuming no discrimination.
- Start with physical simulation (beads), finish with technology (Fathom)
- Here are the results of 50 trials:
- Because it is plausible to get 5 or women by chance alone, there is not convincing evidence of discrimination.
- What would be convincing evidence?
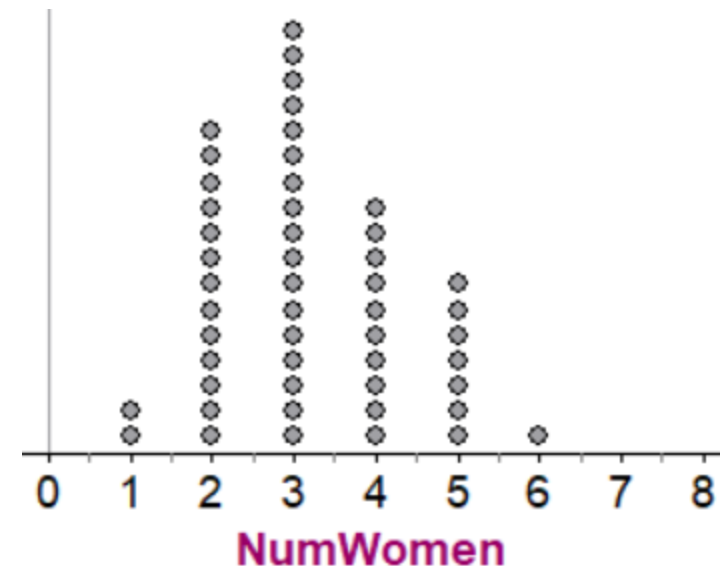
Activity 2: Is Steph Curry a Streaky Shooter? *Adapted from Statistical Reasoning in Sports 2e*

Steph Curry is an NBA Most Valuable Player and three-time NBA champion. He is most famous for his ability to shoot, often having streaks of several made shots in a row. Does being a good shooter mean he is a streaky shooter as well? Or, are the outcomes of his shots independent, meaning that his ability to make a shot isn't affected by the outcome of his previous shot?

Activity 2: Is Steph Curry a Streaky Shooter?

Here are the outcomes—in order—of each of Curry's 23 shots in a recent game, where Y represents a made shot and N represents a missed shot. Do these data provide *convincing* evidence that Curry was a streaky shooter in this game?

YYY N YYY NN Y NNNN Y N YY NN YYY

What is the evidence of streakiness? How can we measure streakiness?

- Most of his shots were part of streaks
- Count the number of streaks of 1 or more in a row (Curry had 11)
- A **smaller** number of streaks in a fixed number of shots is **stronger** evidence for streakiness.
  - YYYY NNNN (2 streaks) is streakier than Y N Y N Y N Y N (8 streaks)

Activity 2: Is Steph Curry a Streaky Shooter?

What are the two explanations for this evidence?

1. Curry was not a streaky shooter and the smaller-than-expected number of streaks happened by chance alone.
2. Curry is a streaky shooter.

Activity 2: Is Steph Curry a Streaky Shooter?

How can we determine if the evidence is convincing?

- Evaluate Explanation #1 by estimating how likely it is to get the observed results by chance alone, assuming he's not streaky.
- Start with physical simulation (spinner):
- Finish with technology (www.stapplet.com)
- Here are the results of 50 trials:

Simulated number of streaks

Missed shot 43.5%

Made shot 56.5%
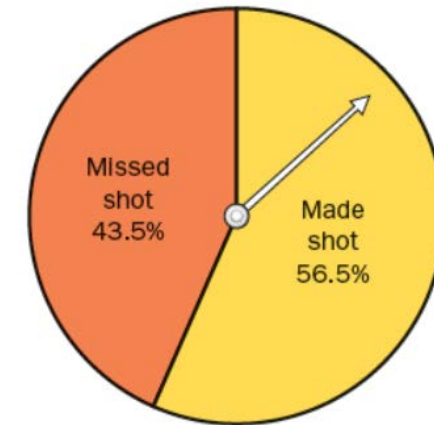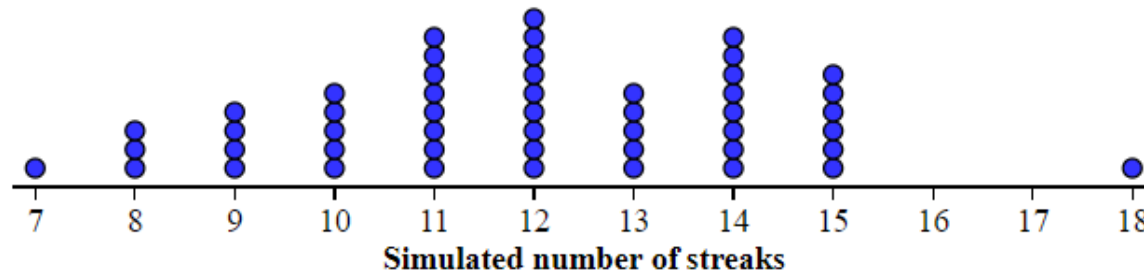
- Because 11 or fewer streaks could happen by chance alone, there is not convincing evidence that Curry was a streaky shooter.

Activity 3: Is there a Home-Field Advantage in the NFL? *Adapted from Statistical Reasoning in Sports 2e*

Unfortunately for football fans outside of the Northeast, the New England Patriots are regularly one of the best teams in the league. But do they have a greater ABILITY to win at home than on the road? Here is a two-way table summarizing the PERFORMANCES of the Patriots in a recent season. Do these data provide *convincing* evidence that the Patriots had a greater ABILITY at home?

		Location		
		Home	Away	Total
Outcome	Win	7	5	12
	Loss	1	3	4
	Total	8	8	16

Activity 3: Is there a Home-Field Advantage in the NFL?

What is the evidence for a home-field advantage?

- Home: 7/8 = 87.5% wins
- Away: 5/8 = 62.5% wins
- Home – Away = 25 > 0

		Location		
		Home	Away	Total
Outcome	Win	7	5	12
	Loss	1	3	4
	Total	8	8	16

Activity 3: Is there a Home-Field Advantage in the NFL?

What are the two explanations for this evidence?

1. The Patriots had the same ability to win at home and away and the greater-than-expected difference in winning percentages happened by chance alone.
2. The Patriots had a greater ability to win at home.

Activity 3: Is there a Home-Field Advantage in the NFL?

How can we determine if the evidence is convincing?

- Evaluate Explanation #1 by estimating how likely it is to get the observed results by chance alone, assuming they had the same ability at home and away.

- Start with physical simulation (cards):

Win	Win	Win	Win
Win	Win	Win	Win
Win	Win	Win	Win
Loss	Loss	Loss	Loss

Shuffle →

Home

Win	Win
Win	Loss
Loss	Win
Loss	Win

Away

Win	Win
Win	Loss
Win	Win
Win	Win

- Finish with technology (www.stapplet.com)

Activity 3: Is there a Home-Field Advantage in the NFL?

How can we determine if the evidence is convincing?

- Finish with technology (www.stapplet.com).
- Here are the results of 50 trials:

Simulated difference in sample percentage
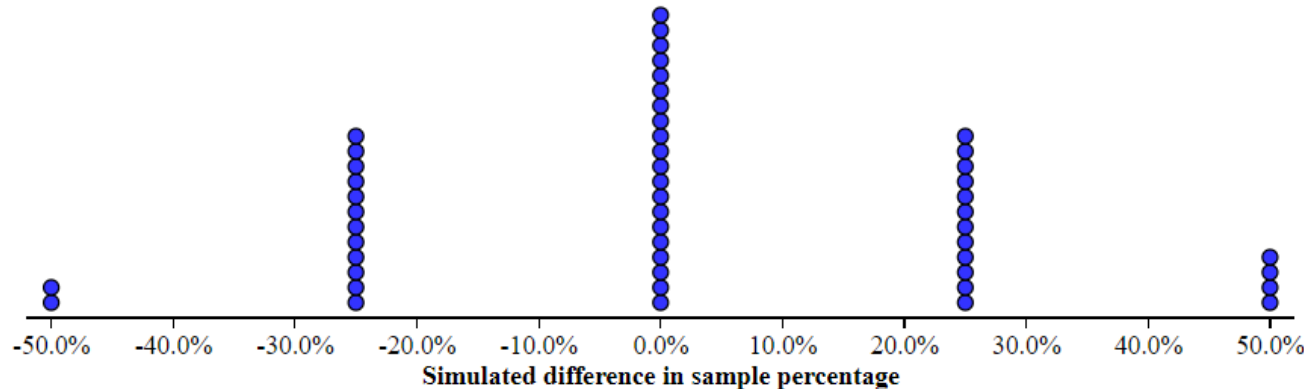
- Because a difference of 25 percentage points or more could happen by chance alone, there is not convincing evidence that the Patriots had a greater ability to win at home.

The Logic of Inference

1. Identify the claim being made
2. Identify evidence for the claim
3. Consider the two explanations for the evidence: nothing special is happening (the claim isn't true) and the observed result was due to chance alone OR something special is happening (the claim is true)
4. Perform a simulation to determine which outcomes are likely to happen by chance alone
5. Compare the observed result with what is likely to happen by chance alone
6. If the observed result would rarely happen by chance alone, there is convincing evidence that something special is happening (the claim is true)

QUESTIONS??

UPCOMING SESSIONS OF INTEREST

- 463.4 Promoting Success on the AP Exam with The Practice of Statistics, by Daren Starnes, Josh Tabor, Luke Wilcox
  - Friday, 1:30-2:30, 33 C

- 486 Connecting Statistics to the Algebra Classroom, by Doug Tyson
  - Friday 1:30-2:30, Sapphire AB Hilton Bayfront

- 515.4 Two Great Options for On-Level Statistics, by Daren Starnes and Josh Tabor
  - Friday, 3:00-4:00, 33 C

- 635.4 AP Statistics Panel Discussion, with Daren Starnes, Josh Tabor, Chris Olsen, and Stephanie Ogden from the College Board
  - Saturday, 9:30-10:30, 33 C