Pick Up The

WARM UP

and more candy

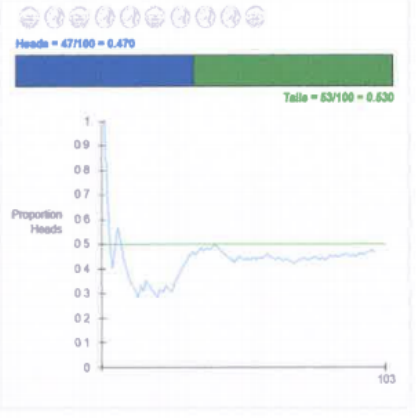
Happy November!

Proposal

Either turn in a hard copy by end of today or send me something by email by tonight.

1. If you toss a fair coin, what's the probability of getting "heads"? Why?

2. If you toss a thumbtack, what's the probability of it landing "point up"?



1. If you toss a fair coin, what's the probability of getting "heads"? Why? 50%.

Because if you toss a coin many many times, about 50% of the tosses will be heads.

2. If you toss a thumbtack, what's the probability of it landing "point up"? We don't know.

If we toss a thumbtack a very large number of times, then we can determine the long run relative frequency and thus, the probability.

Law of large numbers

vs

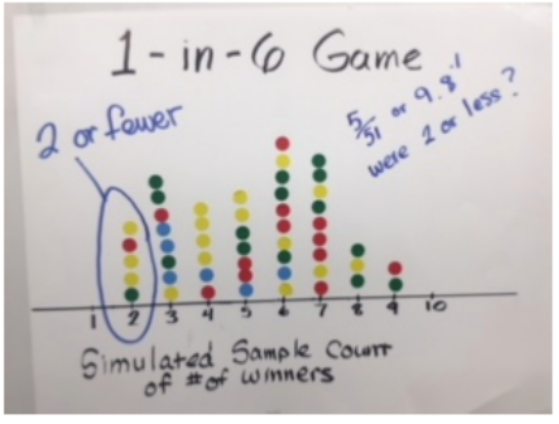
the mythical law of averages

Law of Large Numbers vs The Mythical law of averages
While there is a real theorem that a random variable will reflect its underlying probability over a very large sample (the **law of large numbers**), the **law of averages** typically assumes that unnatural short-term "balance" must occur. The **law of averages** is sometimes known as "**Gambler's Fallacy**".

3. Roll a die 12 times and record the result of each roll. Which of the following outcomes is more probable? 1 2 3 4 5 6 6 5 4 3 2 1 or 1 5 4 5 2 4 3 3 6 1 2 6 1 1 2 2 3 3 3 3 4 6

Both outcomes have the same chance of ocurring

4. Yesterday you did a simulation of the "1-in-6 Game" (20 oz bottles of soda where bottle caps indicated winners or losers, 30 students in the class bought a bottle to see if they were a winner. You rolled a die 30 times to simulate this. **The results:** Two of the thirty students got caps that were winners. Another class ran 51 trials and their dot plot is shown.



i. What did one single dot represent on the dot plot?

wins from 1 trial of 30 rolls

ii. We assume that the Soda company was telling the truth. Did that that class find statistically significant evidence that the company was lying?

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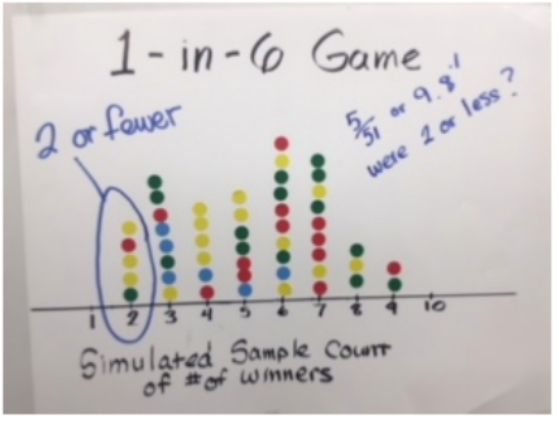

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The number of winners from one sample of 30 bottles.

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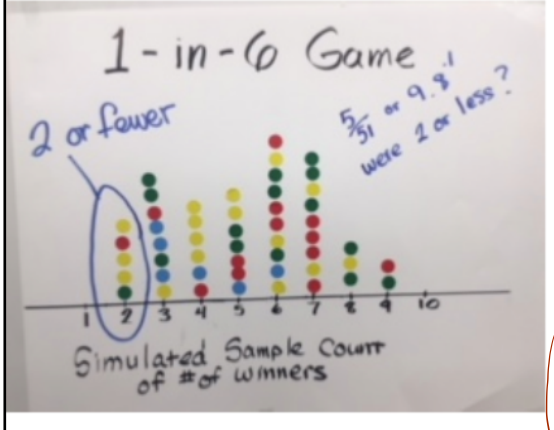

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The number of winners from one sample of 30 bottles.

ii. We assume that the Soda company was telling the truth. Did that that class find statistically significant evidence that the company was lying?

Above 5% → not statistically significant

≤ 5% → Statistically signif.

9.8% of the trials had 2 or fewer winners.

So there is not statistically significant evidence of lying.

AP Class Notes – 5.2 Day 2 – Simulation

In this chapter, you will learn several strategies that you can use to approach probability questions.

1. **Simulation** ← Today's Aim
2. Sample Space
3. Two-way tables
4. Venn Diagrams
5. Tree Diagrams
6. Formulas

Learning Target: Use simulation to model chance behavior.

Simulation is the _____ of chance behavior, based on a _____ that accurately reflects a situation.

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Simulation is the Imitation of chance behavior, based on a model that accurately reflects a situation.

Simulation

- Can often be used to estimate probabilities, especially when there is a complex series of events.
- A valid technique for verifying another type of probability model.
- Is accepted on the AP Exam.
- Can be done using a calculator, computer, or random number table.

Simulation Process (must haves)

1. Describe how to...

2. Perform...

3. Use the results...

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3. **Use the results...** of your simulation to answer the question of interest.

Let's do the NASCAR promotion together

Nascar Promotion:

- In an attempt to increase sales, a breakfast cereal company decides to offer a NASCAR promotion. Each box of cereal will contain a collectible card featuring one of the following NASCAR drivers: Joey Lagano, Kevin Harvick, Chase Elliott, Danica Patrick, or Jimmie Johnson.
- The company claims that each of the 5 cards is equally likely to appear in any box of cereal. A NASCAR fan decides to keep buying boxes of the cereal until she has all 5 drivers' cards. She is surprised when it takes her 23 boxes to get the full set of cards. Does this outcome provide convincing evidence that the 5 cards are not equally likely?
- To help answer this question, we want to perform a simulation to estimate the probability that it will take 23 or more boxes to get a full set of 5 NASCAR collectible cards.

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Use RNG(1,5) RNG(1-5)

Generate a rand. integer from 1 to 5 to simulate buying one box of cereal and looking at which card is inside.

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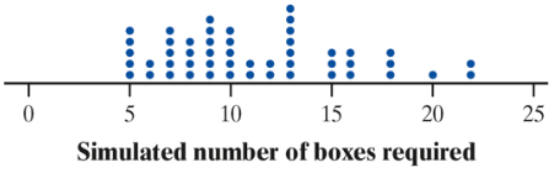
Generate a rand. integer from 1 to 5 to simulate buying one box of cereal and looking at which card is inside.

Keep generating random integers until all 5 labels appear. Record the number of times it takes to get all 5 cards

(b) The dotplot shows the number of cereal boxes it took to get all 5 drivers' cards in 50 trials. Explain what the dot at 20 represents.

boxes required to get all 5 boxes labeled in 1 trial



c) Use the results of the simulation to estimate the probably that it will take 23 or more boxes to get a full set of cards. Does this outcome provide convincing evidence that the 5 cards are not equally likely?

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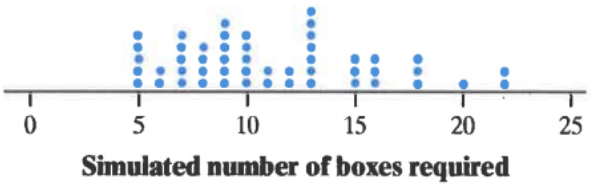
A trial where it took 20 boxes to get all 5 drivers' cards.



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This is unlikely!

There is convincing evidence the the 5 cards are not equally likely

[there is statistical evid. since $p \leq 5\%$]

BB.

Streaky

Who used:

- computer random number generator
- Calculator random number generator Rand(int)
- by hand

Streaky

A basketball announcer suggests that a certain player is a streaky shooter. That is, the announcer believes that if the player makes a shot, the player is more likely to make the next shot. As evidence, the announcer points to a recent game where the player took 30 shots and had a streak of 10 made shots in a row. Is this convincing evidence of streaky shooting by the player? Assume that this player makes 50% of the shots and that the results of a shot don't depend on previous shots.

1. Describe how you would carry out a simulation to estimate the probability that a 50% shooter who takes 30 shots in a game would have a streak of 10 or more made shots.

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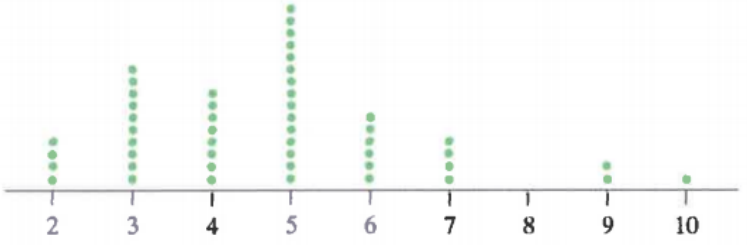
- Flip a coin 30 times.
- Assign heads (to be a make), tails (to be a miss)
- Record whether or not there are 10 heads in a row.
- Do this many times to estimate what percent of the time there is a streak of 10.

The dotplot displays the results of 50 simulated games in which this player took 30 shots.



Longest streak in simulated game

2. Explain what the two dots above 9 indicate.

3. What conclusion would you draw about whether this player was streaky? Explain your answer.

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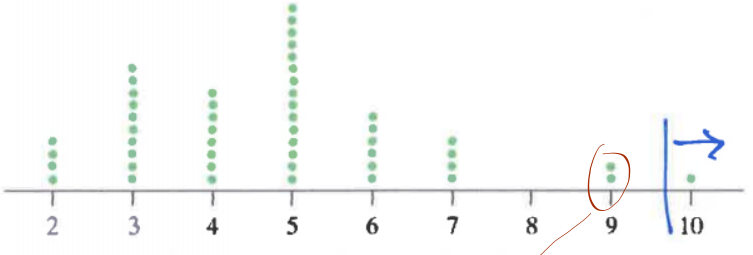

Longest streak in simulated game

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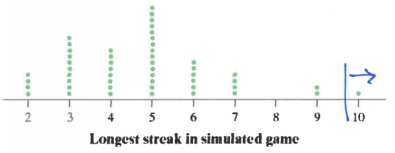
There were 2 trials that resulted 9 consecutive makes.



3. What conclusion would you draw about whether this player was streaky? Explain your answer.

From the 50 simulated trials there was only 1/50 chance that was a streak of 10 or more (2%) this means that it is not likely to happen by chance so the player is streaky.

P-value

there is statistical evidence

5.1.... 9, 11, 15, 21, 23-28

and study pp.304-308, especially the Golden Parking Ticket Lottery