LESSON MAKER PRO

Model Reality Check

Use probability to decide when results are unusual.

HIGH SCHOOL · HSS-IC.A.2

CCSS.Math.Content.HSS-IC.A.2 "Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5..."

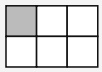
NAME _____ DATE _____

WHEN TO QUESTION A MODEL

To test a probability model, find the chance of the result you saw or a result even more extreme in the same direction. Using a 5% rule, a chance at or below 1/20 is unusual enough to question the model.

WORKED EXAMPLE

A game claims a 6-sided die is fair. In 7 rolls, it lands on a six 4 times. Should you question the claim?

possible die faces 

1. Find P(4 or more sixes).
2. $P = [35(5^3) + 21(5^2) + 7(5) + 1]/6^7$.
3. P = 4936/279936.
4. 4936/279936 < 1/20, so the result is unusual.

Answer: Yes. The probability is 4936/279936, which is less than 1/20.

PRACTICE 4 problems

1 A coin model says heads has probability 1/2. You flip 3 heads in 3 flips. Find the probability. Should you question the model using the 5% rule?

ANSWER _____

2 A spinner model says P(red) = 1/3. It lands red on both of 2 spins. Find the probability. Should you question the model?

ANSWER _____

3 A random-digit generator says each digit is equally likely. Its next 2 outputs are both 8. Find the probability. Should you question the model?

ANSWER _____

4 A bag model says P(blue) = 2/3. With replacement, 3 draws are all not blue. Find the probability. Should you question the model?

ANSWER _____

APPLY IT Show your work

1 A beta app claims a login has a 1/5 chance of crashing, independently. In 6 test logins, 4 crash. Find P(4 or more crashes). Should the team question the claim?

WORK SPACE

ANSWER _____

2 A music app says 1/4 of its recommendations are from new artists, independently. In 5 recommendations, 3 are from new artists. Find P(3 or more new artists). Should you question the model?

WORK SPACE

ANSWER _____

CHALLENGE One step up

An esports coach models each match as an independent win with probability 1/2. The team wins 9 of 11 matches. Find P(9 or more wins), then explain whether this result makes you question the model using the 5% rule.

WORK SPACE AND ANSWER

ANSWER KEY

Model Reality Check

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A coin model says heads has probability 1/2. You flip 3 heads in 3 flips. Find the probability. Should you question the model using the 5% rule?	**1/8; No, because 1/8 > 1/20.**
2	A spinner model says P(red) = 1/3. It lands red on both of 2 spins. Find the probability. Should you question the model?	**1/9; No, because 1/9 > 1/20.**
3	A random-digit generator says each digit is equally likely. Its next 2 outputs are both 8. Find the probability. Should you question the model?	**1/100; Yes, because 1/100 < 1/20.**
4	A bag model says P(blue) = 2/3. With replacement, 3 draws are all not blue. Find the probability. Should you question the model?	**1/27; Yes, because 1/27 < 1/20.**

PART 2 · APPLY IT

1. **265/15625; Yes, because 265/15625 < 1/20.** Add the probabilities for 4, 5, and 6 crashes: 240/15625 + 24/15625 + 1/15625 = 265/15625. This is below 1/20.
2. **53/512; No, because 53/512 > 1/20.** Add the probabilities for 3, 4, and 5 new artists: 90/1024 + 15/1024 + 1/1024 = 53/512. This is greater than 1/20.

CHALLENGE

P(9 or more wins) = (55 + 11 + 1)/2048 = 67/2048. Yes, question the model because 67/2048 < 1/20.

Accept equivalent fractions and correct comparisons to 5% or 1/20. Students should include outcomes more extreme than the observed result when finding the probability.