LESSON MAKER PRO

Model Check

Use probability to test a claim.

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

Find the probability of the result, or a result at least that unusual, if the model is true. A result below 0.05 is unusual enough to question the model, but it does not prove the model is false.

WORKED EXAMPLE

A machine model says an item works with probability 0.6. In 10 tests, exactly 8 items work. Should you question the model?

1. P(exactly 8 work) = C(10,8) (0.6)^8(0.4)^2.
2. P = 45(0.6)^8(0.4)^2 = 0.120932352.
3. 120932352 is greater than 0.05.

Answer: No. This result has probability about 0.121, so it is not unusually rare.

PRACTICE 5 problems

1 A fair coin model predicts heads with probability 1/2. You get 7 heads in a row. Find the probability. Question the model?

ANSWER _____

2 A model says a device succeeds with probability 0.7. It fails on 4 attempts in a row. Find the probability. Question the model?

ANSWER _____

3 A model says a player makes a free throw with probability 0.2. The player makes 6 in a row. Find the probability. Question the model?

ANSWER _____

4 A bag model says red is drawn with probability 0.4, with replacement. In 4 draws, exactly 3 are red. Find the probability. Question the model?

ANSWER _____

5 An app model says an update crashes with probability 0.1. Nine updates have no crashes. Find the probability. Question the model?

ANSWER _____

APPLY IT Show your work

1 A music app says each song in a shuffle has probability 0.25 of being explicit. A listener gets 5 explicit songs in a row. Should the listener question the shuffle model?

WORK SPACE

ANSWER _____

2 An esports player claims to win each round with probability 3/4. In 7 rounds, the player loses every round. Should you question the claim?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A quiz app model says a random guess is correct with probability 1/2. In 11 questions, a student gets 9 or more correct. Find the probability of 9, 10, or 11 correct answers. Should you question the model? Explain.

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ANSWER KEY

Model Check

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A fair coin model predicts heads with probability 1/2. You get 7 heads in a row. Find the probability. Question the model?	**1/128. Yes, because 1/128 is less than 0.05.**
2	A model says a device succeeds with probability 0.7. It fails on 4 attempts in a row. Find the probability. Question the model?	**0.0081. Yes, because 0.0081 is less than 0.05.**
3	A model says a player makes a free throw with probability 0.2. The player makes 6 in a row. Find the probability. Question the model?	**0.000064. Yes, because 0.000064 is less than 0.05.**
4	A bag model says red is drawn with probability 0.4, with replacement. In 4 draws, exactly 3 are red. Find the probability. Question the model?	**0.1536. No, because 0.1536 is greater than 0.05.**
5	An app model says an update crashes with probability 0.1. Nine updates have no crashes. Find the probability. Question the model?	**0.387420489. No, because 0.387420489 is greater than 0.05.**

PART 2 · APPLY IT

1. **Yes. The probability is (0.25)^5 = 1/1024, which is less than 0.05.** Multiply 0.25 by itself 5 times. The result is an unusually rare streak if the model is correct.
2. **Yes. The probability is (1/4)^7 = 1/16384, which is less than 0.05.** The probability of a loss is 1/4. Multiply 1/4 by itself 7 times and compare with 0.05.

CHALLENGE

P = [C(11,9) + C(11,10) + C(11,11)]/2^11 = (55 + 11 + 1)/2048 = 67/2048, about 0.0327. Yes, because getting 9 or more correct has probability less than 0.05.

Accept exact fractions or accurate decimals. Accept reasoning that identifies the result as unusual under the stated 0.05 guideline.