LESSON MAKER PRO

Smart Odds Choices

Use expected value to compare risky options.

HIGH SCHOOL · HSS-MD.B.7

CCSS.Math.Content.HSS-MD.B.7 "(+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game)."

NAME _____ DATE _____

EXPECTED VALUE

Expected value predicts the average net result of a choice over many repeats. Multiply each outcome by its probability, use negative values for losses, and add the results.

WORKED EXAMPLE

A game has a 1/8 chance to win $24 and a 7/8 chance to lose $4. Find the expected value.

1. Write the outcomes as 24 and -4.
2. EV = (1/8)(24) + (7/8)(-4).
3. EV = 3 - 3.5 = -0.5.

Answer: -$0.50 expected value: an average loss of 50 cents per play.

PRACTICE 5 problems

1 A game has a 2/3 chance to win $9 and otherwise loses $3. Find its expected value.

ANSWER _____

2 A coupon has a 3/5 chance to save $20 and otherwise costs $5. Find its expected value.

ANSWER _____

3 A contest has a 2/5 chance to pay $15 and otherwise charges $5. Find its expected value.

ANSWER _____

4 Option A has a 2/3 chance to gain $12 and otherwise loses $6. Option B has a 3/5 chance to gain $10 and otherwise loses $5. Which option has the greater expected value?

ANSWER _____

5 A mystery box has a 3/10 chance to contain a $30 gift card and otherwise contains nothing. What is a fair price for the box?

ANSWER _____

APPLY IT Show your work

1 A robotics club can sell one of two hoodie designs. Design A has a 2/5 chance to earn $45 profit and otherwise loses $15. Design B guarantees a $6 profit. Which design should the club choose based on expected value?

WORK SPACE

ANSWER _____

2 A student musician can buy a promotion for $12. The promotion has a 3/5 chance to bring in $25 in extra sales and otherwise brings in $0. Should the musician buy it based on expected value?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A game developer can test a new feature for $5. A serious bug has probability 2/5. If a bug exists, the test catches it with probability 2/3, and an early repair costs $6. A missed bug costs $30 after release. If no test is used, any bug costs $30 after release. Which plan has the lower expected cost? Show the expected cost of each plan.

WORK SPACE AND ANSWER

Smart Odds Choices

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A game has a 2/3 chance to win $9 and otherwise loses $3. Find its expected value.	**$5**
2	A coupon has a 3/5 chance to save $20 and otherwise costs $5. Find its expected value.	**$10**
3	A contest has a 2/5 chance to pay $15 and otherwise charges $5. Find its expected value.	**$3**
4	Option A has a 2/3 chance to gain $12 and otherwise loses $6. Option B has a 3/5 chance to gain $10 and otherwise loses $5. Which option has the greater expected value?	**Option A, with an expected value of $6. Option B has an expected value of $4.**
5	A mystery box has a 3/10 chance to contain a $30 gift card and otherwise contains nothing. What is a fair price for the box?	**$9**

PART 2 · APPLY IT

1. **Choose Design A. Its expected value is $9, compared with $6 for Design B.** Design A: (2/5)(45) + (3/5)(-15) = 18 - 9 = 9. Compare $9 with the guaranteed $6.
2. **Yes. The expected net value is $3.** Expected sales are (3/5)(25) = 15. Subtract the $12 cost to get a net expected value of $3.

CHALLENGE

Test the feature. Testing has expected cost $53/5, or $10.60: 5 + (2/5)[(2/3)(6) + (1/3)(30)] = 53/5. No test has expected cost (2/5)(30) = $12.

Accept equivalent fraction, decimal, or currency forms. For decision items, accept the stated choice only when it is supported by the correct expected values.