LESSON MAKER PRO

Expected Value Lab

Find the long-run average of a random variable.

HIGH SCHOOL · HSS-MD.A.2

CCSS.Math.Content.HSS-MD.A.2 "(+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution."

NAME _____ DATE _____

EXPECTED VALUE

Multiply each possible value of a random variable by its probability. Then add the products. The expected value is the mean of the probability distribution, so it describes a long-run average, not necessarily one result you will get.

WORKED EXAMPLE

A random variable X has values 11, 17, and 23 with probabilities 0.2, 0.3, and 0.5. Find E(X).

1. 11(0.2) = 2.2, 17(0.3) = 5.1, and 23(0.5) = 11.5.
2. E(X) = 2.2 + 5.1 + 11.5.
3. E(X) = 18.8.

Answer: E(X) = 18.8

PRACTICE 6 problems

1 Random variable A is 0 with probability 1/8 and 8 with probability 7/8. Find E(A).

ANSWER _____

2 Random variable B is -6 with probability 3/10, 0 with probability 4/10, and 10 with probability 3/10. Find E(B).

ANSWER _____

3 Random variable C is 4 with probability 1/4, 6 with probability 1/2, and 14 with probability 1/4. Find E(C).

ANSWER _____

4 Random variable D is -4 with probability 1/8, 8 with probability 3/8, and 16 with probability 4/8. Find E(D).

ANSWER _____

5 Random variable E is -10 with probability 1/4, 0 with probability 1/2, and 20 with probability 1/4. Find E(E).

ANSWER _____

6 Random variable F is 1 with probability 2/10, 4 with probability 5/10, and 7 with probability 3/10. Find E(F).

ANSWER _____

APPLY IT Show your work

1 At a school game night, a student-run snack booth has a net profit of -$8 if turnout is low, $4 if turnout is medium, and $14 if turnout is high. The probabilities are 1/4, 1/2, and 1/4. What is the expected net profit for the evening?

WORK SPACE

ANSWER _____

2 A robotics team enters a design contest. After materials and entry costs, the team's net funds will be -$12 with probability 1/5, $3 with probability 1/2, or $18 with probability 3/10. What is the expected net funds from entering?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two student creators are choosing a payment plan for a sponsored post. Plan A pays $0 with probability 1/4, $8 with probability 1/2, and $16 with probability 1/4. Plan B pays $4 with probability 1/2 and $12 with probability 1/2. Find the expected value of each plan. Then state which plan you would choose if you want a guaranteed minimum of $4, and explain why.

WORK SPACE AND ANSWER

ANSWER KEY

Expected Value Lab

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Random variable A is 0 with probability 1/8 and 8 with probability 7/8. Find E(A).	**E(A) = 7**
2	Random variable B is -6 with probability 3/10, 0 with probability 4/10, and 10 with probability 3/10. Find E(B).	**E(B) = 6/5**
3	Random variable C is 4 with probability 1/4, 6 with probability 1/2, and 14 with probability 1/4. Find E(C).	**E(C) = 15/2**
4	Random variable D is -4 with probability 1/8, 8 with probability 3/8, and 16 with probability 4/8. Find E(D).	**E(D) = 21/2**
5	Random variable E is -10 with probability 1/4, 0 with probability 1/2, and 20 with probability 1/4. Find E(E).	**E(E) = 5/2**
6	Random variable F is 1 with probability 2/10, 4 with probability 5/10, and 7 with probability 3/10. Find E(F).	**E(F) = 43/10**

PART 2 · APPLY IT

1. **$7/2, or $3.50** Calculate (-8)(1/4) + 4(1/2) + 14(1/4). The expected net profit is -2 + 2 + 7/2 = 7/2 dollars.
2. **$9/2, or $4.50** Calculate (-12)(1/5) + 3(1/2) + 18(3/10). The sum is 9/2 dollars.

CHALLENGE

E(A) = $8 and E(B) = $8. Choose Plan B because its lowest possible payment is $4, while Plan A can pay $0.

Accept equivalent fractions, decimals, or money forms for expected values. For the challenge, accept any clear explanation that both plans have the same expected value and that Plan B guarantees at least $4.