Chance Value Lab

Build distributions and find their long-run means.

HIGH SCHOOL · MA.912.DP.6.2

MA.912.DP.6.2 "Develop a probability distribution for a discrete random variable using theoretical probabilities. Find the expected value and interpret it as the mean of the discrete distribution."

NAME ______________________ DATE ______________

EXPECTED VALUE

For each possible value of X, find its theoretical probability. Multiply each value by its probability and add: E(X)=sum of xP(x). The expected value is the mean of the distribution over many repetitions.

WORKED EXAMPLE

A fair spinner has 3 equal sections labeled 11, 13, and 17. Let X be the label landed on. Make the distribution and find E(X).

1. Each label has probability 1/3.
2. Distribution: X=11, 13, 17 and P(X)=1/3, 1/3, 1/3.
3. E(X)=11(1/3)+13(1/3)+17(1/3)=41/3.

Answer: E(X)=41/3. The long-run mean label is 41/3.

PRACTICE 5 problems

1 Flip a fair coin twice. Let X be the number of heads. Write the distribution and find E(X).

ANSWER ______________________

2 A bag has 1 red, 2 blue, and 3 green marbles. Pick one. Let X=0 for red, X=2 for blue, and X=4 for green. Write the distribution and find E(X).

ANSWER ______________________

3 Roll a fair die. Let X=1 if the roll is even and X=0 otherwise. Write the distribution and find E(X).

ANSWER ______________________

4 Flip a fair coin 3 times. Let X be the number of heads. Write the distribution and find E(X).

ANSWER ______________________

5 A fair spinner has 4 equal sections labeled -1, 0, 1, and 6. Let X be the label landed on. Write the distribution and find E(X).

ANSWER ______________________

APPLY IT Show your work

1 A mobile game tournament gives a player one reward code chosen from 10 equally likely codes. Five codes give 0 coins, three give 2 coins, and two give 5 coins. Let X be the number of coins. Write the distribution, find E(X), and interpret it.

WORK SPACE

ANSWER ______________________

2 A school cafe has 12 sealed discount cards. Four cards give $0 off, six give $1 off, and two give $4 off. Let X be the discount. Write the distribution, find E(X), and interpret it.

WORK SPACE

ANSWER ______________________

CHALLENGE One step up

CHALLENGE

Two fair dice are rolled. Let X=0 if the sum is 2 through 5, X=4 if the sum is 6 through 9, and X=10 if the sum is 10 through 12. Develop the distribution, find E(X), and explain what it means.

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ANSWER KEY **Chance Value Lab** HIGH SCHOOL · MA.912.DP.6.2

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Flip a fair coin twice. Let X be the number of heads. Write the distribution and find E(X).	**X=0, 1, 2; P(X)=1/4, 1/2, 1/4; E(X)=1.**
2	A bag has 1 red, 2 blue, and 3 green marbles. Pick one. Let X=0 for red, X=2 for blue, and X=4 for green. Write the distribution and find E(X).	**X=0, 2, 4; P(X)=1/6, 1/3, 1/2; E(X)=8/3.**
3	Roll a fair die. Let X=1 if the roll is even and X=0 otherwise. Write the distribution and find E(X).	**X=0, 1; P(X)=1/2, 1/2; E(X)=1/2.**
4	Flip a fair coin 3 times. Let X be the number of heads. Write the distribution and find E(X).	**X=0, 1, 2, 3; P(X)=1/8, 3/8, 3/8, 1/8; E(X)=3/2.**
5	A fair spinner has 4 equal sections labeled -1, 0, 1, and 6. Let X be the label landed on. Write the distribution and find E(X).	**X=-1, 0, 1, 6; P(X)=1/4 for each value; E(X)=3/2.**

PART 2 · APPLY IT

1. **X=0, 2, 5; P(X)=1/2, 3/10, 1/5; E(X)=8/5. Over many codes, the mean reward is 8/5 coins per code.** Use the number of each code type out of 10 for the probabilities. Compute 0(1/2)+2(3/10)+5(1/5)=8/5.
2. **X=0, 1, 4; P(X)=1/3, 1/2, 1/6; E(X)=7/6. Over many cards, the mean discount is $7/6 per card.** Use the card counts out of 12 for the probabilities. Compute 0(1/3)+1(1/2)+4(1/6)=7/6.

CHALLENGE

X=0, 4, 10; P(X)=5/18, 5/9, 1/6; E(X)=35/9. Over many rolls, the mean score is 35/9 points per roll.

Accept equivalent fractions and equivalent probability forms. For interpretations, accept wording that identifies expected value as the long-run mean, not a guaranteed result of one trial.