LESSON MAKER PRO

Data to Mean

Use trial results to build distributions and find their mean.

HIGH SCHOOL · MA.912.DP.6.3

MA.912.DP.6.3 "Develop a probability distribution for a discrete random variable using empirical probabilities. Find the expected value and interpret it as the mean of the discrete distribution."

NAME _____ DATE _____

EMPIRICAL DISTRIBUTIONS

Find each empirical probability by dividing its frequency by the total number of trials. Multiply each value by its probability and add the products to find E(x), the distribution's mean.

WORKED EXAMPLE

In 12 trials, x = 1 occurred 2 times, x = 3 occurred 4 times, and x = 5 occurred 6 times. Find the distribution and E(x).

1. Total trials = 2 + 4 + 6 = 12.
2. P(1) = 2/12 = 1/6, P(3) = 4/12 = 1/3, P(5) = 6/12 = 1/2.
3. E(x) = 1(1/6) + 3(1/3) + 5(1/2) = 11/3.

Answer: Distribution: P(1)=1/6, P(3)=1/3, P(5)=1/2. E(x)=11/3.

PRACTICE 5 problems

1 In 24 trials, x = 0 occurred 9 times, x = 7 occurred 8 times, and x = 8 occurred 7 times. Find the distribution and E(x).

ANSWER _____

2 In 30 trials, x = 0 occurred 11 times, x = 7 occurred 10 times, and x = 9 occurred 9 times. Find the distribution and E(x).

ANSWER _____

3 In 27 trials, x = 0 occurred 11 times, x = 8 occurred 9 times, and x = 10 occurred 7 times. Find the distribution and E(x).

ANSWER _____

4 In 39 trials, x = 0 occurred 8 times, x = 7 occurred 20 times, and x = 9 occurred 11 times. Find the distribution and E(x).

ANSWER _____

5 In 15 trials, x = 0 occurred 7 times and x = 8 occurred 8 times. Find the distribution and E(x).

ANSWER _____

APPLY IT Show your work

1 During 30 weekly playlist updates, a student added 0 tracks in 11 weeks, 7 tracks in 10 weeks, and 9 tracks in 9 weeks. Build the empirical distribution and find the expected number of tracks added per update.

WORK SPACE

ANSWER _____

2 Over 30 games, a basketball team made 0 three-pointers in 13 games, 7 three-pointers in 9 games, and 8 three-pointers in 8 games. Build the empirical distribution and find the expected number of three-pointers per game.

WORK SPACE

ANSWER _____

CHALLENGE One step up

In 24 trials, x = 10 occurred 9 times, x = 13 occurred 8 times, and x = 16 occurred 7 times. Find the distribution and E(x). A classmate says E(x) must be the most likely result. Explain why the classmate is incorrect.

WORK SPACE AND ANSWER

ANSWER KEY # Data to Mean

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	In 24 trials, x = 0 occurred 9 times, x = 7 occurred 8 times, and x = 8 occurred 7 times. Find the distribution and E(x).	**P(0)=3/8, P(7)=1/3, P(8)=7/24; E(x)=14/3.**
2	In 30 trials, x = 0 occurred 11 times, x = 7 occurred 10 times, and x = 9 occurred 9 times. Find the distribution and E(x).	**P(0)=11/30, P(7)=1/3, P(9)=3/10; E(x)=151/30.**
3	In 27 trials, x = 0 occurred 11 times, x = 8 occurred 9 times, and x = 10 occurred 7 times. Find the distribution and E(x).	**P(0)=11/27, P(8)=1/3, P(10)=7/27; E(x)=142/27.**
4	In 39 trials, x = 0 occurred 8 times, x = 7 occurred 20 times, and x = 9 occurred 11 times. Find the distribution and E(x).	**P(0)=8/39, P(7)=20/39, P(9)=11/39; E(x)=239/39.**
5	In 15 trials, x = 0 occurred 7 times and x = 8 occurred 8 times. Find the distribution and E(x).	**P(0)=7/15, P(8)=8/15; E(x)=64/15.**

PART 2 · APPLY IT

1. **P(0)=11/30, P(7)=1/3, P(9)=3/10; E(x)=151/30 tracks per update.** Divide each frequency by 30. Then calculate 0(11/30) + 7(1/3) + 9(3/10) = 151/30.
2. **P(0)=13/30, P(7)=3/10, P(8)=4/15; E(x)=127/30 three-pointers per game.** Divide each frequency by 30. Then calculate 0(13/30) + 7(3/10) + 8(4/15) = 127/30.

CHALLENGE

P(10)=3/8, P(13)=1/3, P(16)=7/24; E(x)=51/4. The most likely result is 10 because it has probability 3/8. The expected value, 51/4, is the mean and does not have to be an observed result.

Accept equivalent unsimplified probabilities and equivalent expected-value fractions. Accept a decimal interpretation only if it is accurate and clearly identified as an average.