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Section 7.2: Expected Value and Odds

The **average** (mean) of n numbers, x_1, x_2, x_3,..., x_n is $\bar{x}$.

Formula: $\bar{x} = \dfrac{x_1 + x_2 + \ldots + x_n}{n}$

Expected Value of a Random Variable *X*

Let *X* denote a random variable that assumes the values x_1, x_2, x_3,..., x_n with associated probabilities p_1 p_2, ..., p_n, respectively. The **expected value** of *X*, *E(X)*, is given by

$$E(X) = x_1 p_1 + x_2 p_2 + \cdots + x_n p_n = \mu$$

Example 1: In this Finite Math class Test 1 is worth 8%, each of the 2- 4 tests are worth 14%, the quiz average is worth 12%, the homework average is worth 10%, the popper average is worth 10%, and the final exam is worth 18%. If your grades are as follows:

Test 1 – 82, Test 2 – 86, Test 3 – 68, Test 4 – 90, Quiz Average – 100, Homework Average – 91, Popper Average – 100, and Final Exam – 95.

What is your class average (expected value)?

Example 2: A box contains 15 quarters, 7 dimes, 5 nickels, and 8 pennies. A coin is drawn at random from the box. What is the mean of the value of the draw?

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Example 3: An investor is interested in purchasing an apartment building containing six apartments. The current owner provides the following probability distribution indicating the probability that the given number of apartments will be rented during a given month.

Number of Rented Apt	0	1	2	3	4	5	6
Probability	0.02	0.08	0.10	0.12	0.15	0.25	0.28

a. Find the number of apartments the investor could expect to be rented during a given month?

b. If the monthly rent for each apartment is $799, how much could the investor expect to collect in rent for the whole building during a given month?

Odds in Favor of and Odds Against

If P(E) is the probability of an even E occurring, then

1. The odds in favor of E occurring are

$$\frac{P(E)}{P(E^c)}$$

2. The odds against E occurring are

$$\frac{P(E^c)}{P(E)}$$

Note: Odds are expressed as ratios of whole numbers.

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Probability of an Event (Given the Odds)

If the odds in favor of an event E occurring are *a* to *b*, then the probability of E occurring is

$$P(E) = \frac{a}{a+b}$$

Example 4: The probability that the race horse Galloping George will win a race is 0.65.

a. What are the odds in favor of George winning?

b. What are the odds against George winning?

c. What is the probability that George will lose?

Example 5: The odds against Laura winning a certain raffle are 99:1. What is the probability that Laura will not win the raffle?

Example 6: The odds that it will rain on Thursday are 3 to 5. What is the probability that it will rain?

Example 7: The probability that I will not finish my paper this week is 85%. What are the odds I will finish my paper?