

What is the process for finding the mean of a probability distribution and can you provide some examples?

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The process for finding the mean of a probability distribution involves calculating the weighted average of all possible outcomes, where the weights are determined by the probability of each outcome occurring. This can be achieved by multiplying each outcome by its corresponding probability and then adding all the products together.

For example, if we have a probability distribution with outcomes of 1, 2, and 3, with probabilities of 0.3, 0.4, and 0.3 respectively, the mean can be calculated as $(1 \cdot 0.3) + (2 \cdot 0.4) + (3 \cdot 0.3) = 2$.

In a more formal sense, the formula for finding the mean of a probability distribution is:

Mean = $\sum(x \cdot P(x))$, where x is the outcome and $P(x)$ is the probability of that outcome occurring.

This process is commonly used in statistics and probability to measure the central tendency of a distribution and can be applied to various scenarios, such as calculating the average number of goals scored in a soccer match or the average temperature in a region over a period of time.

Find the Mean of a Probability Distribution (With Examples)

A probability distribution tells us the probability that a takes on certain values.

For example, the following probability distribution tells us the probability that a certain soccer team scores a certain number of goals in a given game:

Goals (X)	Probability P(X)
0	0.18
1	0.34
2	0.35
3	0.11
4	0.02

Note: The probabilities in a valid probability distribution will always add up to 1. We can confirm that this probability distribution is valid: $0.18 + 0.34 + 0.35 + 0.11 + 0.02 = 1$.

To find the mean (sometimes called the "expected value") of any probability distribution, we can use the following formula:

Mean (Or "Expected Value") of a Probability Distribution: $\mu = \sum x * P(x)$

where:

- x: Data value
- P(x): Probability of value

For example, consider our probability distribution for the soccer team:

Goals (X)	Probability P(X)
0	0.18
1	0.34
2	0.35
3	0.11
4	0.02

The mean number of goals for the soccer team would be calculated as:

$$\mu = 0 \cdot 0.18 + 1 \cdot 0.34 + 2 \cdot 0.35 + 3 \cdot 0.11 + 4 \cdot 0.02 = 1.45 \text{ goals.}$$

The following examples show how to calculate the mean of a probability distribution in a few other scenarios.

Example 1: Mean Number of Vehicle Failures

The following probability distribution tells us the probability that a given vehicle experiences a certain number of battery failures during a 10-year span:

Failures (X)	Probability P(X)
0	0.24
1	0.57
2	0.16
3	0.03

Question: What is the mean number of expected failures for this vehicle?

Solution: The mean number of expected failures is

calculated as:

$$\mu = 0*0.24 + 1*0.57 + 2*0.16 + 3*0.03 = 0.98 \text{ failures.}$$

Example 2: Mean Number of Wins

The following probability distribution tells us the probability that a given basketball team wins a certain number of games in a tournament:

Wins (X)	Probability P(X)
0	0.06
1	0.15
2	0.17
3	0.24
4	0.23
5	0.09
6	0.06

Question: What is the mean number of expected wins for this team?

Solution: The mean number of expected wins is calculated as:

$$\mu = 0*.06 + 1*.15 + 2*0.17 + 3*0.24 + 4*.23 + 5*.09 + 6*.06 = 2.94 \text{ wins.}$$

Example 3: Mean Number of Sales

The following probability distribution tells us the probability that a given salesman will make a certain number of sales in the upcoming month:

Sales (X)	Probability P(X)
10	0.24
20	0.31
30	0.39
40	0.06

Question: What is the mean number of expected sales for this salesman in the upcoming month?

Solution: The mean number of expected sales is calculated as:

$$\mu = 10 \cdot .24 + 20 \cdot .31 + 30 \cdot 0.39 + 40 \cdot 0.06 = 22.7 \text{ sales.}$$

Bonus: Probability Distribution calculator

You can use to automatically calculate the mean of any probability distribution.