

What Are i.i.d. Random Variables? (Definition & Examples)

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Independent and identically distributed (i.i.d.) random variables are a type of mathematical concept used to describe a set of random variables that are mutually independent and have the same probability distribution. This means that each variable in the set has no influence on the outcome of the other variables, and they all follow the same probability distribution. This allows for simpler calculations and modeling in statistical analysis. A common example of i.i.d. random variables is a set of coin flips, where each flip has a 50% chance of landing on heads or tails and the outcome of one flip does not affect the outcome of the others. Another example is a set of dice rolls, where each roll has a $1/6$ chance of landing on any number and the outcome of one roll does not affect the outcomes of the others. Overall, i.i.d. random variables are an important concept in probability and statistics, allowing for more efficient and accurate analysis of data.

What Are i.i.d. Random Variables? (Definition & Examples)

In statistics, are said to be i.i.d. - independently and identically distributed - if the following two conditions are met:

- (1) Independent** - The outcome of one event does not affect the outcome of another.
- (2) Identically Distributed** - The probability distribution of each event is identical.

The following scenarios illustrate examples of i.i.d. random variables in practice.

Example 1: Tossing a Coin

Suppose we toss a coin 10 times and keep track of the

number of times the coin lands on heads.

This is an example of a random variable that is independently and identically distributed because the following two conditions are met:

(1) Independent - The outcome of one coin toss does not affect the outcome of another coin toss. Each toss is independent.

(2) Identically Distributed - The probability that a coin lands on heads on any given toss is 0.5. This probability does not change from one toss to the next.

Example 2: Rolling a Dice

Suppose we roll a dice 50 times and keep track of the number of times the dice lands on the number 4.

This is an example of a random variable that is independently and identically distributed because the following two conditions are met:

(1) Independent - The outcome of one dice roll does not affect the outcome of another dice roll. Each roll is independent.

(2) Identically Distributed - The probability that a dice lands on "4" on any given roll is $1/6$. This probability does not change from one roll to the next.

Example 3: Spinning a Spinner

Suppose we spin a spinner 100 times that is equally split into four colors (red, blue, green, and purple) and keep track of the number of times that it lands on purple.

This is an example of a random variable that is independently and identically distributed because the following two conditions are met:

(2) Identically Distributed - The probability that the spinner lands on purple on any given spin is 0.25. This probability does not change from one spin to the next.

Example 4: Choosing a Card

A standard deck of cards contains 52 cards, 4 of which are Queens. Suppose we randomly draw a card from a standard deck, then place the card back in the deck. Suppose we repeat this 100 times and keep track of the number of times we draw a Queen.

This is an example of a random variable that is independently and identically distributed because the following two conditions are met:

(1) Independent - The outcome of one draw does not affect the outcome of another draw. Each draw is independent.

(2) Identically Distributed - The probability that we choose a Queen on any given draw is $4/52$. This probability does not change from one draw to the next.