Random Variables: Count vs. Measure

Learning Objective: Distinguish between discrete and continuous random variables

Before we go any further, a few observations about the nature of discrete and continuous random variables should be mentioned.

Comments

1. Sometimes, continuous random variables are "rounded" and are therefore "in a discrete disguise."

   For example:

   - time spent watching TV in a week, rounded to the nearest hour (or minute)
   - outside temperature, to the nearest degree
   - a person's weight, to the nearest pound.

   Even though they "look like" discrete variables, these are still continuous random variables, and we will in most cases treat them as such.

2. On the other hand, there are some variables which are discrete in nature, but take so many distinct possible values that it will be much easier to treat them as continuous rather than discrete.

   - the IQ of a randomly chosen person
   - the SAT score of a randomly chosen student
   - the annual salary of a randomly chosen CEO, whether rounded to the nearest dollar or the nearest cent

3. Sometimes we have a discrete random variable but do not know the extent of its possible values. For example: How many accidents will occur in a particular intersection this month? We may know from previously collected data that this number is from 0-5. But, 6, 7, or more accidents could be possible.

4. A good rule of thumb is that **discrete** random variables are things we **count**, while **continuous** random variables are things we **measure**.

    - We counted the number of tails and the number of ears with earrings. These were discrete random variables.

    - We measured the weight of the lightweight boxer. This was a continuous random variable.

Often we can have a subject matter for which we can collect data that could involve a discrete or a continuous random variable, depending on the information we wish to know.

Example: Soft Drinks

Suppose we want to know **how many days per week you drink a soft drink**. The sample space would be S = { 0, 1, 2, 3, 4, 5, 6, 7 }. There are a finite number of values for this variable. This would be a discrete random variable.

Instead, suppose we want to know **how many ounces of soft drinks you consume per week**. Even if we round to the nearest ounce, the answer is a measurement. Thus, this would be a continuous random variable.

Example: x-bar

Suppose we are interested in the weights of all males. We take a random sample and get the mean for that sample, namely $\overline{x}$. We then take another random sample (with the same sample size) and get another $\overline{x}$.

We would expect the values of the $\overline{x}$s from these two samples to be different, but pretty close in value.

Each time we take a sample we'll get a different $\overline{x}$. We will take lots of samples and thus get many $\overline{x}$s.

The value of $\overline{x}$ from these repeated samples is a random variable. Since it can take on any value within an interval of possible male weights it is a continuous random variable.

Did I Get This

1/1 point (graded)

Choose a college student at random. Is the following a discrete or continuous random variable?

The number of courses the student takes this semester

- (•) Discrete ✔
- ( ) Continuous

Answer

Correct:

Number of courses is indeed a discrete random variable, since it can take any value from a list of distinct values: 1, 2, 3, 4, etc.

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Did I Get This

1/1 point (graded)

Choose a college student at random. Is the following a discrete or continuous random variable?

The student's height

- ( ) Discrete
- (•) Continuous ✔

Answer

Correct:

Student's height is indeed continuous, since it can take any value in an interval. It's true that when rounded to the nearest inch (or centimeter) it looks like it is discrete, but the exact height of a person is continuous. You cannot list all possible heights.

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Did I Get This

1/1 point (graded)

Choose a college student at random. Is the following a discrete or continuous random variable?

The student's (exact) body temperature

Discrete

Continuous ✔

Answer
Correct:
Student's exact body temperature is indeed a continuous random variable since it can take any value in an interval. It's true that when rounded to the nearest degree Fahrenheit (or Celsius) it looks like it is discrete, but the exact body temperature of a person is continuous. You cannot list all possible temperatures.

Submit

Did I Get This

1/1 point (graded)
Choose a college student at random. Is the following a discrete or continuous random variable?

The number of siblings the student has

Discrete ✔

Continuous

Answer
Correct:
Student's number of siblings is indeed a discrete random variable, since it can take any value from a list of distinct values: 0, 1, 2, 3, 4, etc.

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Did I Get This

1/1 point (graded)
Choose a college student at random. Is the following a discrete or continuous random variable?

The (exact) time the student spends doing school work during a week

Discrete

Continuous ✔

Answer
Correct:
The exact time a student spends doing school work during a week is indeed a continuous random variable, since it can take any value in an interval. It's true that when rounded to the nearest hour or minute it looks like it is discrete, but the exact time is continuous. You cannot list all possible exact times.

Submit

Did I Get This

1/1 point (graded)
Choose a college student at random. Is the following a discrete or continuous random variable?

The number of alcoholic beverages that the student drinks in a typical week

Discrete ✔

Continuous

Answer
Correct:
The number of alcoholic beverages the student drinks in a typical week is indeed a discrete random variable, since it can take any value from a list of distinct values: 0, 1, 2, 3, 4, etc.

Submit

We devote a great deal of attention to random variables, since random variables and the probabilities that are associated with them play a vital role in the theory behind statistical inference, our ultimate goal in this course.