# Discrete vs. Continuous Random Variables

Statistics Worksheet · Grade 9–12

Name: _____ Date: _____

**Learning Objectives**

- Distinguish between discrete and continuous random variables
- Identify and list possible values of discrete random variables from real-world experiments
- Recognize situations that produce continuous random variables involving decimals or proportions

## Problems

**1.** A random variable has possible outcomes that can be listed and counted. What type of random variable is this?

**2.** A coin is flipped two times. Let X be the number of heads. List all possible values of X.

$X = ?$

**3.** Classify each of the following as discrete (D) or continuous (C): the number of students in a class, the weight of a newborn baby, the number of cars in a parking lot, the time it takes to run a mile.

| Random Variable | D or C |
|---|---|
| | |
| | |
| | |
| | |

**4.** A coin is flipped three times. Let X represent the number of tails. List all possible values of X and state how many possible outcomes exist.

$X = ?$

**5.** A sprinter finishes the 100-meter dash. Which of the following best represents the continuous random variable for finishing time: whole seconds only, or decimals such as 9.81 seconds? Explain why.

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**6.** A fair six-sided die is rolled once. Let X be the number showing on top. Is X discrete or continuous? List all possible values.

$X = ?$

**7.** For each scenario below, identify the type of random variable and write the possible values or describe the range of values.

| Scenario | Type (D/C) | Possible Values or Range |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

**8.** A coin is flipped five times. Let X be the number of heads. How many possible values does X have? Write an expression for the number of possible values of X when a coin is flipped n times.

$$\text{Number of possible values} = n + 1$$

**9.** Explain why recording the finishing times of runners in a 100-meter race as whole seconds (e.g., 9, 10, 11) would be a problem for determining a winner, and why using a continuous random variable is more appropriate.

**10.** A statistics teacher records data from two experiments: Experiment A — the number of tails when flipping a coin 6 times; Experiment B — the exact volume of water (in liters) that students drink per day. For each experiment, state the type of random variable, give the range or list of values, and explain whether the variable can equal exactly 3.5.

| Experiment | Type (D/C) | Values or Range | Can X = 3.5? |
|---|---|---|---|
| | | | |
| | | | |

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# Discrete vs. Continuous Random Variables — Answer Key

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## Answer Key

**1. Answer: Discrete random variable**

- A discrete random variable has a finite or countable number of possible outcomes.
- Since the outcomes can be listed and counted, this is a discrete random variable.

**2. Answer: X = 0, 1, 2**

- Each flip results in either heads (H) or tails (T).
- Possible outcomes: TT (0 heads), HT or TH (1 head), HH (2 heads).
- So X can be 0, 1, or 2.

**3. Answer: See completed table**

| Random Variable | D or C |
|---|---|
| Number of students in a class | D |
| Weight of a newborn baby | C |
| Number of cars in a parking lot | D |
| Time it takes to run a mile | C |

**4. Answer: X = 0, 1, 2, 3; there are 4 possible values**

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- Each flip is either H or T. With 3 flips, the number of tails ranges from 0 to 3.
- X = 0 (no tails), X = 1 (one tail), X = 2 (two tails), X = 3 (three tails).
- There are 4 distinct possible values.

**5. Answer: Decimals such as 9.81 seconds, because finishing times are not restricted to whole numbers and can take any value in a range.**

- Continuous random variables take values that include decimals or proportions.
- Using only whole seconds would cause many runners to tie, losing precision.
- Therefore, the finishing time is a continuous random variable measured in decimals.

**6. Answer: Discrete; X = 1, 2, 3, 4, 5, 6**

- A die has exactly 6 faces, each showing a whole number from 1 to 6.
- The outcomes are finite and countable, making X a discrete random variable.
- Possible values: X = 1, 2, 3, 4, 5, 6.

**7. Answer: See completed table**

| Scenario | Type (D/C) | Possible Values or Range |
|---|---|---|
| Number of heads in 4 coin flips | D | 0, 1, 2, 3, 4 |
| Temperature in degrees Celsius at noon | C | Any real number in a range, e.g. -10.5 to 45.3 |
| Number of correct answers on a 10-question quiz | D | 0, 1, 2, ..., 10 |

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| Scenario | Type (D/C) | Possible Values or Range |
|---|---|---|
| Height of a student in centimeters | C | Any real value, e.g. 150.25 cm |

**8. Answer: 6 possible values when n = 5; in general, n + 1 possible values**

- When flipping a coin 5 times, X (number of heads) can be 0, 1, 2, 3, 4, or 5.
- That gives 6 possible values.
- In general, flipping a coin n times gives X values from 0 to n, which is n + 1 values.

**9. Answer: Rounding to whole seconds causes many runners to tie, making it impossible to determine a winner; continuous values like 9.81 or 10.03 provide the precision needed.**

- If times are recorded only as whole seconds, many runners finishing near the same second would appear to tie.
- For example, times of 9.58, 9.72, and 9.99 would all round to 9 seconds.
- Continuous random variables allow decimal precision, distinguishing each runner's true time and identifying a clear winner.

**10. Answer: See completed table**

| Experiment | Type (D/C) | Values or Range | Can X = 3.5? |
|---|---|---|---|
| A: Number of tails in 6 flips | D | 0, 1, 2, 3, 4, 5, 6 | No — only whole numbers |
| B: Volume of water (liters/day) | C | Any positive real value, e.g. 0.5 to 5.0+ | Yes — any decimal is possible |

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