

Probability Distribution	
$x$	$P(X = x)$
1	$\frac{1}{30}$
2	$\frac{4}{30}$
3	$\frac{9}{30}$
4	$\frac{16}{30}$
<b>Total</b>	$\sum P(X = x_i) = \frac{30}{30} = 1$

Note that the distribution possesses the essential properties of all probability distributions; that is, the probabilities sum to one, and all the probabilities are between 0 and 1.

## Continuous Probability Distributions

Continuous random variables also have probability distributions. We often describe their probability distributions using an equation or graph rather than a table since it is impossible to list all of the values in the range of a continuous random variable. They will be the subject of the next chapter.

## 7.1 Exercises

### Basic Concepts

1. What is a random variable?
2. What is a probability distribution?
3. Do all random variables have probability distributions?
4. Explain the concept of an “empirical law”.
5. What are the two types of random variables discussed in this section? What distinguishes the two types?
6. What is the difference between randomness and uncertainty?
7. What is the difference between a probability distribution function and a probability model?
8. Discrete probability distributions always have two characteristics; what are they?
9. What is the value of describing a random variable with a probability distribution?
10. Identify three different ways to express possible values of a random variable along with their associated probabilities.
11. How is a probability distribution created?
12. What is a probability distribution function?

13. Describe what methods Fat the Butch could have used to develop a probability distribution for the game he was playing. What about Pascal and Fermat?
14. How are subjective probabilities usually expressed? Give an example.
15. Sabine Hossenfelder, the particle physicist and YouTube content creator with 850,000+ subscribers, mentioned in one of her videos that with respect to quantum mechanics the only way you can see the “wave function” of a particle is through its probability distribution. How do you see a probability distribution?

## Exercises

16. Classify the following as either a discrete random variable or a continuous random variable.
  - a. The number of pages in a standard math textbook.
  - b. The amount of electricity used daily in a home.
  - c. The number of customers entering a restaurant in one day.
  - d. The time spent daily on the phone after supper by a teenager.
  - e. Campers at a state park over Labor Day weekend.
17. Classify the following as either a discrete random variable or a continuous random variable.
  - a. The speed of a train.
  - b. The possible scores on the SAT exam.
  - c. The number of pizzas eaten on a college campus each day.
  - d. The daily takeoffs at Chicago’s O’Hare Airport.
  - e. The highest temperatures in Maine and Florida tomorrow.
18. Classify the following as either a discrete random variable or a continuous random variable.
  - a. The number of emergency phone calls received per day by a local fire department.
  - b. The speed of pitches of major league baseball pitchers.
  - c. The weight of a lobster caught in Maine.
  - d. The number of defective circuits on a computer chip.
  - e. The time it takes for a 5-year battery to die.
19. Classify the following as either a discrete random variable or a continuous random variable.
  - a. The total points scored per football game for a local high school team.
  - b. The daily price of a stock.
  - c. The interest rate charged by local banks for 30-year mortgages.
  - d. The number of times a backup of the computer network is performed in a month.
  - e. The amount of sugar imported by the U.S. in a day.

20. Determine whether or not the following distribution is a probability distribution. If the distribution is not a probability distribution, give the characteristic which is not satisfied by the distribution.

$x$	1	2	3
$P(X = x)$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{1}{3}$

21. Determine whether or not the following distribution is a probability distribution. If the distribution is not a probability distribution, give the characteristic which is not satisfied by the distribution.

$x$	-2	2	3
$P(X = x)$	0.25	0.50	0.25

22. Tell whether or not the following distribution is a probability distribution. If the distribution is not a probability distribution, give the characteristic which is not satisfied by the distribution.

$x$	2	3	4	5
$P(X = x)$	0.30	-0.50	0.50	0.70

23. Determine whether or not the following distribution is a probability distribution. If the distribution is not a probability distribution, give the characteristic which is not satisfied by the distribution.

$x$	5	10	15
$P(X = x)$	0.46	0.25	0.25

24. Determine whether or not the following distribution is a probability distribution. If the distribution is not a probability distribution, give the characteristic which is not satisfied by the distribution.

$x$	-10	-5	3	8
$P(X = x)$	0.18	0.39	0.08	0.35

25. Determine whether or not the following distribution is a probability distribution. If the distribution is not a probability distribution, give the characteristic which is not satisfied by the distribution.

$x$	100	200	300
$P(X = x)$	-0.10	0.50	0.50

26. Determine whether or not the following distribution is a probability distribution. If the distribution is not a probability distribution, give the characteristic which is not satisfied by the distribution.

$$P(X = x) = \frac{x}{16}, \text{ for } x = 1, 2, 3, 4, 5$$