

6.1 Discrete Random Variables

Learning Objectives:

1. Compute probabilities using the probability distribution of a discrete random variable.
2. Calculate and interpret the mean (expected value) of a discrete random variable.
3. Calculate and interpret the standard deviation of a discrete random variable.
4. Compute probabilities using the probability distribution of certain continuous random variables.

Vocabulary: random variable, probability distribution, discrete random variables, mean of a discrete random variable, expected value, standard deviation of an random variable, continuous random variable

What is a random variable? Give some examples.

What is a probability distribution?

What is a **discrete** random variable? Give some examples.

Alternate Example: *How many languages?*

Imagine selecting a U.S. high school student at random. Define the random variable X = number of languages spoken by the randomly selected student. The table below gives the probability distribution of X , based on a sample of students from the U.S. Census at School database.

Languages:	1	2	3	4	5
Probability:	0.630	0.295	0.065	0.008	0.002

(a) Show that the probability distribution for X is legitimate.

(b) Make a histogram of the probability distribution. Describe what you see.

(c) What is the probability that a randomly selected student speaks at least 3 languages? More than 3?

Alternate Example: *Roulette*

One wager players can make in Roulette is called a “corner bet.” To make this bet, a player places his chips on the intersection of four numbered squares on the Roulette table. If one of these numbers comes up on the wheel and the player bet \$1, the player gets his \$1 back plus \$8 more. Otherwise, the casino keeps the original \$1 bet. If X = net gain from a single \$1 corner bet, the possible outcomes are $x = -1$ or $x = 8$. Here is the probability distribution of X :

Value:	-\$1	\$8
Probability:	34/38	4/38

If a player were to make this \$1 bet over and over, what would be the player’s average gain?

Read 350–352

How do you calculate the **mean (expected value)** of a discrete random variable? Is the formula on the formula sheet?

How do you interpret the mean (expected value) of a discrete random variable?

Alternate Example: Calculate and interpret the mean of the random variable X in the languages example on the previous page.

Does the expected value of a random variable have to equal one of the possible values of the random variable? Should expected values be rounded?

6.1 Discrete & Continuous Random Variables

Read 352–354

Suppose that X is a discrete random variable with probability distribution to the right, and μ_x is the mean of X .

Value	x_1	x_2	x_3	...
Probability	p_1	p_2	p_3	...

Variance of X :

Standard Deviation of X :

Are these formulas on the formula sheet?

How do you interpret the standard deviation of a discrete random variable?

Use a **calculator** to calculate and interpret the standard deviation of X in the languages example....

Are there any dangers to be aware of when using the calculator to find the mean and standard deviation of a discrete random variable?

Read 355–358

What is a **continuous random variable**? Give some examples.

Is it possible to have a shoe size = 8? Is it possible to have a foot length = 8 inches?

How many possible foot lengths are there? How can we graph the distribution of foot length?

How do we find probabilities for continuous random variables?

For a continuous random variable X , how is $P(X < a)$ related to $P(X \leq a)$?

Alternate Example: *Weights of Three-Year-Old Females*

The weights of three-year-old females closely follow a Normal distribution with a mean of $\mu = 30.7$ pounds and a standard deviation of $\sigma = 3.6$ pounds. Randomly choose one three-year-old female and call her weight X .

(a) Find the probability that the randomly selected three-year-old female weighs at least 30 pounds.

(b) Find the probability that a randomly selected three-year-old female weighs between 25 and 35 pounds.

(c) If $P(X < k) = 0.8$, find the value of k .

HW page 360 (14, 18, 19, 23, 25, 27–30)