

L8. Expected Value and Variance of Discrete Random Variables

Example 1

Let X be a random variable with the following probability mass function.

x	-2	-1	0	1	2
$f(x)$	0.2	0.4	0.1	0.2	0.1

- Determine the expected value of X .
- Determine the variance of X .
- What is the standard deviation of X ?

Solution

Example 2

In a semiconductor manufacturing process, three wafers from a lot are tested. Each wafer is classified as pass or fail. Assume that the probability that a wafer passes the test is 0.8 and that wafers are independent.

- a. Determine the probability mass function of the number of wafers from a lot that pass the test.
- b. Determine $E[X]$ and interpret it in the context of the problem.
- c. Determine $V[X]$ and $S[X]$.

Solution

Example 3

An assembly consists of two mechanical components. Suppose that the probabilities that the first and second components meet specifications are 0.95 and 0.98, respectively. Assume that the components are independent.

- a. Determine the probability mass function of the number of components in the assembly that meet specifications.
- b. Determine $E[X]$ and interpret it in the context of the problem.
- c. Determine $V[X]$ and $S[X]$.

Solution

Example 4

An urn contains 11 chips; 3 are white, 3 are red, and 5 are black. Take 3 chips out of the urn at random, and without replacement. You win \$1 for each red chip that you get and lose a \$1 for each white that you get in your selection. Let X represent the amount of money that you win.

- a. Determine the mass function of X .
- b. Determine $E[X]$ and interpret it in the context of the problem.
- c. Determine $V[X]$ and $S[X]$.

Solution