Mean and Variance of a Discrete Random Variable

Combining probabilities and the associated values that could be obtained results to a quantity called the *mathematical expectation* or *expected value*, the weighted mean of the values with their corresponding probabilities as the weights. A measure of the variability, dispersion, or spread of the values is the *variance*, the sum of the squared deviations of these values from their expected value. The positive square root of the variance is the *standard deviation* of the values.

Given a discrete random variable X with probability mass function,

x	x_1	x_2	. . .	x_k
$p(x)$	$p(x_1)$	$p(x_2)$	. . .	$p(x_k)$

the mean and variance of X can be obtained from the formulas below.

Pop-Up!

The *mean* of X is given by $\mu_X = \sum_{i=1}^{k} x_i \cdot p(x_i)$.

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The following are some important points to remember in relation to the mean and variance of a discrete random variable.

1. The mean of a random variable X (that is, the expected value) is a measure of the center of the possible values of X. It is actually the weighted mean of these values of X, with $p(x_i)$ as the weight assigned to the value x_i. The mean of a random variable X need not be one of its mass points.
2. The positive square root of the variance of a random variable is called its *standard deviation*.

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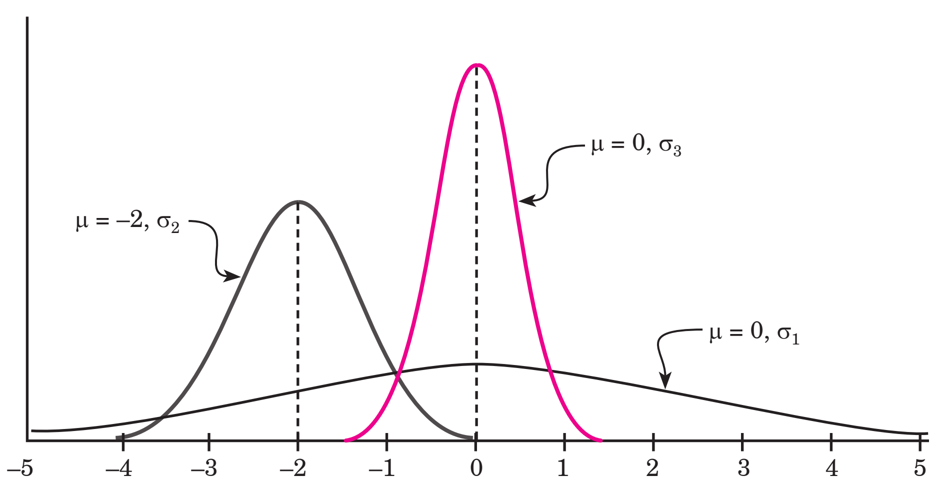

Figure 6.2 Varying Levels of Variability, $\sigma_1 > \sigma_2 > \sigma_3$

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$$\sigma_X = \sqrt{\frac{18}{7}} = \frac{\sqrt{126}}{7} \approx 1.6036.$$

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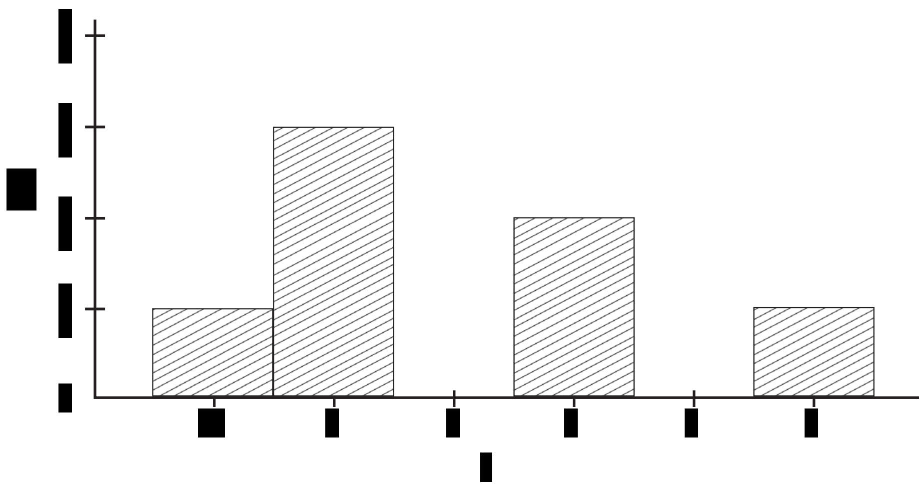

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