

5.3 Expected Value and Variance

(59)

* The expected value of a discrete random variable is

$$E(x) = \mu = \sum x f(x)$$

where x is a random variable

$f(x)$ is the probability of x .

* The expected value or mean of a random variable is a measure of the central location for the random variable.

* The expected value $E(x)$ is a weighted average for the values of the random variable x .

* The variance of a discrete random variable is

$$\text{Var}(x) = \sigma^2 = \sum (x - \mu)^2 f(x) \quad \text{where}$$

$\mu = E(x)$ is the expected value of x .

* The standard deviation of a discrete random variable

is $\sigma = \sqrt{\sigma^2}$

Example (Q15 page 196) Consider the following probability distribution for the random variable x

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x	$f(x)$
3	0.25
6	0.50
9	0.25

(a) Compute $E(x)$, the expected value of x .

(b) Compute σ^2 , the variance of x .

(c) Compute σ , the standard deviation of x .

x	$f(x)$	$x f(x)$	$x - \mu$	$(x - \mu)^2$	$(x - \mu)^2 f(x)$
3	0.25	$(3)(0.25) = 0.75$	$3 - 6 = -3$	9	$(9)(0.25) = 2.25$
6	0.50	$(6)(0.50) = 3$	$6 - 6 = 0$	0	$(0)(0.50) = 0$
9	0.25	$(9)(0.25) = 2.25$	$9 - 6 = 3$	9	$(9)(0.25) = 2.25$
		$\mu = 6$			
					$\sigma^2 = 5$

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a) $E(x) = \sum x f(x)$

$$= (3)(0.25) + (6)(0.50) + (9)(0.25)$$

$$= 0.75 + 3 + 2.25$$

$$= 6$$

b) $\sigma^2 = \sum (x - \mu)^2 f(x) = 5$

c) $\sigma = \sqrt{5}$