Discrete Random Variables 1

STAT-S520

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(continued)

Properties of the expected value and variance

This is a new random variable

Let X, Y be random variables and a, b scalars (constant values).

- $E(a + X) = a + EX$
- $E(bX) = bEX$
- $E(X + Y) = EX + EY$

If in addition, X and Y are independent:

- $Var(a + X) = VarX$
- $Var(bX) = b^2 \cdot VarX$
- $Var(X + Y) = VarX + VarY$

$Var(-X) = Var((-1) \cdot X)$

$= (-1)^2 Var X$

Exercise 5

Let X, Y be independent random variables with $EX = 1$, $EY = 2$, $VarX = 4$, $VarY = 9$. Find the expected value and variance of $(2X + 1)$ and $(X - Y)$

$$E(2X+1) = E(2X) + 1 = 2EX + 1 = 2 \cdot 1 + 1 = 3$$

$$Var(2X+1) = Var(2X) = 2^2 \cdot Var\,X = 4 \cdot 4 = 16$$

$$E(X-Y) = EX - EY = 1 - 2 = -1$$

$$Var(X-Y) = Var(X + (-1)Y)$$

$$= Var\,X + Var[(-1)Y] =$$

$$= Var\,X + (-1)^2 Var\,Y$$

$$= 4 + 9 = 13$$

$Var(X-Y) = Var(X+Y)$

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