Stat 260 Lecture Notes
Set 9 - Expected Value

Let X be a random variable. The *expected value* of X, denoted $E(X)$, is the long-run theoretical average value of X.

Example 1: Suppose we had a population of values:

$$2, \quad 4, \quad 6, \quad 6, \quad 4, \quad 4, \quad 2, \quad 3, \quad 5, \quad 5$$

Find the population mean and find the pmf for this distribution.

Definition: Let X be a discrete random variable with pmf $f(x)$. The *expected value* or *mean value* of X is given by

$$\mu = E(X) = \sum_{\text{all } x} x \cdot f(x) = \sum_{\text{all } x} x \cdot P(X = x)$$

Note: Sometimes we write μ_X to clarify that we are talking about the r.v. X.

Example 2: A one-year life insurance policy of \$250,000 is sold to an 18 year old person for \$350. According to Vital Statistics, the probability that an 18 year old will live another year is 0.998936. What is the expected value of the policy to the life insurance company?

We can find the expected value for a function of X.

Example 3: Suppose we have the discrete random variable X with pmf:

x	25	45	65
$f(x)$	1/2	1/3	1/6

(a) Find $E(X)$.

(b) Find $E(X^2)$.

(c) Find $E(X^2 + 5)$.

Notice then that for $g(x)$ (a function of the r.v. X) we have that $E(g(x)) = \sum_{\text{all } x} g(x) \cdot f(x)$.