

Chapter 4
Probability Distributions
Putting probability &
distributions
together

Random variable-a variable usually represented by x that has a single numerical value, determined by chance, for each outcome of a procedure

Ex: x is the number tails out of 5 coin flips

0, 1, 2, 3, 4, 5

A probability distribution is a graph, or table, that gives the probability for each value of the random variable.

The sum of all the probabilities in the table is 1 and each probability must be between 0 and 1.

Criteria for Prob. Dist.

$$1. \sum p(x) = 1$$

$$2. 0 \leq p(x) \leq 1$$

Ch 4 A discrete random variable has either a finite number of values or countable number of values

A continuous random variable has infinitely many values and those values are associated with measurements

Discrete vs. continuous random variables

X is the height of a basketball player

X is the number of cookies left in the bag

Mean : $\mu = \sum (x \cdot p(x))$
(expected value)

Standard deviation : $\sigma = \sqrt{\sum (x^2 \cdot p(x)) - \mu^2}$

Determine whether a probability distribution is given. If it is a probability distribution, find the mean and std dev. If it's not, explain why not.

X	0	1	2	3
P(X)	.3	.2	.1	.4

Valid?
 $\sum p(x) = 1 \checkmark$
each
 $0 \leq p(x) \leq 1 \checkmark$

$$\mu = \sum (x \cdot p(x)) = 0(.3) + 1(.2) + 2(.1) + 3(.4) = 1.6$$

$$\sigma = \sqrt{0^2(.3) + 1^2(.2) + 2^2(.1) + 3^2(.4) - 1.6^2} = 1.3$$

Tommy was charged \$50 for a flight/life insurance policy worth \$5000. Because planes do not usually crash etc, the prob of Tommy surviving his flight is .9952.

A) From Tommy's perspective, make a probability distribution.

X	-\$50	\$4950
P(x)	.9952	.0048

$5000 - 50 = \text{net amount}$

X: money that Tommy gains or loses

B) What is Tommy's expected value? (one decimal place)

$$\mu = (-50)(.9952) + (4950)(.0048)$$

$$\mu = \$-26$$

In Illinois pick 3 game, you pay \$0.50 to select a sequence of 3 digits. If you win by selecting the same sequence of digits that are drawn you collect \$250.

a) Make a probability distribution.

X	-\$.50	\$249.50
P(X)	999/1000	1/1000

X : money won or lost

b) What is the expected value?

$$\mu = (-.50)\left(\frac{999}{1000}\right) + \$249.50\left(\frac{1}{1000}\right) \frac{10 \cdot 10 \cdot 10}{1000}$$
$$\mu = \$-.25$$

Suppose you roll two dice. The game costs \$2 to play. if you roll a prime number, you win \$5. If you roll a 12, you win \$10. Otherwise, you win nothing.

Make a probability distribution.

X	-\$2	\$3	\$8
P(X)	$\frac{20}{36}$	$\frac{15}{36}$	$\frac{1}{36}$

X : money won or lost

$$\mu = (-2)\left(\frac{20}{36}\right) + (3)\left(\frac{15}{36}\right) + 8\left(\frac{1}{36}\right)$$

$$\mu = \$.36$$