8.1: Distributions of Random Variables

A random variable is a rule that assigns a number to each outcome of a sample space.

EXAMPLE 1. *Let X be the number of girls in a three-child family.*

$$S = \{\text{bbb}, \text{bbg}, \text{bgb}, \text{gbb}, \text{ggb}, \text{gbg}, \text{bgg}, \text{ggg}\}$$

(a) *What are the values of the random variable X?*

(c) *Give the probability distribution for X.*

TYPES OF RANDOM VARIABLES:

- **Finite Discrete** Random Variable that assumes only a finite number of values. (You can write ALL possible values of the random variable that stops.)
- **Infinite Discrete** Random Variable takes on infinitely many values, which may be arranged in a sequence. (You can write all possible values of a random variable in a list of numbers that has a pattern and goes on forever.)
- **Continuous Random** Variable may assume an interval of real numbers.

EXAMPLE 2. *Classify these random variables. Give the values of the random variable (domain).*

(a) *Three cards are drawn from a standard deck of 52. Let X be the random variable denoting the number of diamonds that are drawn. What is the domain of X?*

(b) *A bag contains 3 red, 6 blue, and 4 white marbles. Marbles are drawn one at a time without replacement until a red one is drawn. Let X be the random variable denoting the number of marbles drawn in one trial of this experiment.*

(c) *Let X be the number of times you roll a dice until a 4 appears.*

(d) *Let X denote the number of minutes a person waits (in one particular day) in line to pull football tickets.*

EXAMPLE 3. *Two cards are drawn from a well-shuffled deck of* 52 *playing cards. Let* X *denote the number of aces drawn. Find* $P(X = 2)$.

DEFINITION 4. *A* ***histogram*** *is a way to present the probability distribution of a discrete random variable.*

EXAMPLE 5. *The probability distribution of the random variable* X *is shown:*

x	1	2	3	4	5	6
$P(X = x)$	0.1	0.2	0.3	0.2	0.1	0.1

(a) *Draw the histogram for the random variable* X.

(b) *Compute* $P(X < 3)$

(c) $P(X \leq 4)$

(d) $P(1 < X \leq 6)$

EXAMPLE 6. *The following histogram (your teacher just drew :)) is only missing the rectangle at* $x = 6$.

(a) *Find* $P(X = 6)$

(b) *Give the probability distribution for* X.

(c) *Find* $P(2 \leq X < 5)$

EXAMPLE 7. *The rates paid by thirty financial institutions on a certain day for money-market deposit accounts are shown in the accompanying table:*

Rate, %	*6*	*6.25*	*6.55*	*6.56*	*6.58*	*6.60*	*6.65*	*6.85*
Institutions	*1*	*7*	*7*	*1*	*1*	*8*	*3*	*2*

Let the random variable X *denote the interest paid by a randomly chosen financial institution on its money-market deposit accounts. Find the probability distribution associated with these data.*