

## 5.1 & 5.2 Random Variables

**Probability Distributions** are like relative frequency tables and similar to histograms. They give the probability for each value of the random variable.

**Random Variable** is a variable ( $x$ ) that has a numeric value, determined by chance, for each outcome of an experiment.

Examples:

- $x$  The number of students passing a certain class
- $x$  The number of girls in a family of 5 children
- $x$  The sum on the faces of two rolled die
- $x$  The number of defective parts in a sample of 20

**Figure 5-1 on page 204** shows a frequency table used to collect outcomes of rolling a die (from chapters 2 and 3) and another table that shows probabilities of each outcome (from chapter #4) and then the probability distribution that would be used in this chapter.

**A Discrete Random Variable** has either a finite or countable number of values. (This chapter deals with discrete random variables.)

**A Continuous Random Variable** has infinitely many ways, and those can be associated with measurements on a continuous scale in such a way that there are no gaps or interruptions.

Discrete random variable vs Continuous random variable #5 Page 214

### **Probability Distribution Requirements**

Sum of probabilities approx. =1 or  $\sum P(x) = 1$   
Each entry is valid probability number or  $0 \leq P(x) \leq 1$

Probability Histogram is like Relative Frequency Histogram pg. 207

Determine whether or not a probability distribution is given in the following problems:

#7

#8

Mean, Variance, and Standard Deviation

$$\mu = \sum(x \cdot P(x))$$

$$\sigma^2 = \sum(x^2 P(x)) - \mu^2$$

\*\*Bad notation in text and on card  $\sigma = \sqrt{\sum(x^2 P(x)) - \mu^2}$

**\*\*Round-off rules** - one more place than original random variable  $x$

Work Through #7 Genetic Disorder

X	P(X)	.....	.....	.....
0	0.125			
1	0.375			
2	0.375			
3	0.125			

#10 - Number of babies with green eyes

X	P(X)	.....	.....	.....
0	0.528			
1	0.360			
2	0.098			
3	0.013			
4	0.001			
5	0+			

**IDENTIFYING UNUSUAL RESULTS WITH THE RANGE RULE OF THUMB**

maximum usual value =  $\mu + 2\sigma$

minimum usual value =  $\mu - 2\sigma$

\*\*\* Use the range rule of thumb to identify the unusual values in the problems from the preceding page.

#7

#10

Expected Value Games of chance, Life insurance ...  $E = \sum(x \cdot P(x))$

Expected value represents the mean value of the outcomes. It is the value you would expect if the trials could go on indefinitely. Expected value

#30 Page 217 Life Insurance Problem

	...x...	P(x)	x P(x)
Lives for a year			
Dies during the year			

#26 Page 217 New Jersey's Pick 4 Game

	...x...	P(x)	x P(x)
Win			
Loose			

### EXPECTED VALUE OF A GAME

You pay \$5 to play this game. Each time you play, pull a marble out of a jar, and the house pays you \$2 for a red marble, \$4 for a green marble, \$6 for a blue marble and \$8 for yellow. There are 8 red, 4 green, 16 blue and 4 yellow marbles in the jar. Find the expected value of this game (with replacement). Is it fair?

Color				
x				
P(x)				