

2. A discrete random variable is a random variable that has either a finite number of possible values or a countable number of possible values. The values of a discrete random variable can be plotted on a number line with space between the points. A continuous random variable is a random variable that has an infinite number of possible values that are not countable. The values of a continuous random variable can be plotted on a line in an uninterrupted fashion. Examples will vary.

9. (a) The amount of rain in Seattle during April is a continuous random variable because the amount of rain is measured. If we let the random variable  $R$  represent the amount of rain, the possible values for  $R$  are all nonnegative real numbers; that is,  $r \geq 0$ .
- (b) The number of fish caught during a fishing tournament is a discrete random variable because the value of the random variable results from counting. If we let the random variable  $X$  represent the number of fish caught, the possible values of  $X$  are  $x = 0, 1, 2, \dots$
- (c) The number of customers arriving at a bank between noon and 1:00 P.M. is a discrete random variable because the value of the random variable results from counting. If we let the random variable  $X$  represent the number of customers arriving at the bank between noon and 1:00 P.M., the possible values of  $X$  are  $x = 0, 1, 2, \dots$
- (d) The time required to download a file from the Internet is a continuous random variable because time is measured. If we let the random variable  $T$  represent the time required to download a file, the possible values of  $T$  are all positive real numbers; that is,  $t > 0$ .

12. Yes, because  $\sum P(x) = 1$  and  $0 \leq P(x) \leq 1$  for all  $x$ .

15. No, because  $\sum P(x) = 0.95 \neq 1$ .

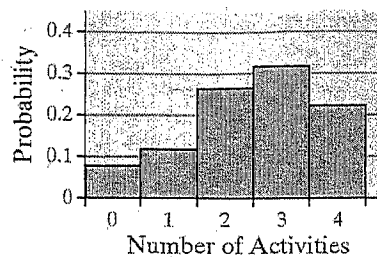
18. We need the sum of all the probabilities to equal 1. For the given probabilities, we have  $0.30 + 0.15 + 0.20 + 0.15 + 0.05 = 0.85$ . For the sum of the probabilities to equal 1, the missing probability must be  $1 - 0.85 = 0.15$ . That is,  $P(2) = 0.15$ .

20. (a) This is a discrete probability distribution because all the probabilities are between 0 and 1 (inclusive) and the sum of the probabilities is 1.

(b)

Parental Involvement  
in School  
(child grades 6-8)

HW10 (2)



(c)  $\mu_x = \sum [x \cdot P(x)] = 0(0.073) + 1(0.117) + \dots + 4(0.230) = 2.519 \approx 2.5$

On average, the number of activities that at least one parent of a 6-8<sup>th</sup> grader is involved in is expected to be about 2.5.

(d) 
$$\sigma_x^2 = \sum [(x - \mu_x)^2 \cdot P(x)]$$

$$= (0 - 2.519)^2 (0.073) + (1 - 2.519)^2 (0.117) + \dots + (4 - 2.519)^2 (0.230)$$

$$\approx 1.382 \text{ or about } 1.4$$

(e)  $\sigma_x = \sqrt{\sigma_x^2} = \sqrt{1.382} \approx 1.176 \text{ or about } 1.2.$

(f)  $P(3) = 0.322$

(g)  $P(3 \text{ or } 4) = P(3) + P(4) = 0.322 + 0.230 = 0.552$

$$\begin{aligned}
 35. (a) \quad E(X) &= \sum x \cdot P(x) \\
 &= (15,000,000)(0.00000000684) + (200,000)(0.00000028) \\
 &\quad + (10,000)(0.000001711) + (100)(0.000153996) + (7)(0.004778961) \\
 &\quad + (4)(0.007881463) + (3)(0.01450116) + (0)(0.9726824222) \\
 &\approx 0.30
 \end{aligned}$$

After many \$1 plays, you would expect to win an average of \$0.30 per play. That is, you would lose an average of \$0.70 per \$1 play for a net profit of -\$0.70.

(Note: the given probabilities reflect changes made in April 2005 to create larger jackpots that are built up more quickly. It is interesting to note that prior to the change, the expected cash prize was still \$0.30)

- (b) We need to find the break-even point. That is, the point where we expect to win the same amount that we pay to play. Let  $x$  be the grand prize. Set the expected value equation equal to 1 (the cost for one play) and then solve for  $x$ .

$$\begin{aligned}
 E(X) &= \sum x \cdot P(x) \\
 1 &= (x)(0.00000000684) + (200,000)(0.00000028) \\
 &\quad + (10,000)(0.000001711) + (100)(0.000153996) + (7)(0.004778961) \\
 &\quad + (4)(0.007881463) + (3)(0.01450116) + (0)(0.9726824222) \\
 1 &= 0.196991659 + 0.00000000684x
 \end{aligned}$$

$$0.803008341 = 0.00000000684x$$

$$117,398,880.3 = x$$

$$118,000,000 \approx x$$

The grand prize should be at least \$118,000,000 for you to expect a profit after many \$1 plays.

(Note: prior to the changes mentioned in part (a), the grand prize only needed to be about \$100 million to expect a profit after many \$1 plays)

- (c) No, the size of the grand prize does not affect your chance of winning. Your chance of winning the grand prize is determined by the number of balls that are drawn and the number of balls that are picked from. The size of the grand prize will impact your expected winnings.