
SECTION 5.3 – Independence and the Multiplication Rule

Independent Events

Two events E and F are independent if the occurrence of event E in a probability experiment does not affect the probability of event F . Two events are dependent if the occurrence of event E in a probability experiment affects the probability of event F .

Multiplication Rule for Independent Events

If E and F are independent events, then

$$P(E \text{ and } F) = P(E) \cdot P(F)$$

Multiplication Rule for n Independent Events

If events $E_1, E_2, E_3, \dots, E_n$ are independent, then

$$P(E_1 \text{ and } E_2 \text{ and } E_3, \text{ and } \dots \text{ and } E_n) = P(E_1) \cdot P(E_2) \cdot P(E_3) \cdot \dots \cdot P(E_n)$$

☺ Exercises:

- 1) What is the probability of obtaining 4 fours in a row when rolling a fair, six-sided die?
- 2) Roll a standard die. Then flip a quarter. What is the probability that you get a '3' and 'tails'?
- 3) **Christmas Lights.** Christmas lights are often designed with a series circuit. This means that when one light burns out the entire string of lights goes black. Suppose that the lights are designed so that the probability a bulb will last 2 years is 0.995. The success or failure of a bulb is independent of the success or failure of other bulbs.
 - a) What is the probability that in a string of 100 lights all 100 will last 2 years?
 - b) What is the probability that at least one bulb will burn out in 2 years?
- 4) **Bowling.** In the game of bowling, a strike is a term used to indicate that all of the pins have been knocked down with the first ball of a frame. PBA Bowler Walter Ray Williams had a strike percentage of 66.35% for the 2007-08 season (the best ever in PBA competition). Based off this probability,
 - a) What is the probability that Walter gets a turkey?
(A turkey is throwing three strikes in a row)
 - b) A perfect game consists of 12 consecutive strikes totaling to a score of 300. What is the probability that Walter bowls a perfect game?
 - c) What is the probability that Walter gets at least one strike in 12 throws?

