

## Section 5.3

Independence and the  
Multiplication Rule

## Definitions

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 (Independent Events)

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

Note: Can have more than two events

## 1. Using the formula

E and F are independent. If  $P(E) = 0.5$  and  $P(F) = 0.3$ . What is the  $P(E \text{ and } F)$ ?

## Notation

$P(A \text{ and } B) = P(\text{event A occurs in a } 1^{\text{st}} \text{ trial and event B occurs in a } 2^{\text{nd}} \text{ trial})$

## 2. What is the probability

What is the probability of rolling a die and getting a 5 and flipping a coin and getting heads?

### 3. What is the probability

Given the probability that you are going to die from cancer (versus other causes) is 0.23, what is the probability that four people picked at random are going to die from cancer?

### 4. What is the probability

Given a standard deck of cards and we pick 3 cards out with replacement, what is the probability of getting 3 kings?

### 5. What is the probability

We are rolling a pair of dice, what is the probability that we get a total of seven (counting the dots) 4 times in a row?

### At-Least One Probabilities

Form: Find probability of at least one {something} out of "n"

1. Write as:  $1 - P(\text{none } \{\text{something}\})$
2. Write as:  $1 - P(\text{all } \{\text{opposite of something}\})$
3. Write as:  $1 - P(\text{all } \{\text{opposite of something}\})^n$

### "At Least One" Rule & Complements

Find probability of none happening and then subtract from 1

Example: Out of 5 births, find the probability of at least getting one girl.

$P(\text{at least one girl in 5 births})$

$= 1 - P(\text{no girls in 5 births})$

$= 1 - P(\text{all boys in 5 births})$

$= 1 - (1/2)(1/2)(1/2)(1/2)(1/2)$

### 6. Find the probability

The test contains 25 multiple choice problems each with 4 parts, only one of which is right. You are guessing, what is the probability you will get at least one right?

### 7. Find the probability

The odds you will die from fireworks is 1 in 652,046. What is the probability that out of 5 people picked at random, at least one will die from fireworks?