

# **MAT 142: College Mathematics**

## **Lecture Notes: Chapter 14 (Part 2)**

### **14.3: Conditional Probability and Intersection of Events**

What is the probability of rolling two dice and obtaining a sum that is an odd number?

What is the probability of rolling a sum that is an odd number given that the sum is greater than 6?

#### **Conditional Probability**

##### **Definition:**

##### **Formulas:**

##### **Examples:**

1. Using a standard 52-card deck, find the probability that if you draw a card at random, it is a king given that the card is a face card.

2. Two events for the sum of two dice are:  $E$ =a total greater than nine  $F$ =the total is odd

a. Find  $P(E/F)$

b. Find  $P(F/E)$

3. Use the table below to answer the following:

	Has Mono	Doesn't	TOTALS
Positive	72	4	76
Negative	8	56	64
TOTALS	80	60	140

- a. Find the probability that a student chosen at random has mono, given that the test is positive.
  
  
  
  
  
  
  
  
  
  
- b. Find the probability that a student chosen at random does not have mono, given that the test is positive.
  
  
  
  
  
  
  
  
  
  
- c. Find the probability that the test is positive, given that the student has mono.

### Intersection of Two Events

#### Formula:

**Example:** Suppose that we draw two cards without replacement from a standard 52-card deck. What is the probability that both cards are red?

**Example Using Trees to Compute Probabilities:** A candidate for a driver's license is currently allowed to take a driving test three times before having to retake a preliminary written test. Some believe that candidates should only be given two attempts at the driving test before retaking the written test. Others believe that such a regulation is too harsh to those who now pass on their third attempt. From past history, 60% pass the driving test the first time, 75% pass on their second try, and only 30% who take it the third time pass.

a. What is the probability that a candidate will fail the test the first time and then pass the test on the second try?

b. What is the probability that a candidate will fail twice and pass the test on the third try?

### **Independent and Dependent Events**

#### **Definitions:**

**Example:** Assume we roll a pair of dice: Are the following events dependent or independent?

a.  $E$ =the total showing is greater than nine  $F$ =The total showing is even

b.  $E$ =A three shows on the first die  $F$ =the total showing is even

## 14.4: Expected Value

### What is Expected Value?

Sum of Two Dice: What is the expected value of the sum of two dice?

Outcomes	Probability
2	$1/36$
3	$2/36$
4	$3/36$
5	$4/36$
6	$5/36$
7	$6/36$
8	$5/36$
9	$4/36$
10	$3/36$
11	$2/36$
12	$1/36$

### Examples:

1. It costs two dollars to roll a pair of dice. If the number is odd, you win one dollar and if it is either double 1s or double 6s, you win five dollars. What is the expected value of the game? Is it fair?
2. It costs \$1 to play a lottery where the player chooses a 3-digit number between and including 000 and 999. If the number is selected that day, then the player wins \$500 (profit of \$499). Find the expected value of the game. Is the game fair? What should the price of a ticket be in order for the game to be fair?
3. Based on mortality tables, the probability of a 20-year-old male living to age 21 is 0.99. If a \$1,000 one-year term life insurance policy on a 20-year-old male costs \$25, what is its expected value?