MAT 142: College Mathematics
Lecture Notes: Chapter 14 (Part 1)

14.1: The Basics of Probability Theory

Definitions:

1. **Experiment**

2. **Outcomes**

3. **Sample Space**

4. **Event**

5. **Probability of an outcome**

6. **Probability of an event**

Basic Formulas/Ideas

1. **Empirical Assignment of Probabilities**

2. **Calculating Probabilities when Outcomes are Equally Likely**

3. **Calculating Probabilities when Outcomes are not Equally Likely**

4. **Basic Properties of Probability**

5. **Odds**

Examples:

1. **If we select a card at random from a 52-card deck, what is the probability that we draw a face card?**

2. **What are the odds against the event in #1?**

3. **If we toss three fair coins, what is the probability we get one tail and two heads?**

4. **In a town there are 1,512 people who support a new business coming to town while there are 2,268 who don't support it. What is the probability that a person chosen at random will support the business?**

5. **If 10 horses are racing and you randomly select three as your bet in the trifecta (picking the first three places in the proper order) what is the probability that you will win (assume that all the horses have the same chance of winning)?**

Application: Punnett Squares

***Sickle-cell anemia* is a serious inherited disease that is about 30 times more likely to occur in African American babies than in non-African American babies. A person with two *sickle-cell* genes will have the disease, but a person with only one sickle-cell gene will be a carrier of the disease. If two parents who are carriers of sickle-cell anemia have a child, what is the probability of each of the following?**

a. A child has sickle-cell anemia?

b. The child is a carrier?

c. The child is disease free.

14.2: Complements and Unions of Events

Definition: Complementary Events are 2 events which make up the whole sample space.

Computing the Probability of the Complement of an Event

Example: If there is a 1 in 4 chance that it will rain on Thanksgiving, what is the probability that it won't rain?

Definition: The union of two sets is all elements that are in either set.

Definition: The intersection of two sets is all elements that are in both sets.

Picture of the union and intersection of sets.

Computing the Probability of a Union of Two Events

Example: If P(A union B) = 0.6, P(B) = 0.45, and P(A intersect B) = 0.2, find P(A).

Example: If you draw a card from a 52-card deck, what is the probability that it is either a face card or a red card?

Example: Use the table containing information about income related to hours spent shopping on the Internet per month to answer the following questions:

Annual Income	**10 + Hours**	**3 – 9 Hours**	**0 – 2 Hours**	**TOTALS**
Above $60,000	192	176	128	**496**
$40,000 - $60,000	160	208	144	**512**
Below $40,000	128	192	272	**592**
TOTALS	**480**	**576**	**544**	**1600**

1. What is the probability that a consumer we select at random either spends 0 – 2 hours per month shopping on the Internet or has an annual income below $40,000?

2. What is the probability that a consumer we select randomly either spends ten or more hours per month shopping on the Internet or has an annual income between $40,000 and $60,000?

3. What is the probability that a consumer we select randomly neither spends more than two hours per month shopping on the internet nor has an annual income of $60,000 or less?