Sections 7.2 and 7.3

- Suppose we repeat an experiment \( n \) times and an event \( E \) occurs \( m \) of those times. Then \( \frac{m}{n} \) is called the relative frequency of the event \( E \).
- The probability of an event is a number between 0 and 1 that represents the likelihood of the event occurring. The larger the probability, the more likely the event is to occur.
- An event which consists of exactly one outcome is called a simple event of the experiment.
- The table that lists the probability of each outcome in an experiment is known as the probability distribution.
- For a uniform sample space with \( n \) outcomes the probability of each outcome is \( \frac{1}{n} \).
- To find the probability of an event \( E \), add the probabilities of the simple events of \( E \). Recall \( P(\emptyset) = 0 \) and \( P(S) = 1 \).
- Rules of Probability
  - \( P(E \cup F) = P(E) + P(F) - P(E \cap F) \)
  - If \( E \) and \( F \) are mutually exclusive, then \( P(E \cap F) = 0 \)
  - \( P(E) = 1 - P(E^c) \)

1. An experiment consists of randomly selecting a sample of 2 chips from a bowl containing 3 chips numbered 1 through 3 and observing the numbers.
   
   (a) Find the sample space
   
   (b) Find the simple events associated with the experiment.

2. A marble is selected at random from a bowl containing 3 blue, 6 yellow, and 8 orange marbles and the color is observed.
   
   (a) Find the sample space for this experiment.
   
   (b) Find the probability distribution for this experiment.
   
   (c) Find the event \( E \) where \( E \) is the event that the marble drawn is not orange.
   
   (d) What is \( P(E) \)?

3. For a particular experiment the sample space is \( S = \{d, e, f, g, h\} \) with the following probability distribution table.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.25</td>
</tr>
</tbody>
</table>

If \( A = \{d, e, f\} \), \( B = \{d, g, h\} \), and \( C = \{g, h\} \) are events of the experiment,

(a) what is the probability of \( A \)?

(b) what is the probability of \( A \cap C \)?

(c) what is the probability of \( B \cup C^c \)?

4. Two fair six-sided dice are rolled.

(a) What is the probability that at least one 5 is rolled?

(b) What is the probability that the sum of the numbers is even?

(c) What is the probability that at least one 6 is rolled and the sum is at least 9?

(d) What is the probability that the sum is at least 10 or exactly 1 six is rolled?

5. A survey was done of students in which both their age and the number of pieces of candy they ate on Halloween was observed. The following results were obtained:

<table>
<thead>
<tr>
<th>Under 18</th>
<th>0 pieces</th>
<th>1 – 10 pieces</th>
<th>&gt; 10 pieces</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>30</td>
<td>45</td>
<td>80</td>
</tr>
<tr>
<td>18 – 20</td>
<td>20</td>
<td>50</td>
<td>40</td>
<td>110</td>
</tr>
<tr>
<td>Over 20</td>
<td>25</td>
<td>75</td>
<td>60</td>
<td>160</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>155</td>
<td>145</td>
<td>350</td>
</tr>
</tbody>
</table>

(a) What is the probability that a student selected at random was under 18 and ate more than 10 pieces of candy?

(b) What is the probability that a student selected at random ate 10 or fewer pieces of candy?

(c) What is the probability that a student selected at random was over 20 or ate at least one piece of candy?

6. A survey was conducted of 80 freshmen. It was found that 50 students play intramural soccer, 60 students play intramural basketball, and 10 students play neither of the two sports. If a student is selected at random, what is the probability that they play exactly one of the two sports?

Section 7.4

- If \( S \) is a uniform sample space then \( P(E) = \frac{n(E)}{n(S)} \).

7. A bowl contains 30 red marbles, 15 green marbles, and 28 yellow marbles. An experiment consists of randomly selecting 5 marbles without replacement.

(a) What is the probability of selecting exactly 2 red marbles?

(b) What is the probability of selecting at least 1 green marble?

(c) What is the probability of selecting exactly 2 red marbles or exactly 2 yellow marbles?

8. Three cards are randomly selected from a deck of 52. What is the probability of selecting a pair (exactly two cards of the same rank)?

9. An exam consists of 5 true/false questions and 5 multiple choice questions each having 5 choices (of which only one is correct). If a student randomly guesses on each question, what is the probability that the student answers at least 4 true/false questions and at least 4 multiple choice questions correctly?

10. Five people are selected at random. What is the probability that at least two of the people in this group were born on the same day of the week? (Assume that being born on each day of the week is equally likely.)