1. Which of these describes equally likely outcomes?
   A. an outcome of odd and an outcome of even when a fair die is rolled
   B. each possible sum when two fair dice are rolled and the sum of the faces is recorded
   C. each possible number of heads when a fair coin is flipped twice
   D. recording a male and recording a female when a person is selected randomly from a classroom of 15 men and 10 women
   E. an outcome of odd and an outcome of even when a roulette wheel with 38 spaces numbered 1–36, 0, and 00 is spun (0 and 00 are even numbers.)

2. Which of these pairs of events for the stated action are mutually exclusive (disjoint)?
   A. Roll two dice: doubles; sum is 6.
   B. Randomly select a student in your school: the student is left-handed; the student is a junior.
   C. Randomly select a student in your school: the student is a class officer; the student takes an English course.
   D. Roll two dice: 6 on one die; sum is 5.
   E. Roll one die: a prime number; an even number.

3. Find the probability of getting one tail and three heads when you flip a fair coin four times.

4. If you roll two dice, what is the probability that the sum is 9?

5. In Hitense City, 35% of adults have high blood pressure or high cholesterol. One out of every four people has high blood pressure, and one out of every five has high cholesterol. Find the probability that a person chosen at random will have both high blood pressure and high cholesterol.

6. Optic City sells six brands of digital cameras. Each brand is available in 4, 6, or 10 megapixels.
   a. How many different digital cameras are sold by Optic City?
   b. Make a tree diagram showing all of the different cameras.

7. There are a total of 2.4 million drivers in the United States who own two-seater sports cars. Of them, 1.8 million are male, 2.1 million are single/divorced, and 1.6 million are male and single/divorced. What is the probability that a randomly selected driver of a two-seater sports car is male or single/divorced?
   a. Construct a two-way table showing this information, and then use it to answer this question.
   b. Use the Addition Rule to answer this question.
8. The proportion of households in the United States that own a cat is 0.34. Suppose you pick four households at random and count the number that own a cat. Describe how to use simulation to construct an approximate distribution for the situation described. Conduct two trials of your simulation using these random digits.

89254 99538 18315 45716 36270 79665 49830 06226
88863 02322 36630 07176 04011 70959 23449 62572
Chapter 5 | Quiz 2

Name ________________________________________ Date _____________________

1. If events $A$ and $B$ are independent and $P(A) = 0.3$ and $P(B) = 0.5$, then which of these is true?
   A. $P(A \text{ and } B) = 0.8$
   B. $P(A \text{ or } B) = 0.15$
   C. $P(A \text{ or } B) = 0.8$
   D. $P(A \mid B) = 0.3$
   E. $P(A \mid B) = 0.5$

For Questions 2 and 3, refer to this two-way table, which gives auto crash fatality data from the year 2002.

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Single Vehicle</th>
<th>Multiple Vehicles</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Related</td>
<td>10,741</td>
<td>4,887</td>
<td>15,628</td>
</tr>
<tr>
<td>Not Alcohol Related</td>
<td>11,345</td>
<td>11,336</td>
<td>22,681</td>
</tr>
<tr>
<td>Total</td>
<td>22,086</td>
<td>16,223</td>
<td>38,309</td>
</tr>
</tbody>
</table>

2. If a fatal auto crash is chosen at random, what is the approximate probability that the crash was alcohol related, given that it involved a single vehicle?
   A. 0.28
   B. 0.49
   C. 0.58
   D. 0.69
   E. The answer cannot be determined from the information given.

3. What is the approximate probability that a randomly chosen fatal auto crash involves a single vehicle and is alcohol related?
   A. 0.28
   B. 0.49
   C. 0.58
   D. 0.69
   E. The answer cannot be determined from the information given.

4. For all events $A$ and $B$, $P(A \text{ and } B) =$
   A. $P(A) \cdot P(B)$
   B. $P(B \mid A)$
   C. $P(A \mid B)$
   D. $P(A) + P(B)$
   E. $P(B) \cdot P(A \mid B)$
5. The mathematics department at a school has twenty instructors. Six are easy graders. Twelve are considered to be good teachers. Seven are neither. If a student is assigned randomly to one of the easy graders, what is the probability that the instructor will also be good?

A. \( \frac{7}{20} \)

B. \( \frac{5}{12} \)

C. \( \frac{7}{12} \)

D. \( \frac{5}{6} \)

E. The answer cannot be determined from the information given.

6. The management of Young & Sons Sporting Supply, Inc., is responding to a claim of discrimination. If the company has employed the 60 people in this table, how many females over the age of 40 must the company hire so that the age and sex of its employees are independent?

<table>
<thead>
<tr>
<th></th>
<th>( \leq 40 ) Years</th>
<th>( &gt; 40 ) Years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>25</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Medi-Mart has just come out with a new pregnancy test that registers blue (indicating a pregnancy) in 95% of users who are pregnant. However, the new test also registers blue in 5% of users who are not pregnant. Suppose that, in reality, only 4% of women using this test are pregnant.

a. Construct a table that reflects the situation.

b. What is the probability that a randomly selected woman who uses this test gets a blue result?

c. What is the probability that the woman is pregnant if the test registers blue?
Chapter 5  Test A

Name ______________________________  Date __________________

For Questions 1–4, answer true or false.

1. Two events, each with probability greater than 0, are mutually exclusive (disjoint). The probability that both occur on the same opportunity is 0.

2. Suppose you flip a fair coin and get five heads in a row. The probability that you will get a tail on the next flip is less than 0.5.

3. When sampling units randomly from a population with replacement, pairs of successive selections are independent.

4. If events A and B are disjoint, then they are independent.

Questions 5–9 refer to this study:

A researcher classified 1000 students according to both grade-point average (GPA) and the students’ participation in at least one school-related club. A student is chosen at random from this group.

<table>
<thead>
<tr>
<th>GPA</th>
<th>&lt; 2.0</th>
<th>2.0 to 3.0</th>
<th>&gt; 3.0</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Least One Club</td>
<td>60</td>
<td>110</td>
<td>220</td>
<td>390</td>
</tr>
<tr>
<td>No Club</td>
<td>190</td>
<td>350</td>
<td>70</td>
<td>610</td>
</tr>
<tr>
<td>Total</td>
<td>250</td>
<td>460</td>
<td>290</td>
<td>1000</td>
</tr>
</tbody>
</table>

5. What is the probability that a student chosen at random has a GPA greater than 3.0?
   A. 0.11  B. 0.22  C. 0.29  D. 0.39  E. 0.68

6. What is the probability that a student chosen at random has a GPA greater than 3.0 and joined at least one club?
   A. 0.22  B. 0.29  C. 0.39  D. 0.46  E. 0.68

7. What is the probability that a student chosen at random has a GPA greater than 3.0 or joined at least one club?
   A. 0.22  B. 0.29  C. 0.39  D. 0.46  E. 0.68

8. What is the approximate probability that a student chosen at random has a GPA greater than 3.0 given that he or she joined at least one club?
   A. 0.22  B. 0.46  C. 0.56  D. 0.68  E. 0.76

9. Are the events GPA greater than 3.0 and participated in at least one club independent?
   A. No, because \( P(\text{GPA greater than 3.0} \mid \text{participated in at least one club}) \neq P(\text{participated in at least one club}) \).
B. No, because \( P(\text{GPA greater than 3.0} | \text{participated in at least one club}) \neq P(\text{GPA greater than 3.0}) \).

C. Yes, because \( P(\text{GPA greater than 3.0} | \text{participated in at least one club}) \neq P(\text{participated in at least one club}) \).

D. Yes, because \( P(\text{GPA greater than 3.0} | \text{participated in at least one club}) \neq P(\text{GPA greater than 3.0}) \).

E. No, because there were many students with GPAs greater than 3.0 who participated in at least one club.

10. Suppose that among all U.S. students, 80% have gone to an amusement park and 45% have gone to a beach. Only 15% have done neither. If you select a student at random, what is the probability that the student has gone to the beach but not to an amusement park? Include a tree diagram or table that illustrates this situation.

11. A recent study reported that math instructors estimate that 70% of their students do homework regularly and that if a student does the homework regularly, she or he will have a 90% chance of passing the final exam. What is the probability that a student chosen at random will have done homework regularly and passed the math final exam?

12. Suppose that 2% of a clinic’s patients are known to have Lyme disease. A test is developed that is positive in 98% of patients with Lyme disease, but it is also positive in 3% of patients who do not have the disease. A patient is chosen at random from the clinic.

   a. Construct a table or draw a tree diagram that reflects the situation.
   b. What is the probability that the patient’s test comes out positive for Lyme disease?
   c. What is the probability that the person actually has Lyme disease given that the test comes out positive?

13. Complete this table so that the events survived and male are independent.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survived</td>
<td>650</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did Not Survive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1640</td>
<td>2000</td>
<td></td>
</tr>
</tbody>
</table>

14. The proportion of voters who voted for George W. Bush in the 2000 presidential election was approximately 0.48.

   a. Describe how to use these lines from a random digit table to simulate taking a sample of 10 people who voted in the 2000 presidential election and recording whether they voted for Bush.

   11805 05431 39808 27732 50725 68248
   83452 99634 06288 98083 13746 70078
   88685 40200 86507 58401 36766 67951

   b. Start at the beginning of the first line, take three samples of size 10, and compute the sample proportion for each sample. (Do not start a new line for each sample. Start where the previous sample finished.)
Chapter 5 Test B

For Questions 1–4, answer true or false.

1. The sample space for randomly selecting two people to form a team from a group of five people contains ten equally likely outcomes.
2. An event $A$ and its complement $\overline{A}$ must be mutually exclusive (disjoint).
3. If you roll two dice, all possible sums are equally likely.
4. If events $A$ and $B$ are independent, then $P(A \text{ and } B) = P(A) + P(B)$.

5. Armine and her friend Terry both hope to get an A in math this year. Their teacher estimates the probability that Armine gets an A is 0.7 and that Terry gets an A is 0.8. If the probability that one or both gets an A is 0.9, what is the probability that both get an A?
   A. 0.34  B. 0.56  C. 0.60  D. 0.90  
   E. We cannot determine the probabilities unless we know that Armine gets an A and Terry gets an A are independent events.

Questions 6–9 refer to this study:

A sociologist was interested in studying the relationship between how long an employee commutes and whether the employee works full- or part-time. This table shows that information for a total of 2000 employees. An employee is selected at random from this group.

<table>
<thead>
<tr>
<th>Commuting Time</th>
<th>Less Than 30 Minutes</th>
<th>Between 30 and 60 Minutes</th>
<th>Greater Than 60 Minutes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment Status</td>
<td>Part-Time</td>
<td>Full-Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>540</td>
<td>410</td>
<td>240</td>
<td>1220</td>
</tr>
<tr>
<td></td>
<td>440</td>
<td>260</td>
<td>110</td>
<td>780</td>
</tr>
<tr>
<td></td>
<td>950</td>
<td>700</td>
<td>350</td>
<td>2000</td>
</tr>
</tbody>
</table>

6. What is the probability that an employee chosen at random works full-time and commutes less than 30 minutes?
   A. 0.205  B. 0.39  C. 0.475  
   D. 0.66  E. 0.865

7. What is the probability that an employee chosen at random works full-time or commutes less than 30 minutes?
   A. 0.205  B. 0.39  C. 0.475  
   D. 0.66  E. 0.865

8. What is the probability that an employee chosen at random works part-time given that he or she commutes more than 60 minutes?
   A. 0.12  B. 0.20  C. 0.31  
   D. 0.69  E. 0.785
9. Are the events *commutes more than 60 minutes* and *works full-time* independent?
   A. No, because $P(\text{commutes more than 60 minutes} | \text{works full-time}) \neq P(\text{commutes more than 60 minutes})$.
   B. No, because $P(\text{commutes more than 60 minutes} | \text{works full-time}) \neq P(\text{works full-time})$.
   C. Yes, because $P(\text{commutes more than 60 minutes} | \text{works full-time}) \neq P(\text{commutes more than 60 minutes})$.
   D. Yes, because $P(\text{commutes more than 60 minutes} | \text{works full-time}) \neq P(\text{works full-time})$.
   E. No, because some full-time employees commute more than 60 minutes.

10. Suppose that the probability that a student selected at random takes statistics is 0.35, the probability that a student selected at random takes both statistics and biology is 0.19, and the probability that a student selected at random takes statistics but not biology is 0.17. Which of these is a proper conclusion?
   A. The probability that the student takes biology is 0.36.
   B. The probability that the student does not take biology is 0.21.
   C. The probability that the student takes statistics or biology is 0.71.
   D. The probability that the student takes biology but not statistics is 0.18.
   E. None of the above is true because the probabilities given in the question are contradictory.

11. A recent census found that 40% of students are against the idea of requiring students to carry identification cards (IDs) on campus. Of those against the ID requirement, 60% were seniors, 30% were juniors, and the remaining 10% were underclassmen (freshmen and sophomores). Of those in favor of IDs, 20% were seniors and 50% were underclassmen.
   a. Construct a table or draw a tree diagram that summarizes this situation.
   b. What is the probability that a student chosen at random is a senior?
   c. What is the probability that a senior chosen at random is in favor of the ID requirement?

12. Consider a screening test for Rocky Mountain Fever that has reasonably good specificity and sensitivity: Of people who have the illness, 95% get a positive result on the test, and of people who do not have the illness, 92% get a negative result on the test. Now consider Rockytown, which has a population of 10,000 people; in the town, 100 people have Rocky Mountain Fever.
   a. Fill out a table or draw a tree diagram to show how the test would perform if you used it to screen the residents of Rockytown.
   b. Compute the positive predictive value (probability of having the disease given the test is positive).
   c. Compute the negative predictive value (probability of not having the disease given the test is negative).
   d. Comment on these rates and what they mean for the usefulness of the test.
13. The proportion of 18-year-olds who are registered to vote is approximately 15%.
   a. Describe how to use the following lines from a random digit table to simulate taking a sample of ten 18-year-olds and recording whether they are registered to vote.
      15474  45266  95270  79953  59367  83848
      94557  28573  67897  54387  54622  44431
      42481  16213  97344  08721  16868  48767
   b. Start at the beginning of the first line, take three samples of size 10, and compute the sample proportion for each sample. (Do not start a new line for each sample. Start where the previous sample finished.)