Review of Key Concepts

6.1 Basic Probability Concepts
Refer to the Key Concepts on page 311.

1. A bag of marbles contains seven whites, five blacks, and eight cat's-eyes. Determine the probability that a randomly drawn marble is
   a) a white marble
   b) a marble that is not black

2. When a die was rolled 20 times, 4 came up five times.
   a) Determine the empirical probability of rolling a 4 with a die based on the 20 trials.
   b) Determine the theoretical probability of rolling a 4 with a die.
   c) How can you account for the difference between the results of parts a) and b)?

3. Estimate the subjective probability of each event and provide a rationale for your decision.
   a) All classes next week will be cancelled.
   b) At least one severe snow storm will occur in your area next winter.

6.2 Odds
Refer to the Key Concepts on page 317.

4. Determine the odds in favour of flipping three coins and having them all turn up heads.

5. A restaurant owner conducts a study that measures the frequency of customer visits in a given month. The results are recorded in the following table.

Number of Visits	Number of Customers
1	4
2	6
3	7
4 or more	3

Based on this survey, calculate
   a) the odds that a customer visited the restaurant exactly three times
   b) the odds in favour of a customer having visited the restaurant fewer than three times
   c) the odds against a customer having visited the restaurant more than three times

6.3 Probabilities Using Counting Techniques
Refer to the Key Concepts on page 324.

6. Suppose three marbles are selected at random from the bag of marbles in question 1.
   a) Draw a tree diagram to illustrate all possible outcomes.
   b) Are all possible outcomes equally likely? Explain.
   c) Determine the probability that all three selected marbles are cat's-eyes.
   d) Determine the probability that none of the marbles drawn are cat's-eyes.

7. The Sluggers baseball team has a starting line-up consisting of nine players, including Tyrone and his sister Amanda. If the batting order is randomly assigned, what is the probability that Tyrone will bat first, followed by Amanda?

8. A three-member athletics council is to be randomly chosen from ten students, five of whom are runners. The council positions are president, secretary, and treasurer. Determine the probability that
   a) the committee is comprised of all runners
   b) the committee is comprised of the three eldest runners
   c) the eldest runner is president, second eldest runner is secretary, and third eldest runner is treasurer

6.4 Dependent and Independent Events

Refer to the Key Concepts on page 333.

9. Classify each of the following pairs of events as independent or dependent.

	First Event	Second Event
a)	Hitting a home run while at bat	Catching a pop fly while in the field
b)	Staying up late	Sleeping in the next day
c)	Completing your calculus review	Passing your calculus exam
d)	Randomly selecting a shirt	Randomly selecting a tie

10. Bruno has just had job interviews with two separate firms: Golden Enterprises and Outer Orbit Manufacturing. He estimates that he has a 40% chance of receiving a job offer from Golden and a 75% chance of receiving an offer from Outer Orbit.

a) What is the probability that Bruno will receive both job offers?

b) Is Bruno applying the concept of theoretical, empirical, or subjective probability? Explain.

11. Karen and Klaus are the parents of James and twin girls Britta and Kate. Each family member has two shirts in the wash. If a shirt is pulled from the dryer at random, what is the probability that the shirt belongs to

a) Klaus, if it is known that the shirt belongs to one of the parents?

b) Britta, if it is known that the shirt is for a female?

c) Kate, if it is known that the shirt belongs to one of the twins?

d) Karen or James

12. During a marketing blitz, a telemarketer conducts phone solicitations continuously from 16 00 until 20 00. Suppose that you have a 20% probability of being called during this blitz. If you generally eat dinner between 18 00 and 18 30, how likely is it that the telemarketer will interrupt your dinner?

6.5 Mutually Exclusive Events

Refer to the Key Concepts on page 340.

13. Classify each pair of events as mutually exclusive or non-mutually exclusive.

	First Event	Second Event
a)	Randomly selecting a classical CD	Randomly selecting a rock CD
b)	Your next birthday occurring on a Wednesday	Your next birthday occurring on a weekend
c)	Ordering a hamburger with cheese	Ordering a hamburger with no onions
d)	Rolling a perfect square with a die	Rolling an even number with a die

14. a) Determine the probability of drawing either a 5 or a black face card from a standard deck of cards.

b) Illustrate this situation with a Venn diagram.

15. In a data management class of 26 students, there are 9 with blonde hair, 7 with glasses, and 4 with blonde hair and glasses.

a) Draw a Venn diagram to illustrate this situation.

b) If a student is selected at random, what is the probability that the student will have either blonde hair or glasses?

16. Of 150 students at a school dance, 110 like pop songs and 70 like heavy-metal songs. A third of the students like both pop and heavy-metal songs.

a) If a pop song is played, what are the odds in favour of a randomly selected student liking the song?

b) What are the odds in favour of a student disliking both pop and heavy-metal songs?

c) Discuss any assumptions which must be made in parts a) and b).

17. The four main blood types are A, B, AB, and O. The letters A and B indicate whether two factors (particular molecules on the surface of the blood cells) are present. Thus, type AB blood has both factors while type O has neither. Roughly 42% of the population have type A blood, 10% have type B, 3% have type AB, and 45% have type O. What is the probability that a person

a) has blood factor A?

b) does not have blood factor B?

6.6 Applying Matrices to Probability Problems

Refer to the Key Concepts on page 352.

18. Alysia, the star on her bowling team, tends to bowl better when her confidence is high. When Alysia bowls a strike, there is a 50% probability that she will bowl a strike in the next frame. If she does not bowl a strike, then she has a 35% probability of bowling a strike in the next frame. Assume that Alysia starts the first game with a strike.

a) What is the initial probability vector for this situation?

b) What is the transition matrix?

c) Determine the probability that Alysia will bowl a strike in the second, third, and tenth frames.

d) There are ten frames in a game of bowling. What is the probability that Alysia will bowl a strike in the first frame of the second game?

e) What is the long-term probability that Alysia will bowl a strike?

f) What assumptions must be made in parts d) and e)?

19. A year-long marketing study observed the following trends among consumers of three competing pen manufacturers.

• 20% of Blip Pens customers switched to Stylo and 10% switched to Glyde-Wryte.

• 15% of Stylo customers switched to Glyde-Wryte and 25% switched to Blip Pens.

• 30% of Glyde-Wryte customers switched to Blip Pens and 5% switched to Stylo.

a) What is the transition matrix for this situation?

b) Determine the steady-state vector.

c) What is the expected long-term market share of Glyde-Wryte if these trends continue?