Name______________________________________ Date ____________________

Rolling, Flipping, and Pulling
Probability and Sample Spaces

Vocabulary

Write the term that best completes each statement.

1. A(n) ____________________ consists of two or more events.
2. Drawing a card and then replacing that card in the deck before drawing another card is an example of an event ____________________.
3. Drawing a card and then drawing another card from the same deck is an example of an event ____________________.
4. The ____________________ is a list of all possible outcomes in a given situation.
5. The probability of an event happening is the ratio of the number of ____________________ to the total number of possible ____________________.
6. The likelihood of a particular event occurring is referred to as the ____________________ of that event.
7. Two events are ____________________ if the outcome of the first event does not affect the outcome of the second event.
8. Two events are ____________________ if the second event is affected by the outcome of the first event.

Problem Set

Consider a four-sided triangular pyramid with faces numbered 1 through 4. Determine each probability.

1. What is the probability of rolling a number other than a 3?

   P(not 3) $= \frac{3}{4}$

2. What is the probability of rolling a 4?

3. What is the probability of rolling a 5?

4. What is the probability of rolling a number less than 5?

5. What is the probability of rolling an odd number?

6. What is the probability of rolling an even number?

7. What is the probability of rolling a prime number?

8. What is the probability of rolling a composite number?

9. What is the probability of rolling a number greater than 1?

10. What is the probability of rolling a number less than or equal to 3?

From a standard deck of 52 cards, you draw the 7 of diamonds. Determine each probability.

11. What is the probability of drawing the king of spades next if you don't return the card? If you do return the card?

    $\frac{1}{51}, \frac{1}{52}$

12. What is the probability of drawing the 7 of diamonds next if you don't return the card? If you do return the card?

13. What is the probability of drawing a diamond next if you don't return the card? If you do return the card?

14. What is the probability of drawing a club next if you don't return the card? If you do return the card?

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15. What is the probability of drawing a red card next if you don't return the card? If you do return the card?

16. What is the probability of drawing a black card next if you don't return the card? If you do return the card?

17. What is the probability of drawing a 7 or lower (2, 3, 4, 5, 6, 7) next if you don't return the card? If you do return the card?

18. What is the probability of drawing a 7 or higher (7, 8, 9, 10, J, Q, K, A) next if you don't return the card? If you do return the card?

From a standard deck of 52 cards, you draw one card. Then you flip a coin. Calculate each probability.

19. You draw a king and flip heads.

$\frac{4}{104} = \frac{1}{26}$

20. You draw a 2 and flip tails.

21. You draw a heart and flip tails.

22. You draw a diamond and flip heads.

23. You draw a 10 or higher (10, J, Q, K, A) and flip tails.

24. You draw a 9 or lower (2, 3, 4, 5, 6, 7, 8, 9) and flip heads.

Create a table to show each sample space.

25. A four-card deck contains the J, Q, K, and A of hearts. Create a table to show the sample space for drawing two cards with replacement.

	J	Q	K	A
J	J, J	Q, J	K, J	A, J
Q	J, Q	Q, Q	K, Q	A, Q
K	J, K	Q, K	K, K	A, K
A	J, A	Q, A	K, A	A, A

26. A four-card deck contains the 2, 3, 4, and 5 of spades. Create a table to show the sample space for drawing two cards with replacement.

27. A five-card deck contains the 2, 3, 4, 5, and 6 of diamonds. Create a table to show the sample space for drawing two cards with replacement.

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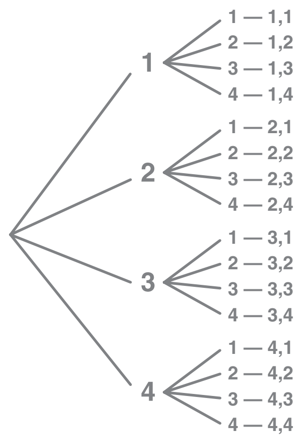
28. A five-card deck contains the 10, J, Q, K, and A of clubs. Create a table to show the sample space for drawing two cards with replacement.

Draw a tree diagram to show each sample space.

29. A four-sided triangular pyramid with faces numbered 1 through 4 is rolled twice. Draw a tree diagram that represents two rolls of the number pyramid.



30. A four-sided triangular pyramid with faces numbered 1 through 4 is rolled three times. Draw a tree diagram that represents three rolls of the number pyramid.

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31. A four-card deck contains the 2, 3, 4, and 5 of spades. Draw a tree diagram for drawing two cards without replacement.

32. A four-card deck contains the J, Q, K, and A of spades. Draw a tree diagram for drawing two cards without replacement.

33. A five-card deck contains the 10, J, Q, K, and A of clubs. Draw a tree diagram for drawing two cards without replacement.

34. A five-card deck contains the A, 2, 3, 4, and 5 of diamonds. Draw a tree diagram for drawing two cards without replacement.

Name____ Date ______________________

Multiple Trials
Compound and Conditional Probability

Vocabulary

Define each term in your own words.

1. compound event

2. compound probability

3. conditional probability

Problem Set

Suppose you have a reduced deck of cards that has only the 10s, jacks, queens, kings, and aces of the four suits, for a total of 20 cards. Calculate each probability.

1. You draw one card, replace it, and then draw another card. Calculate P(10 and ace).

   $\frac{4}{20} \cdot \frac{4}{20} = \frac{1}{5} \cdot \frac{1}{5} = \frac{1}{25}$

2. You draw one card, replace it, and then draw another card. Calculate P(queen and king).

3. You draw one card, replace it, and then draw another card. Calculate P(two hearts).

4. You draw one card, replace it, and then draw another card. Calculate P(two clubs).

5. You draw one card and replace it, then draw another card and replace it, and then draw another card and replace it. Calculate P(three of a kind, any card).

6. You draw one card and replace it, then draw another card and replace it, and then draw another card and replace it. Calculate P(three jacks).

7. You draw four cards and replace each card after drawing. Calculate P(four kings).

8. You draw four cards and replace each card after drawing. Calculate P(four of a kind, any card).

Suppose you have a reduced deck of cards that has only the 10s, jacks, queens, kings, and aces of the four suits, for a total of 20 cards. Calculate each probability.

9. You draw two cards at once, without replacement. Calculate P(10 and ace).

$$\frac{4}{20} \cdot \frac{4}{19} = \frac{1}{5} \cdot \frac{4}{19} = \frac{4}{95}$$

10. You draw two cards at once, without replacement. Calculate P(queen and king).

11. You draw two cards at once, without replacement. Calculate P(two hearts).

12. You draw two cards at once, without replacement. Calculate P(two clubs).

13. You draw three cards at once, without replacement. Calculate P(three of a kind, any card).

14. You draw three cards at once, without replacement. Calculate P(three jacks).

15. You draw four cards at once, without replacement. Calculate P(four kings).

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16. You draw four cards at once, without replacement. Calculate P(four of a kind, any card).

Use the given information to answer parts (a) and (b) of each question.

17. Your math teacher, Mr. Johnson, is in charge of the school math club. Suppose that there are 20 students in the math club.

a. If Mr. Johnson chooses three students at random to serve on the club council, what is the probability that they will be Josh, Jen, and Josie?

$$\frac{3}{20} \cdot \frac{2}{19} \cdot \frac{1}{18} = \frac{1}{1140}$$

b. If Mr. Johnson chooses three students at random to serve as club officers, what are the chances he selects Josh as president, Jen as secretary, and Josie as treasurer?

$$\frac{1}{20} \cdot \frac{1}{19} \cdot \frac{1}{18} = \frac{1}{6840}$$

18. Suppose that there are 27 students in Ms. Calipari's math class. She chooses one student at random each week to make a presentation. Once the student makes a presentation, he or she will not be chosen again.

a. What is the probability that Sarah, Sam, and Susie will all be done with their presentations after the first three weeks?

b. What is the probability that Sarah will be chosen for the first week, Sam for the second week, and Susie for the third week?

19. There are 18 students in a dance class. The dance instructor chooses four students at random to each perform her own free style dance in front of the class.

a. What is the probability that Marcie, Madelyn, Joanie, and Leticia will be chosen to perform?

b. What is the probability that Marcie will be chosen to perform first, Madelyn will be chosen to perform second, Joanie will be chosen to perform third, and Leticia will be chosen to perform last?

20. There are 25 people in a restaurant. The manager randomly distrubutes a $50 gift card, a $25 gift card, a $10 gift card, and a $5 gift card to four of the customers.

a. What is the probability that Michael, Shawna, Jada, and Carlos receive gift cards?

b. What is the probability that Michael receives the $50 gift card, Shawna receives the $25 gift card, Jada receives the $10 gift card, and Carlos receives the $5 gift card?

Use the given information to determine each probability.

21. Ms. Nguyen informs her class that 40 percent of them have received a score of 80 or above on both the first test and the second test. Then she informs them that 50 percent of the students in the class scored an 80 or above on the first test. What is the probability that a student who scored an 80 or above on the first test also scored an 80 or above on the second test?

Let A = a score of 80 or above on the first test, and B = a score of 80 or above on the second test.

$$P(A \cap B) = \frac{2}{5},\ P(A) = \frac{1}{2}$$

$$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{\frac{2}{5}}{\frac{1}{2}} = \frac{4}{5}$$

There is an 80 percent probability that a student who scored an 80 or above on the first test also scored an 80 or above on the second test.

22. Mr. Abdullah informs his class that 75 percent of them have received a score of 80 or above on both the first test and the second test. Then he informs them that 80 percent of the students in the class scored an 80 or above on the first test. What is the probability that a student who scored an 80 or above on the first test also scored an 80 or above on the second test?

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23. The probability for a positive test for a disease and actually having the disease is $\frac{1}{5000}$. The probability of a positive test is $\frac{1}{4500}$. What is the probability of actually having the disease given a positive test?

24. The probability for a positive test for a disease and actually having the disease is $\frac{1}{800}$. The probability of a positive test is $\frac{1}{700}$. What is the probability of actually having the disease given a positive test?

25. A baseball player gets hits on two successive at–bats one time out of every sixteen. If he gets a hit 25% of the time, what is the probability that he will get a hit on the second successive at–bat after getting a hit on the first at-bat?

26. A basketball player makes two out of two free throws 81 percent of the time. If he makes 90 percent of his free throws, what is the probability that he will make the second free throw after making the first?

7

Name______________________________________ Date ____________________

Counting
Permutations and Combinations

Vocabulary

Match each word with its corresponding definition.

1. factorial

2. permutation

3. combination

4. permutations with repeated elements

5. circular permutation

a. an ordered list of items without repetition

b. an unordered collection of items

c. an ordered list of items in which the final term links back to the first term to create a loop

d. the product of all positive integers up to (and including) the given number

e. an ordered list of items that includes repeated items

Problem Set

Calculate each factorial.

1. 4!

$4! = 4(3)(2)(1) = 24$

2. 7!

3. 0!

4. 1!

Simplify each fraction.

5. $\frac{5!}{2!}$

$$\frac{5!}{2!} = \frac{5(4)(3)\cancel{(2)}\cancel{(1)}}{\cancel{(2)}\cancel{(1)}} = 5(4)(3) = 60$$

6. $\frac{3!}{8!}$

7. $\frac{2!4!}{6!}$

8. $\frac{5!5!}{4!3!}$

Use the given information to answer each question.

9. Using any eight letters in the alphabet, how many different four-letter strings are there?

$$_8P_4 = \frac{8!}{(8-4)!} = \frac{8(7)(6)(5)\cancel{(4)}\cancel{(3)}\cancel{(2)}\cancel{(1)}}{\cancel{4}\cancel{(3)}\cancel{(2)}\cancel{(1)}} = 1680$$

10. Using any eight letters in the alphabet, how many five-digit strings are there?

11. Using any 12 letters in the alphabet, how many ten-digit strings are there?

12. Using any 12 letters in the alphabet, how many six-digit strings are there?

Name ______________________________ Date ______________

Use the given information to answer each question.

13. In a group of 8 people, how many different four–member committees can be chosen?

$${}_{8}C_{4} = \frac{8!}{(8-4!)4!} = \frac{8(7)(6)(5)\cancel{(4)}\cancel{(3)}\cancel{(2)}\cancel{(1)}}{4(3)(2)(1)\cancel{(4)}\cancel{(3)}\cancel{(2)}\cancel{(1)}} = \frac{1680}{24} = 70$$

14. In a group of 11 people, how many different five–member committees can be chosen?

15. In a group of 9 people, how many different six–member committees can be chosen?

16. In a group of 15 people, how many different three–member committees can be chosen?

Determine each probability.

17. There are 10 students in a classroom assigned randomly to desks numbered 1 to 10. What is the probability that the students are arranged alphabetically?

Number of permutations = 10! = 3,628,800

Number of alphabetical arrangements = 1

Probability of alphabetical arrangement = $\frac{1}{3{,}628{,}800}$

18. Joe has forgotten his 4-digit PIN. Each digit of Joe's PIN is a different digit. What is the probability that he can guess it in 10 tries?

19. Kira has forgotten her 5-digit PIN. Each digit of Kira's PIN is a different digit. What is the probability that she can guess it in 20 tries?

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20. There are 10 students, 5 boys and 5 girls, who are assigned randomly to classroom desks numbered 1 to 10. What is the probability that the students are arranged boy, girl, boy, girl, and so on?

Determine each probability.

21. In a standard 52-card playing deck, what is the probability that a person is dealt a hand of five cards that are all diamonds?

All possible 5-card hands:

$${}_{52}C_5 = \frac{52(51)(50)(49)(48)}{5(4)(3)(2)(1)} = 2{,}598{,}960$$

Possible 5 diamonds: $${}_{13}C_5 = \frac{13(12)(11)(10)(9)}{5(4)(3)(2)(1)} = \frac{154{,}440}{120} = 1287$$

The probability is $\frac{1287}{2{,}598{,}960} = \frac{33}{66{,}640}$.

22. In a standard 52-card playing deck, what is the probability that a person is dealt a hand of 10, J, Q, K, and A, all in one suit?

23. In a 20-card playing deck with only 10s, jacks, queens, kings, and aces, what is the probability that a person is dealt a hand of five cards that are all diamonds?

7

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24. In a 20-card playing deck with only 10s, jacks, queens, kings, and aces, what is the probability that a person is dealt a hand of five cards with four aces?

Use the formula for permutations with repeated elements to calculate each number.

25. The number of seven-letter strings that can be formed from the word ALGEBRA

$$\frac{7!}{2!} = \frac{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1} = 2520$$

26. The number of eight-letter strings that can be formed from the word CALCULUS

27. The number of ten-letter strings that can be formed from the word ANALYTICAL

28. The number of ten-letter strings that can be formed from the word STATISTICS

Use the formula for circular permutations to calculate the number of arrangements.

29. A necklace is made from 10 different types of beads strung along a circle of string. How many different possible bead arrangements are there?

Circular permutation of 10 items: (10−1)! = 9! = 362,880

30. A necklace is made from 8 different colors of beads strung along a circle of string. How many different possible bead arrangements are there?

31. A disc jockey plays the same 11 songs over and over in a cycle, repeating the same order. How many different orders does he have to choose from for his 11 songs?

32. Nine people sit around a circular table. How many different ways are there to arrange the people?

Skills Practice

Name____ Date ______________________

Trials
Independent Trials

Vocabulary

Define each term in your own words.

1. regular tetrahedron

2. combination

3. Pascal's Triangle

Problem Set

Consider an octahedron (an eight-sided solid with each face identical to the others) that is thrown like a number cube. Three sides are red (*R*), two sides are blue (*B*), two sides are yellow (*Y*), and one side is green (*G*). Determine each probability for two rolls of the octahedron.

1. $P(RR)$

   $P(RR) = P(R) \cdot P(R) = \frac{3}{8} \cdot \frac{3}{8} = \frac{9}{64}$

2. $P(YY)$

3. $P(RG)$

4. $P(YG)$

5. $P(BG)$

6. $P(RB)$

A number cube has 5 red (*R*) sides and 1 blue (*B*) side. Use this information to calculate each probability.

7. Rolling 3 reds and 1 blue in four rolls

   $P(3\ R \text{ and } 1\ B) = 4\left(\frac{5}{6}\right)^3\left(\frac{1}{6}\right)^1 = \frac{125}{324}$

8. Rolling 3 reds and 2 blues in five rolls

9. Rolling 3 reds and 3 blues in six rolls

10. Rolling 3 reds and 4 blues in seven rolls

A regular tetrahedron has 3 red (*R*) sides and 1 blue (*B*) side. Use this information to calculate each probability.

11. Rolling 2 reds and 2 blues in four rolls

    $P(2\ R \text{ and } 2\ B) = 6\left(\frac{3}{4}\right)^2\left(\frac{1}{4}\right)^2 = \frac{27}{128}$

12. Rolling 4 reds and 1 blue in five rolls

13. Rolling 2 reds and 4 blues in six rolls

14. Rolling 2 reds and 5 blues in seven rolls

Name ______________________________ Date ______________

Consider a situation where each trial has one of two possible outcomes. Outcome *A* has a probability of *p*, while outcome *B* has probability of 1 – *p*. Write a formula for each probability.

15. $P(2A \text{ and } 2B)$ in four trials

$P(A) = p$, $P(B) = 1 - p$

There are six different ways to get two *A*s and two *B*s: *AABB, ABAB, ABBA, BABA, BAAB, BBAA*. The probability for each individual outcome is $p^2(1-p)^2$. Therefore, the total probability is six times this, or $6p^2(1-p)^2$.

16. $P(3A \text{ and } 1B)$ in four trials

17. $P(5A \text{ and } 5B)$ in ten trials

18. $P(9A \text{ and } 3B)$ in twelve trials

7

Skills Practice

Name_______________________________________ Date _____________________

To Spin or Not to Spin
Expected Value

Vocabulary

Write the term or terms that best complete each statement.

1. The _____________ is a list of all possible outcomes in a given situation.

2. The likelihood of a particular event occurring is referred to as the __________ of that event.

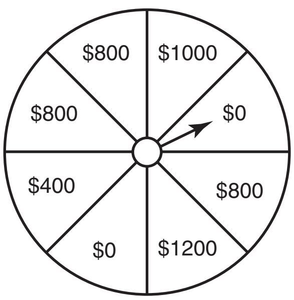
3. The ______________ is the average value when the number of trials is large.

4. The probability of an event happening is the ratio of the number of ________________ to the total number of possible __________.

Problem Set

Calculate the expected value when spinning each wheel shown.

1.



$P(0) = \frac{2}{8} = \frac{1}{4}$, $P(\$400) = \frac{1}{8}$, $P(\$800) = \frac{3}{8}$, $P(\$1000) = \frac{1}{8}$, $P(\$1200) = \frac{1}{8}$

The expected value is

$\frac{1}{4} \cdot \$0 + \frac{1}{8} \cdot \$400 + \frac{3}{8} \cdot \$800 + \frac{1}{8} \cdot \$1000 + \frac{1}{8} \cdot \$1200$

$= \$0 + \$50 + \$300 + \$125 + \$150 = \$625.$

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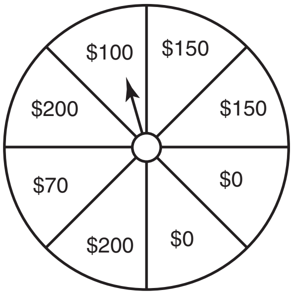
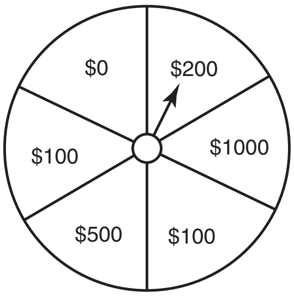
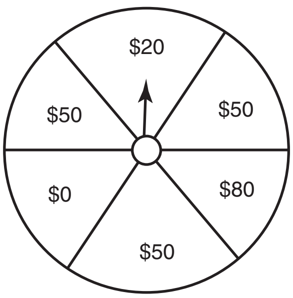
2.


$100
$150
$200
$150
$70
$0
$200
$0

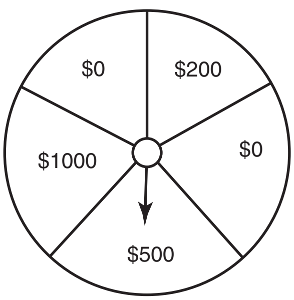
3.


$0
$200
$100
$1000
$500
$100

4.


$20
$50
$50
$0
$80
$50

5.


$0
$200
$1000
$0
$500

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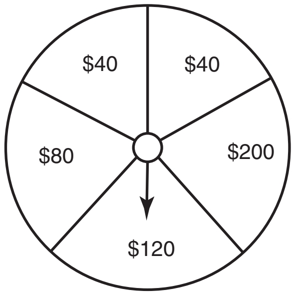
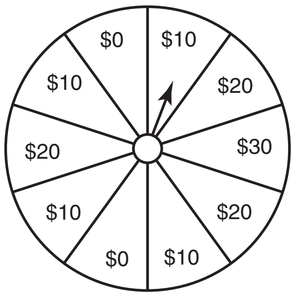
6.



7.



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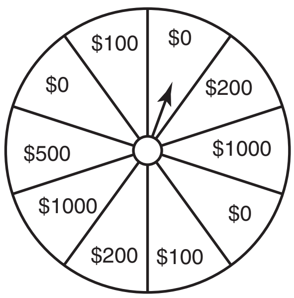

A game at a fair involves a deck with 10 cards, the 2 through 6 of spades and the 2 through 6 of hearts. To play the game, a player pulls a single card out of the deck and is paid depending on the card. For the various payouts described, calculate the expected value of playing this game.

9. $0 for a heart; $1 for a spade

The probability of drawing either a heart or a spade is $\frac{1}{2}$. So, the expected value is

$$\frac{1}{2} \cdot \$0 + \frac{1}{2} \cdot \$1 = \$0.50.$$

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10. $3 for a heart; $0 for a spade

11. $0 for a heart; $0 for an even spade, $1 for an odd spade

12. $0 for a spade; $1 for an even heart, $2 for an odd heart

13. $0 for a spade; $1 for an even heart, $2 for the 3 of hearts, and $3 for the 5 of hearts

14. $0 for a heart; $2 for an even spade, $3 for the 3 of spades, and $4 for the 5 of spades

15. $0 for a heart; $2 for a spade (except the 6 of spades, which pays $5)

Name ______________________________ Date ________________

16. \$0 for a spade; \$1 for a heart (except the 5 of hearts, which pays \$20)

A game at a fair involves tossing a colored cube. The cube has two white sides, one red side, one green side, one yellow side, and one blue side. For the various payouts described, calculate the expected value of playing this game.

17. \$0 for white, red, yellow, and green; \$6 for blue

The probability of throwing white is $\frac{2}{6} = \frac{1}{3}$, while the probability of throwing red, green, yellow, or blue is $\frac{1}{6}$. So, the expected value is

$\frac{1}{3} \cdot \$0 + \frac{1}{6} \cdot \$0 + \frac{1}{6} \cdot \$0 + \frac{1}{6} \cdot \$0 + \frac{1}{6} \cdot \$6 = \$1.$

18. \$0 for white, red, and yellow; \$3 for green and blue

19. \$0 for white, \$1 for red, yellow, and blue; \$9 for green

20. \$1 for white, \$0 for red, yellow, and blue; \$6 for green

A game at a fair involves tossing a colored cube. The cube has two red sides, two green sides, one yellow side, and one blue side. For the various payouts described, calculate the expected value of playing this game.

21. \$1 for yellow, \$2 for blue, \$0 for the others

The probability of throwing red or green is $\frac{2}{6} = \frac{1}{3}$, while the probability of throwing yellow or blue is $\frac{1}{6}$. So, the expected value is

$\frac{1}{3} \cdot \$0 + \frac{1}{3} \cdot \$0 + \frac{1}{6} \cdot \$1 + \frac{1}{6} \cdot \$2 = \$0.50.$

22. \$2 for red, \$2 for blue, \$0 for the others

23. \$10 for yellow, \$4 for green, \$0 for the others

24. \$20 for yellow, \$2 for red, \$0 for the others

A game at a fair involves tossing a bean bag at a target shaped like a tic-tac-toe board, made up of 9 squares in a 3-by-3 arrangement. It is difficult to control the bean bag, so it lands randomly in one of the nine squares, which offer different payouts depending on the game. For the various payouts described, calculate the expected value of playing this game.

25. \$1 for the top row, \$0 for the others

The probability of landing in any of the three rows is $\frac{3}{9} = \frac{1}{3}$. So, the expected value is

$\frac{1}{3} \cdot \$1 + \frac{1}{3} \cdot \$0 + \frac{1}{3} \cdot \$0 = \$0.33.$

26. \$2 for the left-hand column, \$0 for the others

27. \$2 for the bottom row, \$0 for the others (except for \$6 for landing in the center)

Name ______________________________ Date ______________

28. \$5 for the right column, \$0 for the others (except for \$15 for landing in the center)

29. \$5 for the middle column (except \$20 for the middle square), \$0 for the others

30. \$4 for the middle row (except \$10 for the middle square), \$0 for the others

31. \$2 for one of the corners, \$10 for the middle square, \$0 for the others

32. \$3 for one of the corners, \$15 for the middle square, \$0 for the others

Name____ Date ______________________

The Theoretical and the Actual
Experimental Versus Theoretical Probability

Vocabulary

Discuss how the following words are related by describing their similarities and differences.

1. theoretical probability and experimental probability

Problem Set

Calculate the theoretical probability for each situation.

1. A wheel is equally divided into 5 different colored wedges: red, blue, yellow, green, and black. The wheel is spun. What is the theoretical probability of the pointer of the wheel stopping on either red or green?

   $\frac{1}{5} + \frac{1}{5} = \frac{2}{5}$

2. A six-sided number cube is rolled one time. What is the theoretical probability that the result is an even number?

3. Jason, his two brothers, and his three sisters each put their name on a slip of paper in a hat. He draws one name. What is the probability that the name is one of Jason's sisters?

4. Eight blue marbles, 6 green marbles, 8 red marbles, and 10 white marbles are placed in a paper bag. What is the probability that a green marble will be drawn?

5. One tile for each letter of the alphabet is placed in a bag. One tile is drawn from the bag. What is the probability that the letter on the tile is a consonant?

6. A standard deck of playing cards consists of 52 cards with 13 cards in each suit: clubs, diamonds, hearts, and spades. Clubs and spades are black, and diamonds and hearts are red. Each suit is made up of cards from 2 to 10, a jack, a queen, a king, and an ace. One card is drawn. What is the probability that the card is a red king?

Calculate the experimental probability for each situation.

7. A card is drawn at random and then replaced from a standard deck of cards one hundred times. The suit of the card is recorded in the table below. What is the experimental probability of the event of a heart being drawn?

♠	♥	♦	♣
36	16	9	39

$\frac{16}{100} = \frac{4}{25}$

8. A six-sided number cube is rolled fifty times. The results are shown in the table. What is the experimental probability that the result of a roll will be a 3?

1	2	3	4	5	6
6	20	10	8	4	2

9. A fair spinner is spun 20 times and the results are recorded in the table below. What is the experimental probability that the spinner stops on the color black?

green	blue	white	red	orange	black
3	5	3	2	4	3

Name ______________________________ Date ________________

10. Letter tiles from the name "Toby" are put into a bag. One tile is drawn at a time, the result recorded, and then replaced. This is done 60 times and the results are recorded in the table. What is the experimental probability of the letter T being drawn?

T	O	B	Y
16	22	14	8

11. A six-sided number cube is rolled 100 times. A one is rolled 18 times, a two is rolled 16 times, a three is rolled 16 times, a four is rolled 20 times, a five is rolled 17 times, and a six is rolled 13 times. What is the experimental probability of rolling the cube again and rolling a four?

12. A coin is tossed 100 times. The coins lands on heads 41 times and tails 59 times. What is the experimental probability of the coin landing on heads?

13. Three toy cars are run on a slanted track. Out of 100 trials, the number 1 car is fastest 43 times, the number 2 car is fastest 38 times, and the number 3 car is fastest 19 times. What is the experimental probability that the number 3 car wins the next race?

14. In a carnival game, a toy mole randomly pops out of one of five holes and a player hits the mole with a mallet. The holes are numbered one through five. Out of 50 events, the mole appears in hole one 13 times, hole two 5 times, hole three 10 times, hole four 12 times, and hole five 10 times. What is the experimental probability that the mole appears in hole two?

Use the given information to answer each question.

15. A coin is tossed 70 times. How many times would you expect the coin to land on heads?

$\frac{1}{2}(70) = 35$

16. A bag contains 10 blue, 10 red, 10 green, and 10 yellow marbles. A marble is drawn and replaced 100 times. How many times would you expect a blue marble to be drawn?

17. Two six-sided number cubes are rolled 50 times. How many times would you expect the sum of the cubes to be an even number?

18. An eight-sided numbered shape is rolled 40 times. How many times would you expect the result to be a number divisible by 3?

19. A card is drawn from a standard deck and then replaced 100 times. How many times would you expect to draw a queen?

20. A spinner is divided into 10 equal sections. Three are blue, three are red, two are white, and two are yellow. The spinner is spun 50 times. How many times would you expect the spinner to stop on the color red?

Describe how you would expect the experimental probabilities to compare for each set of experiments.

21. Three experiments are done using a six-sided number cube. For each experiment, the number cube was rolled 20 times to determine the experimental probability of rolling a 2.

The experimental probabilities are likely to be different, but close in value.

22. Three bags of marbles each contain 10 red, 10 yellow, 10 green, and 10 blue marbles. An experiment is run on each bag where a marble is drawn and then replaced 40 times to determine the experimental probability of drawing a green marble.

23. A standard deck of cards is used to conduct three experiments to find the experimental probability of drawing a card that is a spade. In the first experiment, a card is drawn and replaced 20 times. In the second experiment, a card is drawn and replaced 200 times. In the third experiment, a card is drawn and replaced 2000 times.

Name ______________________ Date ______________

24. Two coins are tossed together in an experiment to determine the experimental probability of one head and one tail. Three sets of trials are run. In the first trial, the coins are tossed 4 times. In the second trial, the coins are tossed 40 times. In the third trial, the coins are tossed 400 times.