

## Homework Day 1: Counting Methods, Permutations &amp; Combinations

Solve the following problems by hand using factorials. Show all work!

1)  ${}_7P_3$

2)  ${}_{10}C_6$

Create a tree diagram to solve the following problem.

3) A popular brand of pen is available in three writing tips (bold, medium, and fine) and five different colors (purple, pink, red, blue, and green). How many different pen choices does this brand offer?

Use the Fundamental Counting Principle to solve each problem.

4) The model of the SUV you are thinking of buying is available in seven different colors and three different styles (standard, limited and luxury). In how many ways can you order the SUV?

5) You are taking a multiple choice test that has eight questions. Each of the questions has four choices, which one correct choice for each question. If you select one option per question and leave no questions blank, in how many ways can you answer the questions?

Determine if the following scenarios involve combinations or permutations, then solve.

6) Suppose you are asked to list, in order of preference, the three best movies you have seen this year. If you saw 20 movies during the year, in how many ways can the three best be chosen and ranked?

7) There are 14 standbys who hope to get seats on a flight, but only 6 seats are available on the plane. How many different ways can the 6 people be selected?

8) In a production of West Side Story, eight actors are considered for the male roles of Tony, Riff, and Bernardo. In how many ways can the director cast the male roles?

10) You and your parent volunteer to help drive children at a charity event to the zoo, but you can only fit 8 of the 17 children present in your minivan. How many different groups of 8 children can you drive?

12) A student must answer 3 out of 5 essay questions on a test. In how many different ways can the student select the questions?

14) A lock will open when the right choice of three numbers (from 1 to 30, inclusive) is selected. How many different lock possibilities are possible, assuming no number is repeated?

15) How many more ways can 12 freshman running for the positions of president, vice president, secretary, treasurer and historian be selected when compared to 15 sophomores running for 6 identical positions of class representative?

9) Nine bands have volunteered to perform at a benefit concert, but there is only enough time for five of the bands to play. How many lineups are possible?

11) Of the 100 people in the U.S. Senate, 18 serve on the Foreign Relations Committee. How many ways are there to select Senate members for this committee (assuming party affiliation is not a factor in selection)?

13) A basketball team consists of two centers, five forwards, and four guards. In how many ways can the coach select a starting line up of one center, two forwards, and two guards?

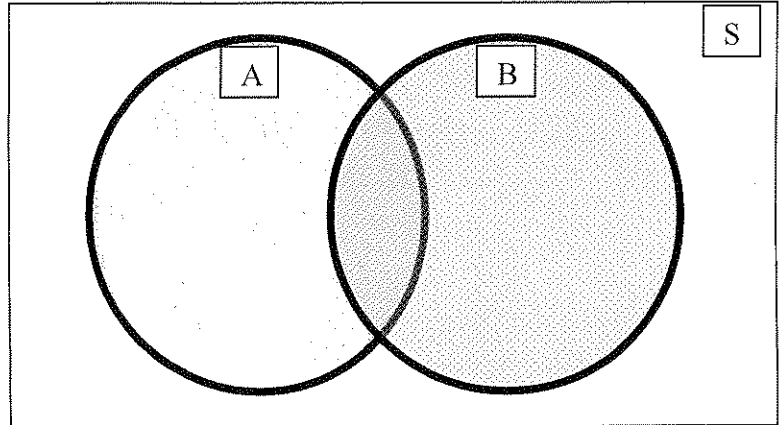
Homework Day 2: Basic Probability

**Part I:** Organize the data into the Venn Diagram given the following information and answer the questions in set notation.

$S = \{0, 1, 2, 3, 4, 6, 7, 8, 9, 12, 16, 24, 30, 32, 55, 64\}$

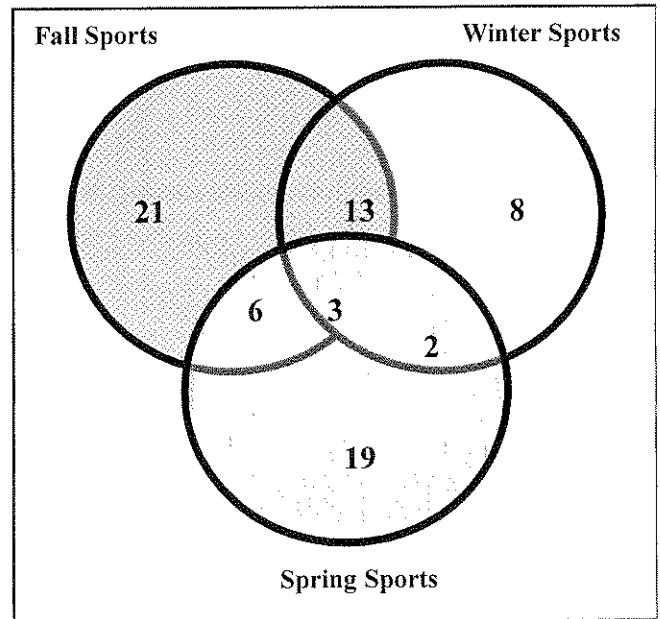
$A = \{\text{factors of } 64\}$

$B = \{\text{factors of } 24\}$



1. What is  $A \cup B$ ?
2. What is  $A \cap B$ ?
3. What is  $A^c$ ?
4. What is  $B^c$ ?

**Part II:** Answer Questions about the diagram.



- 1) How many students play sports year-round?
- 2) How many students play sports in the spring and fall?
- 3) How many students play sports in the winter and fall?
- 4) How many students play sports in the winter and spring?
- 5) How many students play only one sport?
- 6) How many students play at least two sports?

7) Suppose you have a standard deck of 52 cards.

Let:  $A$  : draw a 7

$B$  : draw a Diamond

a. Describe  $A \cup B$  for this experiment, and find the probability of  $A \cup B$ .

b. Describe  $A \cap B$  for this experiment, and find the probability of  $A \cap B$ .

8) Suppose a box contains three balls, one red, one blue, and one white. One ball is selected, its color is observed, and then the ball is placed back in the box. The balls are scrambled, and again, a ball is selected and its color is observed. What is the sample space of the experiment?

9) Suppose you have a jar of candies: 4 red, 5 purple and 7 green. Find the following probabilities of the following events:

a. Selecting a red candy.

b. Selecting a purple candy.

c. Selecting a green or red candy.

d. Selecting a yellow candy.

e. Selecting any color except a green candy.

f. Find the odds of selecting a red candy.

g. Find the odds of selecting a purple or green candy.

10) What is the sample space for a single spin of a spinner with red, blue, yellow and green, purple, and orange sections spinner?

a. What is the sample space for 2 spins of the first spinner?

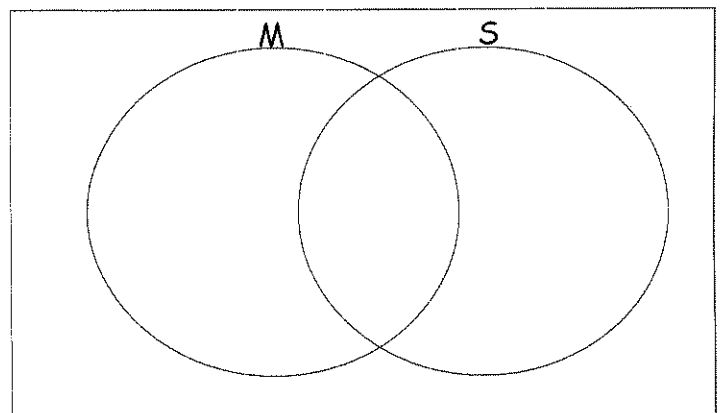
b. If the spinner is equally likely to land on each color, what is the probability of landing on red in one spin?

c. What is the probability of landing on a primary color in one spin?

d. What is the probability of landing on green both times in two spins?

11) In a group of 52 students, 34 take a math class, 22 take a science class, and 8 take both. 4 students in the group do not take math or science. Let  $M$  = students taking math and  $S$  = students taking science.

a) Complete the Venn Diagram based on the information above.



b) What is  $M \cup S$ ?

c) What is  $M \cap S$ ?

d) Describe  $M \cap S$  in the context of this problem.

e) What is  $M^c$ ?

f) What is  $S^c$ ?

g) Describe  $(M \cup S)^c$  in the context of the problem.

## Homework Day 3: Independent and Dependent Events and Tree Diagrams

1) The freshman class of a high school is 55% female and 60% of the females play a competitive sport. Of the males, 70% play a competitive sport.

a) Create a tree diagram for the scenario, displaying all possibilities and percentages

b) What is the probability that a randomly selected student from this high school is female and plays a competitive sport?

c) What is the probability that a randomly selected student from this high school is male and does not play a competitive sport?

d) What is the probability that a randomly selected student plays a competitive sport?

2. A student conducted a survey at school and found that 75% of the boys and 65% of the girls like to watch hockey games. There are an equal number of boys and girls in the school.

a) Create a tree diagram for the scenario, displaying all possibilities and percentages

b) What is the probability that a randomly selected student from this school is female and likes to watch hockey?

c) What is the probability that a randomly selected student from this school does not like to watch hockey?

d) If someone does not like to watch hockey games, what is the approximate probability that the person is a boy?



## Homework Day 4: Mutually Exclusive and Inclusive Events

Solve the following problems by hand. Show all work!

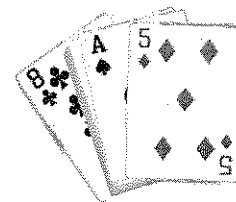
1. Given that 2 dice are tossed, answer the following questions:
  - a) What is the probability of obtaining a sum equal to 6?
  - b) What is the probability of obtaining a sum less than 6?
  - c) What is the probability of obtaining a sum of at least 6?
  
2. A card is chosen at random from a standard deck of cards. What is the probability that the card chosen is a heart or spade? Are these events mutually exclusive?
  
3. 3 coins are tossed simultaneously. What is the probability of getting 3 heads or 3 tails? Are these events mutually exclusive?
  
4. In question 3, what is the probability of getting 3 heads *and* 3 tails when tossing the 3 coins simultaneously?
  
5. Consider a sample set as  $S = \{2, 4, 6, 8, 10, 12, 14, 16, 18, 20\}$ . Event  $A$  is the multiples of 4, while event  $B$  is the multiples of 5. What is the probability that a number chosen at random will be from both  $A$  and  $B$ ?
  
6. From question 5, what is the probability that a number chosen at random will be from either  $A$  or  $B$ ?



7. Brenda did a survey of the students in her classes about whether they liked to get a candy bar or a new math pencil as their reward for positive behavior. She asked all 71 students she taught, and 32 said they would like a candy bar, 25 said they wanted a new pencil, and 4 said they wanted both. If Brenda were to select a student at random from her classes, what is the probability that the student chosen would want:
- a) a candy bar or a pencil?
  - b) neither a candy bar nor a pencil?
8. A card is chosen at random from a standard deck of cards. What is the probability that the card chosen is a heart or a face card? Are these events mutually inclusive?
9. A bag contains 26 tiles with a letter on each, one tile for each letter of the alphabet.
- a) What is the probability of reaching into the bag and randomly choosing a tile with one of the letters in the word ENGLISH on it?
  - b) What is the probability of reaching into the bag and randomly choosing a tile with a vowel on it?
  - c) What is the probability of reaching into the bag and randomly choosing a tile with one of the letters in the word ENGLISH on it **OR** choosing a tile with a vowel on it?

**Homework Day 5: Two-Way Frequency Tables and Conditional Probability**

Show ALL work to receive credit!



1. Steve and Scott are playing a game of cards with a standard deck of playing cards. Steve deals Scott a black king. What is the probability that Scott's second card will be a red card?
2. Sandra and Karen are playing a game of cards with a standard deck of playing cards. Sandra deals Karen a red seven. What is the probability that Karen's second card will be a black card?
3. Donna discusses with her parents the idea that she should get an allowance. She says that in her class, 55% of her classmates receive an allowance for doing chores, and 25% get an allowance for doing chores and are good to their parents. Her mom asks Donna what the probability is that a classmate will be good to his or her parents given that he or she receives an allowance for doing chores. What should Donna's answer be?
4. At a local high school, the probability that a student speaks English and French is 15%. The probability that a student speaks French is 45%. What is the probability that a student speaks English, given that the student speaks French?
5. On a game show, there are 16 questions: 8 easy, 5 medium-hard, and 3 hard. If contestants are given questions randomly, what is the probability that the first two contestants will get easy questions?
6. On the game show above, what is the probability that the first contestant will get an easy question and the second contestant will get a hard question?
7. Figure 2.2 shows the counts of earned degrees for several colleges on the East Coast. The level of degree and the gender of the degree recipient were tracked. Row & Column totals are included.

	Bachelor's	Master's	Professional	Doctorate	Total
Female	542	128	26	18	714
Male	438	165	38	20	661
Total	980	293	64	38	1375

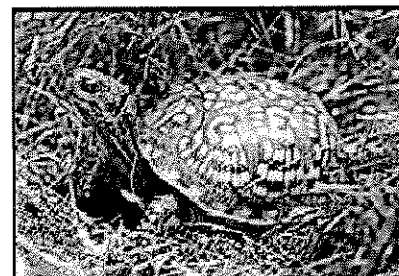
- a. What is the probability that a randomly selected degree recipient is a female?
- b. What is the probability that a randomly chosen degree recipient is a man?
- c. What is the probability that a randomly selected degree recipient is a woman, given that they received a Master's Degree?
- d. For a randomly selected degree recipient, what is  $P(\text{Bachelor's Degree}|\text{Male})$ ?

8. Animals on the endangered species list are given in the table below by type of animal and whether it is domestic or foreign to the United States. Complete the table and answer the following questions.

	Mammals	Birds	Reptiles	Amphibians	Total
United States	63	78	14	10	
Foreign	251	175	64	8	
Total					

An endangered animal is selected at random. What is the probability that it is:

- a. a bird found in the United States?
- b. foreign or a mammal?
- c. a bird given that it is found in the United States?
- d. a bird given that it is foreign?



9. A student conducted a class survey of who did household chores last night. In the class of 28 students, half of whom completed a chore last night. According to the survey, there were 13 females, 6 of whom did not complete a chore last night. Complete the following table to show the results.

	Yes	No	Total
Male			
Female			
Total			

- a. Find  $P(\text{respondent is male})$
- b. Find  $P(\text{respondent did a chore last night})$
- c. Find  $P(\text{chore} \mid \text{male})$
- d. If a person did not do a chore, how likely is it that she is female?

**Day 8 HW: More of Experimental and Theoretical Probability & Some Review**

Show All work! Use separate paper, if needed.

1. Two dice are rolled. The numbers are multiplied. If the product is odd, Player A wins a point. If the product is even, Player B wins a point. The winner is the player with the most points after 20 rounds.

- A) Create a sample space for this situation
- B) What is the probability that player A wins?
- C) What is the probability that player B wins?
- D) Is the game fair? Why or why not?

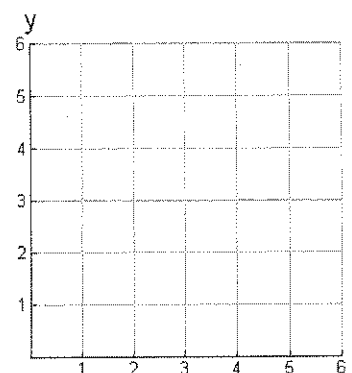
2. Player A and Player B each toss two coins. If there are exactly two heads and two tails, player A score 1 point. Otherwise, Player B scores 1 point. The player with the most points after 10 rounds wins.

- A) Create a sample space for this situation
- B) What is the probability that player A wins?
- C) What is the probability that player B wins?
- D) Is the game fair? Why or why not?

3. A locker combination system uses three digits from 0 to 9. How many different three-digit combinations with no digit repeated are possible?

4. A fair coin is tossed three times. What is the probability that the coin will land tails up on the second toss?

5. A square dartboard is represented on the accompanying diagram. The entire dartboard is the first quadrant from  $x = 0$  to 6 and from  $y = 0$  to 6. A triangular region on the dartboard is enclosed by the graphs of the equations  $y = 2$ ,  $x = 6$ , and  $y = x$ . Find the probability that a dart that randomly hits the dartboard will land in the triangular region formed by the three lines.



6. A bag contains 12 red M&Ms, 12 blue M&Ms, and 12 green M&Ms. What is the probability of drawing two M&Ms of the same color in a row? When the first M&M is drawn, it is looked at and eaten.



7. The telephone company has run out of seven-digit telephone numbers for an area code. To fix this problem, the telephone company will introduce a new area code. Find the number of new seven-digit telephone numbers that will be generated for the new area code if both of the following conditions must be met:

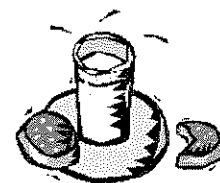
- the first digit cannot be a zero or a one
- the first three digits can't be the emergency number (911) or the information number (411).

8. Alex's wallet contains four \$1 bills, three \$5 bills, and one \$10 bill. If Alex randomly removes two bills without replacement, determine whether the probability that the bills will total \$15 is greater than the probability that the bills will total \$2.

9. A bag of cookies contains 6 chocolate chip cookies, 5 peanut butter cookies, and 1 oatmeal cookie. Brandon selects 2 cookies at random. Find the probability that Brandon selected :

- a) 2 chocolate chip cookies
- b) 1 chocolate chip and 1 peanut butter cookie

10. A bag contains three chocolate, four sugar, and five lemon cookies. Greg takes two cookies from the bag, at random, for a snack. Find the probability that Greg did **not** take two chocolate cookies from the bag. Explain why using the complement of the event of not choosing two chocolate cookies might be an easier approach to solving this problem.



11. You are off to soccer, and want to be the Goalkeeper, but that depends who is the Coach today:

- with Coach Sam the probability of being Goalkeeper is **0.5**
- with Coach Alex the probability of being Goalkeeper is **0.3**
- Sam is Coach more often ... about 6 out of every 10 games

- a) Draw a tree diagram of this scenario.
- b) What is the probability you'll be goalkeeper today?
- c) What is the probability you'll be goalkeeper given Coach Sam is coaching today?
- d) Given you are not the goalkeeper, what is the probability Coach Alex is coaching today?

12. At Kennedy Middle School, the probability that a student takes Technology and Spanish is 0.087. The probability that a student takes Technology is 0.68. What is the probability that a student takes Spanish given that the student is taking Technology?

13. What is the probability of choosing the ace of spades from a standard deck of cards given that the card you draw is a black card?

14. A pet store contains 79 parakeets including 35 that are light green and 42 that are female. 16 of the sky blue parakeets are male. Arrange this information in a two-way table.

	Male	Female	Total
Light Green Parakeet			
Sky Blue Parakeet			
Total			

- a. You randomly choose one parakeet. What is the probability that it is a female or a sky blue parakeet?
- b. What is the probability that the randomly chosen parakeet is both green and male?
- c. What is the probability that the randomly chosen parakeet is female, given it is green?

HW Day 9 & 10: Unit 6 Probability Review

Show work to receive credit!!

Solve the problem.

- Lisa has 4 skirts, 8 blouses, and 2 jackets. How many 3-piece outfits can she put together assuming any piece goes with any other?  
A) 32                      B) 64                      C) 14                      D) 128
- A combination lock has 20 numbers on it. How many different 3-digit lock combinations are possible if no digit can be repeated?  
A) 2280                      B) 6840                      C) 1140                      D) 380
- A church has 10 bells in its bell tower. Before each church service 3 bells are rung in sequence. No bell is rung more than once. How many sequences are there?  
A) 720                      B) 604,800                      C) 120                      D) 1,209,600
- A hamburger shop sells hamburgers with cheese, relish, lettuce, tomato, onion, mustard or ketchup. How many different hamburgers can be concocted using any 5 of the extras?  
A) 1260                      B) 2520                      C) 42                      D) 21
- You randomly select one card from a standard 52-card deck. Then, the probability of not selecting a king,  $P(\text{not king}) =$   
A)  $1 - P(\text{king})$                       B)  $1 + P(\text{king})$                       C)  $P(\text{king})$                       D)  $- P(\text{king})$
- The physics department of a college has 7 male professors, 11 female professors, 16 male teaching assistants, and 8 female teaching assistants. If a person is selected at random from the group, find the probability that the selected person is a teaching assistant or a female.  
A)  $\frac{4}{7}$                       B)  $\frac{9}{14}$                       C)  $\frac{5}{6}$                       D)  $\frac{19}{42}$
- In a class of 50 students, 32 are Democrats, 16 are business majors, and 6 of the business majors are Democrats. If one student is randomly selected from the class, find the probability of choosing a Democrat or a business major.  
A)  $\frac{1}{5}$                       B)  $\frac{24}{25}$                       C)  $\frac{21}{25}$                       D)  $\frac{27}{25}$

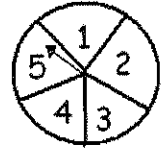
8. Use the spinner shown, find the probability that the arrow will land on an odd number. Assume that it is equally probable to land on any of the numbered spaces. If the pointer lands on the border, spin again.

A)  $\frac{2}{5}$

B)  $\frac{3}{5}$

C) 1

D) 0



9. A die is rolled. The sample space of equally likely outcomes is (1, 2, 3, 4, 5, 6). Find the probability of getting a 6.

A)  $\frac{1}{6}$

B) 1

C) 6

D) 0

10. You are dealt one card from a standard 52-card deck. Find the probability of being dealt a picture card.

A)  $\frac{3}{52}$

B)  $\frac{1}{13}$

C)  $\frac{3}{26}$

D)  $\frac{3}{13}$

11. A fair coin is tossed two times in succession. The sample space of equally likely outcomes is (HH, HT, TH, TT). Find the probability of getting the same outcome on each toss.

A)  $\frac{1}{4}$

B)  $\frac{1}{2}$

C)  $\frac{3}{4}$

D) 1

12. You randomly select one card from a standard 52-card deck. Find the probability of selecting an ace or a 9.

A)  $\frac{2}{13}$

B)  $\frac{13}{2}$

C)  $\frac{5}{13}$

D) 10

13. A spinner is used for which it is equally probable that the pointer will land on any one of six regions. Three of the regions are colored red, two are green, and one is yellow. If the pointer is spun three times, find the probability it will land on green every time.

A)  $\frac{2}{27}$

B)  $\frac{1}{9}$

C)  $\frac{1}{18}$

D)  $\frac{1}{27}$

14. You are dealt one card from a standard 52-card deck. Then the card is replaced in the deck, the deck is shuffled, and you draw again. Find the probability of getting a picture card the first time and a club the second time.

A)  $\frac{3}{13}$

B)  $\frac{1}{13}$

C)  $\frac{3}{52}$

D)  $\frac{1}{4}$

15. Two dice are rolled. The numbers are multiplied. What is the probability of getting a 12?

A)  $\frac{1}{9}$

B)  $\frac{1}{12}$

C)  $\frac{1}{36}$

D)  $\frac{1}{4}$

**HW Day 9 & 10 (cont.): Probability Test Review**

**Show work for credit!!**

1. Bag A contains 12 yellow m&m's and 8 green m&m's. Bag B contains 9 blue m&m's and 11 orange m&m's. Find the probability of selecting one green m&m from Bag A and one blue m&m from Bag B in one draw from each bag.

2. Find the probability of randomly selecting a brown m&m in one draw from a candy dish containing 18 brown m&m's, 7 red m&m's , and 15 orange m&m's.

3. A new Wednesday lunch special at a local fast food restaurant consists of a chicken sandwich, a choice of bottled water, milk or tea and a choice of baked potato or French fries. How many different selections of these items are possible?

4. Two students, one from each of two biology classes are to be randomly selected from to go take a test on anatomy at the local community college. Jill is in a class of 28 students and Emily is in another class of 32 students. Find the probability that both Jill and Emily will be selected?

5. Find the number of ways the letters in the word *friend* can be arranged?

6. How many different ways can you purchase 4 different kinds of soda from a selection of 9 different sodas?

7. Amazon.com Marketplace conducted a survey of 125 customers its biggest seller (1) and 125 customers of its second biggest seller (2). The customers were asked whether their orders arrived early, on-time, late or not at all. The responses are given in the table below.

Group	1	2	Total
Early	5	26	31
On - Time	113	88	201
Late	5	10	15
Never	2	1	3
Total	125	125	250

a. Find the probability that a randomly selected respondent to the survey received their order early or not at all.

b. Find the probability that a randomly selected respondent to the survey ordered from seller 2 or received their order on time.

c. Find the probability that a randomly selected respondent to the survey ordered from seller 2, given that their order arrived on time.

d. If a respondent ordered from seller 1, how likely is it that the respondent received their order early?



8. After interviewing your friends, you find that 75% of them like chocolate ice cream, and that 30% like chocolate and strawberry. What percent of those who like chocolate also like strawberry?

9. In a certain school, 65% of the boys play baseball and 28% of the boys play baseball and football. What percent of those that play baseball also play football?

10. A student conducted a survey about coffee drinking preferences among students. Of the 50 students, 30 were aged 19-23, and 24 overall do not enjoy coffee. From those who said they enjoyed coffee, 4 were 14-18 years old.

	Likes Coffee	Doesn't Like Coffee	Total
Age 14 - 18			
Age 19 - 23			
Total			

a. Complete the two-way table.

b. Find  $P(\text{like coffee})$

c. Find  $P(\text{age 14-18} \mid \text{not like coffee})$

d. Find the probability that someone she surveyed was 14-18 years old.

e. Find probability of a student liking coffee given they are age 19 - 23.

11. Janie has a bag with 9 blue candies and 5 red candies. She selects a candy randomly from the bag, does not replace it then picks again randomly. Blue candy is Janie's favorite, so she hopes to select them.

a. What is the probability that Janie selects 2 of her favorite candy?

b. What is the probability that she gets at least 1 of her favorite candy?

c. Find  $P(1 \text{ of each color})$

d. Find  $P(\text{both red } \otimes)$

12. A student conducted a survey at school and found the following:
- Of the respondents, 60% have 1 sibling and 20% have 2 or more siblings
  - Of the respondents with 0 siblings, 90% have their own room
  - Of the respondents with 1 sibling, 20% do not have their own room
  - Of the respondents with 2 or more siblings, 50% have their own room
- a. Create a tree diagram for the scenario, displaying all possibilities and percentages
- b. What is the probability that a randomly selected student from this school has 1 sibling and has their own room?
- c. What is the probability that a randomly selected student has their own room?
- d. Find  $P(\text{own room} \mid 2 \text{ or more siblings})$
- e. Find  $P(\text{share room} \mid 1 \text{ sibling})$
13. In a certain school the students in *Common Core Math 2* completed a survey about cats and dogs. They found that 47% of the children in a school have a dog. Of those with no dog, 30% have a cat. 16% of those with a dog also have a cat.
- a. Create a tree diagram for the scenario, displaying all possibilities and percentages
- b. What is the probability that a randomly selected student from this school has a dog and a cat?
- c. What is the probability that a randomly selected student has either no dog or no cat?
- d. Find  $P(\text{dog} \mid \text{cat})$
- e. Find  $P(\text{no cat} \mid \text{no dog})$

14. In the game "Marble snap", three red and one blue marble are placed in one bag ; and two red and two blue in the other bag. To play the game, pull a marble from each bag. If the marbles are the same (snap) player A wins a point; otherwise player B wins a point. Replace the marbles after each trial.

a. Make a conjecture about who is most likely to win.

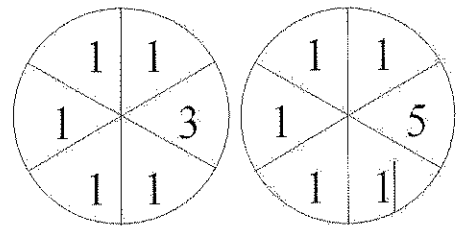
b. Create a sample space for the game.

c. What is the probability that player A will win?

d. What is the probability that player B will win?

e. Is the game fair? Explain.

15. The OR game is a game for two players, A and B. The game requires two spinners, each having 6 equal sectors. The first spinner has 1,1,1,1,3 on its sectors; the second spinner has 1,1,1,1,5. In one round, the spinners are both spun. If the product is 1 OR 15, then player A wins. If the product is 3 OR 5, then player B wins.



a. Make a conjecture about who is most likely to win.

b. Create a sample space for the game.

c. What is the probability that player A will win?

d. What is the probability that player B will win?

e. Is the game fair? Explain