## LOGIC

1. Which of the following are statements?
   - Math is hard.
   - There was measurable rainfall yesterday at the airport.
   - How hot is it?

2. Translate the sentence into symbolic form: "The food is sweet and it is not spicy".

3. Write a truth table for $(p \vee q) \wedge \sim (q \underline{\vee} r)$

4. Write the negation for each of the statements below
   (a) The car is blue
   (b) No cars are blue
   (c) Some cars are blue

5. Write the compound statement $\sim p \underline{\vee} q$ as a sentence given that
   p: The birds are hungry
   q: The birds are thirsty

SETS
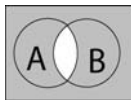
1. Express the shaded region in set notation:

2. A class of math students can be grouped in the following sets:
   $A = \{x | x$ is a woman$\}$ $B = \{x | x$ has taken Economics$\}$
   Find the set of women who have not taken Economics in set builder notation

3. A store has sold 100 microwaves. 80 of the microwaves have turntables and 40 of them have programs. If 90 of them have programs or turntables, how many have only turntables?

4. A survey of two hundred students is done at a school cafeteria. Use the information given to fill in a Venn diagram:
   55 students like pizza and burritos.
   130 students did not like chicken.
   30 students like all three items.
   35 students like burritos but did not like chicken.
   55 students like only pizza.
   60 students like exactly 2 of these dishes.
   15 students like chicken and pizza but not burritos.

5. Shade the region corresponding to
   (a) $\{x | x \notin A$ or $x \in B\}$ (b) $(A \cup B)^c$ (c) $(A \cap B^c) \cup C$ (d) $(B \cup C) \cap A^c$

6. Define the following sets. Note that U is the universal set. Decide if each statement is true or false.
   $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8\}$ $A = \{1, 2, 3\}$ $B = \{2, 4, 6\}$ $C = \{3, 5, 7\}$

   (a) B and C are disjoint   (b) $1 \subseteq A$ (c) $B \subset B$ (d) $\{3,5\} \in C$
   (e) $A \cap B = 2$ (f) $A \cup C = \{1,2,3,3,5,7\}$

BASIC PROBABILITY

1. A cup has one gold, one silver and one bronze coin in it. A single coin is chosen at random from the cup. How many events for this experiment contain a gold or silver coin?

2. A letter is chosen at random from the word WOOD. How many outcomes are in the uniform sample space for this experiment

3. Two fair six-sided dice are rolled. What is the probability that the sum is greater then 10 or at least one 5 is showing?

4. A class has 150 students and the maximum grade possible in this class is 100. Eleven students had a grade of 90 or more. Forty-one students had grades of 80 or more. Fifty-seven students had a grade that was greater than or equal to 60 but less than 70. Ten students had grades less than 60. Organize this information in a probability distribution table.

4. A coffee shop finds that 44% of its customers do not order coffee, 16% order only coffee, and 6% order only a muffin. What is the probability that a randomly selected customer will order coffee or a muffin?

5. A single ball is drawn at random from a container that contains 25 balls numbered 1 through 25. What is the probability that the number drawn is
        a) Even and a non-zero multiple of 5
        b) Even or a non-zero multiple of 5
        c) Odd and a multiple of 3

6. A single card is drawn from a standard deck of 52 cards. What is the probability that the card is not a six or not a seven?

7. Use the facts given, and fill in the Venn diagram with probabilities.
Then, answer the questions. Children brought the following items to a party, if they had them:

B = ball, S = skates, P = pogo stick

$P(B \cap P \cap S^C) = .09$
$P(B \cap P^C \cap S^C) = .30$
$P(P \cap S^C) = .14$
$P(B^C \cap P^C \cap S) = .24$
$P(B \cup P \cup S)^C = .02$
$P(B \cap P^C \cap S) = .11$
$P(B^C) = .43$

Find the probability that a random child attending the party brought …
a) a ball
b) a ball and skates
c) a ball or a pogo stick
d) a ball and one other item
e) a ball, but not skates
f) more than one item

8. The probability that an event E occurs is 55%. What are the odds in favor of event E? If the odds of an event F occurring are 6:11, what is the probability of event F?

CONDITIONAL PROBABILTY

1. The management of a company finds that 30% of the secretaries hired are unsatisfactory. A test is created to help screen secretarial applicants. One hundred employed secretaries are chosen at random and are given the new test. Out of these, 90% of the satisfactory secretaries pass the test and 20% of the unsatisfactory secretaries pass. Based on these results…
   a) if a person applies for a secretarial job, takes the test, and passes it, what is the probability that he/she will be a satisfactory secretary?
   b) if the applicant fails the test, what is the probability that he/she will be an unsatisfactory secretary?

2. A bag contains two one-dollar bills, a five-dollar bill, and a ten-dollar bill. A player draws bills one at a time without replacement from the bag until a ten-dollar bill is drawn. Then the game stops. All bills are kept by the player.
   a) What is the probability of winning $16?
   b) What is the probability of winning all bills in the bag?
   c) What is the probability of the game stopping at the second draw?

3. A survey of 100 students found that 40 like rock music, 55 like country music and 5 students like both.
   a. What is the probability that a student who likes country music likes rock music?
   b. Are the events "likes country music" and "likes rock music" mutually exclusive? Independent?

4. A bookshelf has 22 books on it. There are 7 are hardback books and 15 paperback books. There are 5 reference books (all hardbacks), 10 fiction books (all paperbacks) and 7 non-fiction books. What is the probability that a non-fiction book is a paperback?

5. Two fair six-sided dice are rolled. One is red and one is green.
   Let E denote the event that the green die shows a 3.
   Let F denote the event that the red die shows a 4.
   Let G denote the event that the sum of the numbers is 10.
   Let H denote the event that the numbers shown are the same.
       (a) Are events E and F independent?
       (b) Are events F and G independent?
       (c) Are events E and G mutually exclusive?
       (d) Find P(G|E)
   (e) Find P(G|H)

1~1 2~1 3~1 4~1 5~1 6~1
1~2 2~2 3~2 4~2 5~2 6~2
1~3 2~3 3~3 4~3 5~3 6~3
1~4 2~4 3~4 4~4 5~4 6~4
1~5 2~5 3~5 4~5 5~5 6~5
1~6 2~6 3~6 4~6 5~6 6~6

6. You have three boxes. Box 1 has 3 blue and 4 red marbles. Box 2 has 4 blue and 1 red marble. Box 3 has 2 blue and 7 red marbles. You choose a marble from box 1. If the marble is blue, place it in box 2. If the marble red, place it in box 3. Next choose a marble from box 2.
   a) Show this experiment in a tree diagram.
   b) What is the probability that the marble chosen from box 1 was blue given that a blue was chosen from box 2?
   c) If the marble chosen from box 2 is blue, it is placed in box 3, otherwise it is placed in box 1. A marble is then chosen from box 3. Show this step on the tree diagram from part (a).
   d) What is the probability (to 4 decimal places) that a blue marble is chosen from box 3?

LINEAR PROGRAMMING

1. The graph below shows the feasible region in white. Circle the correct inequality and find the exact values of all corner points.
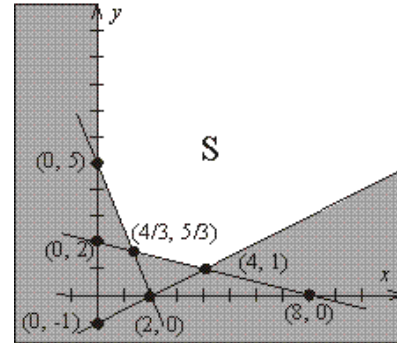

$$x+4y \overset{\leq}{\underset{\geq}{}} 18$$

$$7x+3y \overset{\leq}{\underset{\geq}{}} 21$$
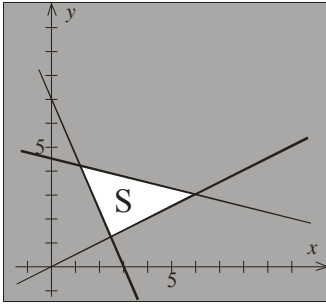
$$x-2y \overset{\leq}{\underset{\geq}{}} 0$$

2. What are the maximum and minimum values of $f(x,y)=3x+4y$, if any, on the region shown to the right?

3. A diet planner is trying to determine how much chicken and potatoes can be used in a packaged dinner. The nutritional requirements produce a feasible region that is unbounded with corners at (0, 40), (5, 20), (10, 10) and (30, 0). If x is the number of ounces of chicken and y is the number of ounces of potatoes, then the calories in the meal is given by

$$C = 42x + 21y.$$

Determine how much chicken and potato should be used in a meal to meet the nutritional requirements with a minimum number of calories.

4. Set up the following Linear Programming Problem. *DO NOT SOLVE.*
Mazie has at most $12000 to invest in three different stocks. The KO company costs $42.00 per share and pays dividends of $1.25 per share. The INTC company costs $21.00 per share and pays dividends of $0.40 per share. The MCD company costs $35.00 per share and pays $0.67 per share in dividends. Mazie has given her broker the following instructions: Invest at least twice as much money in INTC as in KO. Also, no more than 25% of the total invested should be in MCD. How should Mazie invest her money to maximize the dividends?

5. Every day a baker has 44 units of flour, 26 units of sugar and 100 units of raisins. A loaf of raisin bread requires 2 units of flour, 1 unit of sugar and 2 units of raisins. A raisin cake requires 1 unit of flour, 1 unit of sugar and 5 units of raisins. Raisin bread sells for $2 per loaf and raisin cakes sell for $5 each. How many of each item should be made to maximize revenue? What is the maximum revenue? Is anything leftover? Fractional items are not allowed? How does the solution change if the price of raisin bread is increased to $3 per loaf?