1. Four letter code words are to be formed from the first nine letters of the English Alphabet. How many ways can this be done if the code words must have exactly two vowels and repetitions of the same letter is not allowed?

2. Nick, an enthusiast of books, is doing some cleaning. He has found that he has two identical copies of *The Never Ending Story*, five identical copies of *There and Back Again*, and three identical copies of *Dreamcatcher*. How many different ways can he arrange these books on his shelf?

3. A shipping carton has 30 games in it. If it is known that there are 8 defective games in the carton, how many ways can you select 4 games and get exactly 1 defective game?

4. Johnny has been chosen to be one of the team captains for the weekly kickball game. There are 19 other kids in his class and he must choose 9 of them to be on his team. If he is good friends with 4 of the kids, how many ways can he choose his team so that he has at least 2 of his good friends on his team?

5. A National Honor Society Club consists of a president, vice-president, 3 treasurers, and 2 secretaries. The president and vice-president are to be chosen from 6 candidates, the 3 treasurers from 7 candidates, and the 2 secretaries from 12 candidates. How many different groups can be formed?

6. Susie has five different pieces of fruit, eight different vegetables, and seven different cookies. If she is going to pack a lunch that contains five items, how many ways can she have exactly two pieces of fruit or exactly three cookies?

7. How many different ten digit numbers can be formed from three 2’s, one 7, five 8’s, and a 9?

8. An experiment consists of randomly choosing 5 paper clips from a box containing 12 green paper clips, 9 red paper clips, and 3 blue paper clips. In how many ways can this be done if exactly 3 of the paper clips selected are the same color?

9. How many four digit numbers can be formed from the digits 0, 1, 3, 4, 5, 7, 8 if each number formed must be even, repetition of digits is not allowed, and the first digit must be a non-zero number?

10. Determine graphically the solution set for the following system of linear inequalities. Label all corner points.

   \[
   \begin{align*}
   x + y & \leq 4 \\
   2x + y & \leq 6 \\
   2x - y & \geq -1 \\
   x & \geq 0, y \geq 0
   \end{align*}
   \]

11. Clean-Hair Inc. produces three kinds of shampoos. It takes 2.5 hours to produce 1,000 bottles of formula I, 3 hours to produce 1,000 bottles of formula II, and 4 hours to produce 1,000 bottles of formula III. The profits for each 1000 bottles of formula I, formula II, and formula III are $180, $200, and $300 respectively. Suppose for a certain production run, there are enough ingredients on hand to make at most 9,000 bottles of formula I, 12,000 bottles of formula II, and 6,000 bottles of formula III. Furthermore, suppose the time for the production run is limited to a maximum of 70 hours. How many bottles of each formula should be produced in order to maximize the profit? Set-up the Linear Programming Problem but DO NOT SOLVE.

12. Given the following linear programming problem:

   \[
   \begin{align*}
   \text{Maximize} & \quad P = 10x + 2y \\
   \text{Subject to} & \quad x + y \leq 12 \\
   & \quad 2x + y \leq 16 \\
   & \quad x \geq 0, y \geq 0
   \end{align*}
   \]

   The optimal solution occurs at the intersection of which two lines?

13. Using the following sets, determine whether each statement is True or False.

   \[
   U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \\
   A = \{2, 3, 4, 5\}, B = \{1, 3, 10\}, C = \{5, 9, 10\}
   \]

   (a) \( 5 \in B^c \)

   (b) \( \{1, 2\} \subset (A \cap C^c) \cup B \)

   (c) \( B \cup C \) has 1 proper subset

   (d) \( (A \cup B)^c \cap C = A^c \cap B^c \cap C \)

   (e) \( \{3\} \in (B \cap C)^c \)

   (f) \( n(A \cup C^c) = 2 \)

14. A survey was conducted with 200 freshmen in college to learn of their vegetable preferences. Use a Venn Diagram to represent the following information:

   - 60 freshmen will only eat broccoli
   - 60 freshmen will eat exactly 2 of the vegetables
   - 155 freshmen will NOT eat spinach
   - 9 freshmen will eat all 3 vegetables
   - 63 freshmen will eat okra
   - 36 freshmen will eat okra and broccoli
   - 12 freshmen will only eat okra and spinach

   How many freshmen will eat exactly one of these vegetables?

15. Shade the following set on a three-circle Venn Diagram: \( (A \cup B^c) \cap C \)

16. An experiment consists of rolling a fair six-sided die and drawing one marble out of a bowl containing 3 red and 7 blue marbles. The number landing facing up on the die and the color of the marble is observed.

   (a) Find the sample space associated with the experiment.

   (b) Find the event, \( E \), that an even number is rolled.

   (c) Find the event, \( F \), that a green marble is selected.

   (d) Find the event, \( G \), that a number less than three is rolled.

   (e) Are the events \( E \) and \( F \) mutually exclusive?

   (f) Are the events \( E \) and \( G \) complementary?

   (g) How many events does this experiment have?