To graph a system of linear inequalities:

- Solve all inequalities for $y$.
- Graph the corresponding equations. If the inequality is a strict inequality ($<$ or $>$) draw the line as a dotted line to represent that the points on the line are NOT part of the solution. If the inequality is inclusive ($\leq$ or $\geq$) draw the line as a solid line to represent that the points on the line are part of the solution.
- Determine which half-plane satisfies the inequality. You can do this by using a test point or by using the following “rules”. Please note that these “rules” only work once we have the inequality solved for $y$:
  - If you have $y \leq f(x)$ or $y < f(x)$ the solution set lies below the line.
  - If you have $y \geq f(x)$ or $y > f(x)$ the solution set lies above the line.
- Our solution set (feasible region) consists of all points that satisfy all of the inequalities.
- A solution set is bounded if all of the points in our solution set can be enclosed by a circle. Otherwise, we say that the solution set is unbounded.
- A corner point is a point along the boundary of our feasible region in which we have a sharp turn.

A Linear Programming Problem consists of a linear objective function to be maximized or minimized subject to constraints in the form of linear equations or inequalities.

When setting up a linear programming problem, make sure to precisely define your variables, include your objective (maximize or minimize) and objective function along with all of your constraints.

If a linear programming problem has a solution, we are guaranteed that it will occur at a corner point of the feasible region.

If the feasible region is bounded then the objective function has both a maximum and minimum value.

If the feasible region is unbounded and the coefficients of the variables in the objective function are both non-negative, then the objective function has only a minimum value provided that $x \geq 0$ and $y \geq 0$ are two of the constraints.

If the feasible region is the empty set, the linear programming problem has no solution.

Method of Corners for Bounded Solution Set

- Graph the feasible region.
- Find the coordinates of all corner points.
- Make a table and evaluate the objective function at all corner points to see which yields the optimal solution. (Note: If the objective function is optimized at two corner points, then the objective function is optimized at every point along the line segment connecting these two points as well. We say we have infinitely many solutions.)

We can either use roster notation or set-builder notation to represent a set.

Two sets $A$ and $B$ are equal, written $A = B$, if and only if they have exactly the same elements.

If every element of a set $A$ is also an element of a set $B$, then we say that $A$ is a subset of $B$ and write $A \subseteq B$.

If $A$ and $B$ are sets such that $A \subseteq B$ but $A \neq B$ then we say $A$ is a proper subset of $B$ written $A \subset B$.

The set that contains no elements is called the empty set and is denoted by $\emptyset$. It is a subset of all sets.

The universal set is the set of all elements of interest in a particular problem.

We use Venn Diagrams to visually represent sets. The universal set $U$ is represented by a rectangle and subsets of $U$ are represented by circles inside of the rectangle.

The union of $A$ and $B$, written $A \cup B$ is the set of all elements that belong to $A$ or $B$.

The set of elements in common with the sets $A$ and $B$, written $A \cap B$, is called the intersection of $A$ and $B$.

The complement of $A$, denoted $A^c$ is the set of all elements in $U$ that are not in $A$.

Two sets $A$ and $B$ are disjoint if $A \cap B = \emptyset$.

De Morgan’s Laws: Let $A$ and $B$ be sets. Then $(A \cup B)^c = A^c \cap B^c$ and $(A \cap B)^c = A^c \cup B^c$.

$n(A)$ represents the number of elements in a set.

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

We can label each region in a Venn Diagram with the number of elements in it to sort out the given information.

Multiplication Principle: The total number of ways to perform a large task is the product of the number of ways to perform each subtask.

Permutation: $P(n, r) = \frac{n!}{(n-r)!}$ Special case of the multiplication principle. ORDER MATTERS! Things in a row, titles of group members, etc.

$\frac{n!}{n_1! n_2! \cdots n_r!}$ ways to arrange $n$ non-distinct objects

Combination: $C(n, r) = \frac{n!}{r!(n-r)!}$ ORDER DOES NOT MATTER! Used when we are just selecting a subset of our original group.
Section 7.1

- An **experiment** is an activity with an observable result.
- The **outcome** or **sample point** is the observed result.
- The **sample space**, $S$, is the set of all possible outcomes.
- An **event** is a subset of the sample space.
- All set operations (union, intersection, complement) are valid with events.
- Two events are **mutually exclusive** if $E \cap F = \emptyset$.
- The **impossible event** is the empty set. The **certain event** is the sample space.