Fall 2006
Math 141 Exam 2 Topics
courtesy: Kendra Kilmer

(covering Sections 3.1-3.3, 5.1-5.3, and Chapter 6)

Section 3.1

- To graph a system of linear inequalities:(The instructions below use reverse shading. Please note that some instructors might have taught you to shade the true region.)
  - 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 inequaility 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 and then cross-out(shade) the points we don't want. 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 true region lies below the line. Thus, we cross-out(shade) the points above the line.
    - If you have $y \geq f(x)$ or $y > f(x)$ the true region lies above the line. Thus, we cross-out(shade) the points below the line.
  - Our **solution set (feasible region)** consists of all points left unshaded.
- 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.

Section 3.2

- 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.

Section 3.3

- 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 objecitve function is optimized at every point along the line segment connecting these two points as well. We say we have infinitely many solutions.)

- Please note that if we have an unbounded feasible region, depending on the coefficients in our objective function, a maximum or minimum value may not be possible.

Section 5.1

- **Simple Interest:** $A = P(1+rt)$ where A is the accumulated amount, P is the principle amount, r is the annual interest rate as a decimal, and t is time in years.
- **Compound Interest:** $A = P\left(1+\frac{r}{m}\right)^{mt}$ where A, P, r, and t represent the same as above and m is the number of compounding periods per year.
- **Continuous Compound Interest:** $A = Pe^{rt}$ where A, P, r, and t represent the same as above and $e \approx 2.718281828....$
- **TVM Solver:**

  N =the total number of compounding periods

  $I\%$ = interest rate (as a percentage)

  PV = present value (principal amount). Entered as a negative number if invested, a positive number if borrowed.

  PMT = payment amount (0 if no payments are involved)

  FV =future value (accummulated amount)

  $P/Y = C/Y$=the number of compounding periods per year.

  Move the cursor to the value you are solving for and hit ALPHA and then ENTER. In all of the problems we do make sure that END is highlighted at the bottom of the screen. This represents that payments are received at the end of each period.

- The **Effective Rate of Interest** gives the equivalent interest rate if compounding was only done once a year. Use option C:Eff(on the finance menu. Enter as

  Eff(*interest rate as a percentage,number of compounding periods per year*)

Sections 5.2 and 5.3

- **Annuity:** A sequence of payments made at regular time intervals.
- In this course, we will study annuities with the following properties:
  - The terms are given by fixed time intervals.
  - The periodic payments are equal in size.
  - The payments are made at the end of the payment periods.
  - The payment periods coincide with the interest conversion periods.

Section 6.1

- 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 either A or B or both.
- 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 $(A \cap B)^c = A^c \cup B^c$.

Section 6.2

- $n(A)$ 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.

Section 6.3

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

Section 6.4

- **Permutation:** $P(n, r) = \dfrac{n!}{(n-r)!}$ Special case of the multiplication principle. ORDER MATTERS! Things in a row, titles of group members, etc.
- $n!$ ways to arrange n distinct objects.
- $\dfrac{n!}{n_1! n_2! \cdots n_r!}$ ways to arrange n non-distinct objects
- **Combination:** $C(n, r) = \dfrac{n!}{r!(n-r)!}$ ORDER DOES NOT MATTER! Used when we are just selecting a subset of our original group.