Exam #3
Math 111
April 29, 2005

Name_____

All questions are worth an equal number of points. All work is to be done on the blank paper provided. At the end of the exam, please hand in this sheet, together with all of your work.

§1 Calculation

1. Consider the following problem:

   Maximize the objective function $3x + 7y$ subject to the constraints

   $$\begin{cases} x + y \leq 30 \\ 2x - y \geq 10 \\ x \geq 0, \quad y \geq 0 \end{cases}$$

   Write the simplex tableau for this problem. Determine the first pivot element. **Do not solve the problem.**

2. Let $A = \{1, 3, 5, 6\}$, $B = \{1, 2, 4, 7\}$ and $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$. Find

   a. $A \cap B$,

   b. $A \cup B$, and

   c. B'.

3. List all of the subsets of $C = \{1, 2, 3\}$.

4. Evaluate

   a. $\binom{6}{0} + \binom{6}{1} + \binom{6}{2} + \binom{6}{3} + \binom{6}{4} + \binom{6}{5} + \binom{6}{6}$,

   b. $\binom{12}{2} + \binom{12}{3} + \binom{12}{4} + \binom{12}{5} + \cdots + \binom{12}{12}$.

§2 Comprehension

5. What is the inclusion-exclusion principle?

6. What is $C(n, r)$? What is $P(n, r)$? Explain why $C(n, r) = C(n, n - r)$.

§3 Application

7. One hundred and eighty business executives were surveyed to determine if the regularly read *Fortune*, *Time*, or *Money* magazines. Seventy-five read *Fortune*, 70 read *Time*, 55 read *Money*, 45 read exactly two of the three magazines, 25 read *Fortune* and *Time*, 25 read *Time* and *Money* while 5 read all three. How many read none of the three magazines?

8. In how many ways can a baseball team of 9 players arrange themselves in a line for a group picture?

9. In how many ways can a committee of five senators be chosen from the 100 members of the U.S. Senate so that no two members are from the same state?

10. A car dealership has 20 different models, of which 8 are two-door and 12 are four-door models. In how many ways can the manager choose three of the two-door and two of the four-door models for a showroom display?