HW #2, due September 7th

Problem Set 4: 5-11
Problem Set 5: 1-4, 6, 7, 9-11, 14-17
Problem Set 6: 1-4

Extra Problems for HW #2

Problem 1: Consider 5-card poker hands dealt from a standard 52-card deck. How many hands are there of each of the following rank:
   i. Full house?
   ii. Flush?
   iii. Straight?
   iv. Straight flush?
   v. Two pair?

(Note: Rank means the highest possible value for the hand. For example, Four-of-a-kinds and full houses do not count as hands with a rank of two pair.)

Problem 2: A classroom has 2 rows with 10 seats each. If the class has 15 students, 6 of whom always sit in the front and 4 of whom always sit in the back, how many possible seating arrangements are there?

Problem 3: At a gathering of people there are 20 men and 30 women.
   i. How many ways are there to form 20 couples consisting of one man and one woman?
   ii. How many ways are there to form 15 couples consisting of one man and one woman?

Problem 4: Suppose we want to choose a committee of $k$ people from a group of $n$ people, where one of the $k$ members of the committee will be elected president. Find two different ways to compute the number of such $k$-person committees.

Problem 5: XYZ Company has 2200 male and 1800 female employees. This company is going to select 100 of these employees to send to a week-long charity function in the Bahamas. If this group of 100 employees must contain at least 2 men, how many possible ways can XYZ Company choose these 100 employees?

Problem 6: Let $X = \{x_1, x_2, \ldots, x_{20}\}$. Determine the number of ordered triples $(S_1, S_2, S_3)$ such that $S_1, S_2, S_3$ form a set partition of $X$. (Note: This allows for the possibility that $S_i$ could be empty.)
**Problem 7:** Suppose we wish to place rooks on an $8 \times 8$ chessboard such that no two rooks lie in the same row or column.

i. In how many ways can we place 8 indistinguishable rooks on the chessboard?

ii. What if the rooks are all distinct?

iii. What if there are 3 blue rooks, 4 red rooks, and 1 green rook?

iv. What if we are only placing 6 rooks and they are all distinct?

**Bonus Problem:** Let $X = \{x_1, x_2, \ldots, x_{20}\}$. Determine the number of ordered triples $(S_1, S_2, S_3)$ such that

\[ S_1 \cup S_2 \cup S_3 = X, \]

and

\[ S_1 \cap S_2 \cap S_3 = \emptyset. \]