Section 1.4 A Counting: Permutations

1. If you flip a coin 3 times, what are all of the possible outcomes? How many possible outcomes are there?

2. Suppose 3 students are on a road trip, and all 3 are willing to drive. In how many ways can they be seated in the car?

3. Four students are returning from break. If all are willing to drive, in how many ways can they be seated in the car?

4. Definition: The Sample Space of an experiment is the set of all possible outcomes.

5. Factorial: $0! = 1, 1! = 1, 2! = 2 \times 1, 3! = 3 \times 2 \times 1, 4! = 4 \times 3 \times 2 \times 1$.
   In general, $n! = n \times (n-1) \times (n-2) \times \cdots \times 2 \times 1$.

6. Multiplication Principal of Counting:
   If one event can occur in a ways, and for each of those a ways another event can occur in b ways, then the total number of events is the multiplication $a \times b$.

7. A 6 member board sits around a table. How many different seating arrangements are possible?

8. A 6 member board self selects a president and a treasurer. In how many ways can this be done?

9. Permutations:
   A permutation is any ordered arrangement. If we want to order r things out of n total things, then there are
   $$_nP_r = \frac{n!}{(n-r)!}$$
   ways to do this. In example 8 above, there are
   $$_6P_2 = \frac{6!}{(6-2)!} = \frac{6 \times 5 \times 4 \times 3 \times 2 \times 1}{4 \times 3 \times 2 \times 1} = 30$$
   ways.

10. A true/false quiz has 5 questions. In how many ways cna the quiz be completed?

11. A softball team with 9 players needs a batting order. How many different ways are possible if:

- **there are no restrictions;**
- **the pitcher bats last;**
- **the catcher bats last and the pitcher bats anywhere but first?**

12. An identification tag has 2 letters followed by 4 numbers. How many different tags are possible if:

- **repetition of letters and numbers is allowed?**
- **repetition of neither letters nor numbers is allowed?**

13. The athletic department wants a picture for a brochure that includes 4 of the 11 starting offensive players from the football team on the left, 3 of the 6 volleyball players in the center, and 2 of the 5 starting basketball players on the right. How many possible pictures are there?