1. Section 2.1-2.2

1. From a pool of 12 candidates, how many ways can a VP of Finance, a VP of Student Services, and a VP of Student Affairs be assigned?

$$\text{Ways} = \frac{12 \times 11 \times 10}{3!} = 220$$

2. Starbucks offers 25 different frappuccino flavors, each available in 3 different sizes and with or without whipped cream. How many different frappuccino orders are possible?

$$25 \cdot 3 \cdot 2 = 150$$

3. The 12 members of a book club decide to each host one monthly meeting in 2016. How many different meeting schedules are possible?

$$12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 479,001,600$$

4. Twenty horses raced in the 2015 Kentucky Derby. Assuming no ties, how many different ways could 1st, 2nd, and 3rd place finishes be achieved?

$$\binom{20}{3} = \binom{20}{2} = \binom{20}{1} = \binom{20}{19} = \binom{20}{18} = \binom{20}{0} = 1$$
7. A 5-card hand is dealt from a standard 52-card deck.
   (a) How many hands are possible with no restrictions?
   $\binom{52}{5}$
   (b) How many hands consisting of all the same suit are possible?
   $\binom{13}{5}$
   (c) How many hands consist of two matching pairs (of different numbers) if the fifth card is a different number from the pairs?
   $\binom{13}{2} \cdot \binom{4}{2} \cdot \binom{10}{1}$

8. A catering service offers 7 appetizers, 10 main courses, and 5 desserts. A banquet committee is to select 3 appetizers, 4 main courses, and 2 desserts. How many different ways can this be done?
   $\binom{7}{3} \cdot \binom{10}{4} \cdot \binom{5}{2}$

9. Ten points are selected on a circle. How many different triangles can be formed using any of the ten points as vertices?
   $\binom{10}{3}$

10. Two countries each send 3 delegates to a conference. They are to be seated at a rectangular table with 3 chairs on each side.
   (a) How many ways can this be done if there are no seating restrictions?
   $3! \cdot 3!$
   (b) How many ways can this be done if delegates from the same country all sit on the same side?
   $3! \cdot 3! \cdot 2$

11. A Quidditch squad consists of 12 players. A team of seven is to be chosen to start.
   (a) How many ways can the team be selected without regard to positions?
   $\binom{12}{7}$
   (b) How many ways can the team in part (a) be selected if Harry or Ginny (but not both) must start?
   $\binom{10}{5}$

12. A Quidditch squad consists of 12 players. A team of seven is to be chosen to start.
   (c) How many ways can a team of 3 chasers, 2 beaters, a keeper, and a seeker be selected?
   $\binom{12}{3} \cdot \binom{9}{2} \cdot \binom{7}{1} \cdot \binom{6}{1}$
   (d) If the squad consists of 3 chasers, 3 beaters, and 2 beaters, how many ways can the team in part (c) be selected?
   $\binom{12}{3} \cdot \binom{9}{3} \cdot \binom{7}{2}$
12. There are 8 standard classifications of blood type. A 3-question exam for prospective lab technicians consists of having them determine the blood type of 3 different samples (labeled 1, 2, and 3).

(a) How many ways can this be done if no samples are the same type?

\[ \binom{8}{3} = \frac{8!}{3!(8-3)!} \]

(b) How many ways can this be done if two of the samples can be the same, but not all three?

\[ \binom{8}{2} \cdot \binom{6}{1} \cdot \binom{3}{1} \]

13. A nominating convention is to select a president and vice-president from among 4 candidates. How many different outcomes are possible?

\[ \binom{4}{2} = \frac{4!}{2!(4-2)!} \]

14. Three departments of a company have 10, 15, and 20 members, respectively.

(a) If each department is to select a delegate and an alternate to represent the department at a conference, how many different selections are possible?

\[ \binom{10}{1} \cdot \binom{10}{1} \cdot \binom{15}{1} \cdot \binom{15}{1} \cdot \binom{20}{1} \cdot \binom{20}{1} \]

(b) If each department is to select two representatives to the conference, how many different selections are possible?

\[ \binom{10}{2} \cdot \binom{10}{2} \cdot \binom{15}{2} \cdot \binom{15}{2} \cdot \binom{20}{2} \cdot \binom{20}{2} \]

15. If three representatives are to be chosen from all the departments, but at least one must come from the 20-member department, how many selections are possible?

\[ \binom{30}{3} - \binom{10}{3} \cdot \binom{15}{3} \]

\[ \binom{20}{3} \cdot \binom{10}{3} \cdot \binom{15}{3} \]

\[ \binom{30}{3} - \binom{10}{3} \cdot \binom{15}{3} \]

\[ \binom{20}{3} \cdot \binom{10}{3} \cdot \binom{15}{3} \]