Section 9-4 **Permutations**

An **ordering of objects is called a permutation**. For instance there are 6 permutations of the letters A, B and C. ABC ACB BAC BCA CAB CBA

1. You are considering 10 different colleges. Before you decide to apply to the colleges, you want to visit some or all of them. In how many different orders can you visit:

   a) 6 of the colleges? $10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5$

   b) all 10 colleges? $10!$

2. There are 8 movies you would like to see currently showing in the theater.
   a) In how many different ways can you see all 8 of the movies? $8!$

   b) In how many different ways can you choose a movie to see this Saturday and one to see this Sunday? $8 \cdot 7 = 56$

3. Pischke, Sacco and Ancelet each draw two cards and place them face up in a row. The cards are NOT replaced. Pischke goes first. Find the number of different orders in which

   a) Pischke could draw her two cards $52 \cdot 51$

   b) Sacco could draw his two cards *after* Pischke has already drawn $50 \cdot 49$

   c) Ancelet could draw her two cards *after* Pischke and Sacco have drawn theirs $48 \cdot 47$

4. A six-letter permutation is selected at random from the letters in the word NIMBLE. Find the probability of each event.

   a) The third letter is I and the last letter is B. $4 \cdot 3 \cdot 1 \cdot 2 \cdot 1 \cdot 1$

   b) The second letter is a vowel and the third letter is a consonant. $4 \cdot 2 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

   c) The second and third letters are both vowels. $4 \; 2 \; 1 \; 3 \; 2 \; 1$

   d) The second letter is a consonant and the last letter is E. $4 \; 4 \; 3 \; 2 \; 1 \; 1$

   e) The second letter is a consonant and the last letter is L. $4 \; 3 \; 3 \; 2 \; 1 \; 1$

all ÷ by 6!

5. 11 girls try out for the 11 positions on a soccer team

a) In how many different ways could the 11 positions be filled if there are no restrictions on who plays which position? $11!$

b) In how many different ways could the positions be filled if Jenna must be the goalie?

$1 \cdot 10!$

c) If the positions are selected at random, what is the probability that Jenna will be the goalie?

$$\frac{10!}{11!}$$

d) What is the probability in part c expressed as a percent?

e) What is the probability that Jenna, Kyra, or Megan is the goalie?

$$\frac{3 \cdot 10!}{11!}$$

f) Jenna, Kyra, or Megan is the goalie and Alyssa or Rory is the forward?

$$\frac{3 \cdot 2 \cdot 9!}{11!}$$

g) Jenna, Kyra, or Megan is the goalie, Alyssa or Rory is the forward, and Ellie is the left defender?

$$\frac{3 \cdot 2 \cdot 1 \cdot 8!}{11!}$$

$$\frac{3}{11} \cdot \frac{2}{10} \cdot \frac{1}{9} = \frac{6}{990} = \frac{1}{165}$$