Section 9-5 **Permutations** vs **Combinations**

A **permutation** is where the **order** or **arrangement** of elements is important.

A **combination** is where the order is NOT important.

Ex. ABC ACB BAC BCA CAB CBA 1 combination of the letters ABC but 6 permutations

Permutation

$${}_nP_r = \frac{n!}{(n-r)!}$$

Combination

$${}_nC_r = \frac{n!}{r!(n-r)!}$$

1. a) Out of 10 colleges, in how many orders can you visit 6 of them?

$10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5$ or ${}_nP_r$

b) Out of 10 colleges, if the order doesn't matter, how many ways can you visit 6 of them?

${}_{10}C_6$

2. Before each Supreme Court session, each of the nine justices shakes hands with every other justice. How many handshakes take place?

$8+7+6+5+4+3+2+1$ ${}_9C_2$

3. A pizza restaurant offers 11 different toppings. Find the number of different kinds of pizza they could make using

a) 3 toppings ${}_{11}C_3$

b) 5 toppings ${}_{11}C_5$

c) 3 toppings or 5 toppings ${}_{11}C_3 + {}_{11}C_5$

d) all 11 toppings ${}_{11}C_{11}$

4. In a group of 15 people, 6 are left-handed and the rest are right-handed. If 7 people are selected at random from this group, find the probability that

a) three are left-handed and four are right-handed

$$\frac{{}_6C_3 \cdot {}_9C_4}{{}_{15}C_7}$$

b) all are right-handed

$$\frac{{}_9C_7 \cdot {}_6C_0}{{}_{15}C_7}$$

c) all are left-handed

$$\frac{{}_6C_7}{{}_{15}C_7}$$ -- not possible 0%

d) Pam and Joe, two of the left-handers, are selected

$$\frac{{}_1C_1 \cdot {}_1C_1 \cdot {}_{13}C_5}{{}_{15}C_7}$$

e) At least 5 people are left-handed

$$\frac{{}_6C_5 \cdot {}_9C_2 + {}_6C_6 \cdot {}_9C_1}{{}_{15}C_7}$$