

# Permutations and Combinations Notes

## Permutation

A permutation is an arrangement of objects in a definite order. It is denoted by the symbol  $nPr$  where  $n$  is the total number of objects and  $r$  is the number of objects to be taken at a time in each arrangement.

$$1. nPr = n! \quad (\text{if } n = r)$$

$$2. nPr = \frac{n!}{(n-r)!} \quad (\text{if } n > r)$$

$$3. nPr = \frac{n!}{n_1!n_2!\dots n_k!} \quad (n_1, n_2, \dots, n_k \text{ are cells containing objects that are the same kind only.})$$

### Sample Problem 1. Solve Problem involving Permutation.

1. How many possible arrangements can be formed using the letters a, b, c, d and e if the letters are taken:

a. 5 at a time?

b. 3 at a time?

Solution:

A.  $n = 5, r = 5$

$${}_5P_5 = 5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

B.  $n = 5, r = 3$

$${}_5P_3 = \frac{5!}{(5-3)!} = 60$$

2. How many permutation can be made from the letters of the word DISSIMILAR?

Solution:

$D = 1, I = 3, S = 2, M = 1, L = 1, A = 1, R = 1$

$$P = \frac{10!}{1!3!2!1!1!1!1!} = 302400$$

3. In how many ways can 6 couples be seated in a round table with the men and women alternating?

Solution:

The number of ways of assigning the 6 women in their places is  $(6-1)! = 5!$  (Because 1 woman should be assigned one chair first) and men in  $6!$  ways. The total number of ways of arranging the couples is  $5!6! = 86,400$ .

## Combination

A combination is an arrangement of objects which does not involve the order of selection. The symbol for combination is  $nCr$  where  $n$  is the total number of objects and  $r$  is the number of objects taken at a time in an arrangement. The formula is given by

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

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## Sample Problem 2. Solve Problem involving Combination.

4. In how many different ways can a basketball team of 9 members be chosen from the 12 players?

Solution:

$$n = 12, r = 9$$

$${}_{12}C_9 = \frac{12!}{(12-9)!9!} = 220$$

5. In how many ways can 5 physics teacher be selected to attend a convention for free from 8 males and 6 females applicant if the group should be have:

A. 3 men and 2 women

B. 3 or 2 men?

Solution:

A. Men  ${}_8C_3 = 56$ , women  ${}_6C_2 = 15$ . The total number of ways is  $(56)(15) = 840$

B. Add the combination of 3 men and 2 women to the combination of getting 2 men and 3 women  
 $({}_8C_3)({}_6C_2) + ({}_8C_2)({}_6C_3) = (56)(15) + (28)(20) = 840 + 560 = 1400$  ways