

Product Rule and Permutation

Q:→ In how many ways can 3 people be seated in a row containing 7 seats?

Sol:→ First person can be seated in 7 ways
2nd person " " " " 6 ways
3rd person " " " " 5 ways

By the fundamental principle of counting or Product rule, total no. of ways in which three persons can be seated in seven seats in a row

$$= 7 \times 6 \times 5$$

$$= 210$$

Q:→ How many 3-digits numbers can be formed from the digits 1, 2, 3, 4 and 5 assuming that

(i) repetition of the digits is allowed?

(ii) repetition of the digits is not allowed?

Sol:→

(i) Repetition allowed

$$\underline{5} \times \underline{5} \times \underline{5} = 125$$

(ii) Repetition not allowed

$$\underline{3} \times \underline{4} \times \underline{5} = 60$$

Q:→ Find the number of different signals that can be made by arranging at least three flags in order on

a vertical pole, if 6 different flags are available.

sol: \rightarrow No. of flags = 6

i) No. of signals with three flags:

$$\underline{4} \times \underline{5} \times \underline{6} = 120$$

ii) No. of signals with four flags

$$\underline{3} \times \underline{4} \times \underline{5} \times \underline{6} = 360$$

iii) No. of signals with five flags

$$\underline{2} \times \underline{3} \times \underline{4} \times \underline{5} \times \underline{6} = 720$$

iv) No. of signals with six flags

$$\underline{1} \times \underline{2} \times \underline{3} \times \underline{4} \times \underline{5} \times \underline{6} = 720$$

\therefore Total no. of signals with at least 3 flags
 $= 120 + 360 + 720 + 720 = 1920.$

Practical Problems involving Permutation:

$${}^n P_r = \frac{n!}{n-r!}$$

Arrangement of r objects out of n distinct objects.

Q: \rightarrow How many 3-letter words can be made using the letters of the word ORIENTAL?

sol: \rightarrow No. of letters in the word ORIENTAL = 8 = n
No. of letters to be taken at a time = 3 = r

$$\therefore \text{Reqd no. of 3 letters words} = {}^8P_3 = \frac{8!}{5!}$$

$$= 8 \times 7 \times 6$$

$$= 336$$

Q: → Find the no. of different 8 letter words formed from the letters of the word TRIANGLE if each word is to

i) begin with T.

ii) end with E

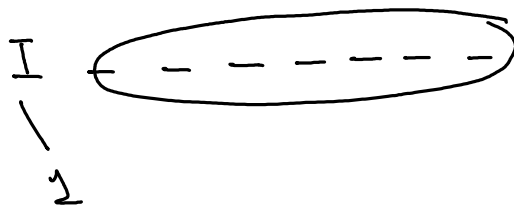
iii) begin with T and end with E

iv) have vowels occupying odd places.

sol: → No. of letters in the word TRIANGLE = 8

No. of letters to be taken at a time = 8

(i) begin with T



7 places 7 letters

$7P_7$

$$\text{Reqd. no. of words} = 1 \times {}^7P_7 = {}^7P_7 = 7! = 5040$$

ii) End with E



7 places 7 letters

$$\text{Reqd no. of words} = {}^7P_7 \times 1 = {}^7P_7 = 7! = 5040$$

iii) Begin with T and end with E

6 places 6 vowels

I ——— E

1 × 6P_6 × 1 = ${}^6P_6 = 720$

(iv)

TRIANGLE

$\frac{X}{1}$ — $\frac{X}{2}$ — $\frac{X}{3}$ — $\frac{X}{4}$ — $\frac{X}{5}$ — $\frac{X}{6}$ — $\frac{X}{7}$ — $\frac{X}{8}$

No. of odd positions = 4

No. of vowels (I, A, E) = 3

The three vowels can be arranged at the 4 odd position in 4P_3 ways

and five consonants can be arranged in 5P_5 ways

Reqd no. of words = ${}^4P_3 \times {}^5P_5$
 = 4×120
 = 24×120
 = 2880.

Q: → How many words can be formed using letters of EQUATION so that vowels and consonants occur together?

Vowels → 1 letter
 E, U, A, I, O

Consonants → 1 letter
 Q, T, N

$(5) \rightarrow {}^5P_5$
 $(3) \rightarrow {}^3P_3$

$${}^2P_2 \times {}^5P_5 \times {}^3P_3$$

$$2 \times 120 \times 6$$

$$= 1440 \quad \underline{\underline{\text{Ans}}}$$