GENERAL APTITUDE

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Permutation & Combination

- What is permutation?
- It is the number of ways a group of things can be arranged.

E.g: Consider 3 letters A,B,C . In how many ways they can be arranged?

- A B C
- A C B
- B A C
- B C A
- C A B
- C B A

6 ways to arrange these 3 letters

- For 3 letter / 4 letter words its possible but for more number of letters we need a formula-
- $nPr = \frac{n!}{(n-r)!}$

Permutation & Combination

Q. Consider 4 letters A,B,C,D and arrange them in 3 spaces

- - - 3 spaces

No . Of letters = 4

No of spaces = 3

nPr = $4P_3 = \frac{4!}{(4-3)!} = \frac{4!}{1!}$ =4! = 4 x 3 x 2 x 1 = 24 ways it can be arranged

Q. Arrange 7 letters A,B,C,D,E,F,G in 4 spaces

- - - - 4 spaces

nPr = $7P_4 = \frac{7!}{(7-4)!} = \frac{7!}{3!} = \frac{5040}{6}$ = 840

Permutation & Combination - Remember

0! = 1

1 ! = 1

2! = 2 x 1 = 2

3! = 3 x 2 x 1 = 6

4! = 4 x 3 x 2 x 1 = 24

5! = 5 x 4 x 3 x 2 x 1 = 120

6! = 6 x 5 x 4 x 3 x 2 x 1 = 720

7! = 7 x 6 x 5 x 4 x 3 x 2 x 1 = 5040

Permutation & Combination

Q. In how many ways can the letters of the word 'LEADER' be arranged?

A. 72 B. 144 C. 360 D. 720 E. None of these

Soln:

The word LEADER has 6 letters. So I can be arranged in 6! ways.

Out of these 6 letters , 2 letters are repeated (letter E repeated twice)

So we write it as - $\frac{6!}{2!}$

$6!$ → 6! ways to arrange letters in the word LEADER

$2!$ → 2! In the denominator as letter E is repeated twice

$$= \frac{6\times5\times4\times3\times2\times1}{2\times1}$$

= 360 ways

Ans : C

Permutation & Combination

Q. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?

A. 360 B. 480 C. 720 D. 5040 E. None of these

Soln:

L E A D I N G ⟶ vowels in this word are E,A I

Remaining letters(consonants) are - L D N G

now we can arrange the vowels together in the remaining spaces as

_ L _ D _ N _ G_ in 5! ways and vowels be rearranged in those spaces in 3! ways

5! X 3! = 720 ways

Ans : C

Permutation & Combination

Q. In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?

A. 810 B. 1440 C. 2880 D. 50400 E. 5760

Soln:

C O R P O R A T I O N------- vowels in this word are O,O,A,I,O

Remaining letters(consonants) are - C R P R T N

now we can arrange the vowels together in the remaining spaces as

_C_R_P_R_T_N_ in 7! ways and vowels be rearranged in those spaces in 5! Ways

But the repeated letters are 2R in consonants and 3O in vowels

$$\frac{7!}{2!} X \frac{5!}{3!} = 50400 \text{ ways}$$

Ans : D

Permutation & Combination

Q. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

A. 210 B. 1050 C. 25200 D. 21400 E. None of these

Soln:

we need to form a 5letter word with 3consonants & 2vowels = C C C V V

Ways to select, (3 consonants out of 7) AND (2 vowels out of 4)

$= {}^{7}C_{3} \times {}^{4}C_{2} \times 5!$ ← each group has 5 letters and they can be arranged in 5! ways

$= \frac{7\times6\times5}{3\times2\times1} \times \frac{4\times3}{2\times1} \times 5!$

$= 35 \times 6 \times 120$

$= 25200$ ways

Ans : C

Permutation & Combination

Q. From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?

A. 564 B. 645 C. 735 D. 756 E. None of these

Soln:

We may have (3 men and 2 women) or (4 men and 1 woman) or (5 men only).

Required number of ways= (7C3 x 6C2) + (7C4 x 6C1) + (7C5)

$$= \left(\frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{6 \times 5}{2 \times 1}\right) + (7C3 \times 6C1) + (7C2) \rightarrow [\text{using } {}^{n}C_{r} = {}^{n}C_{(n-r)}]$$

$$= 525 + \left(\frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{6}{1}\right) + \left(\frac{7 \times 6}{2 \times 1}\right)$$

$$= 525 + 210 + 21$$

$$= 756$$

Ans: D

Difference between permutation and combination

Combination (order does not matter)

"My fruit salad is a combination of apples, grapes and bananas" We don't care what order the fruits are in, they could also be "bananas, grapes and apples" or "grapes, apples and bananas", its the same fruit salad.

Permutation (When the order does matter)

"The combination to the safe is 472". Now we **do** care about the order. "724" won't work, nor will "247". It has to be exactly **4-7-2**.

Difference between permutation and combination

What is permutation?

Permutation: The various ways of arranging a given number of things by taking some or all at a time are all called as permutations.
Permutation includes word formation, number formation, circular permutation, etc. **In permutation, objects are to be arranged in particular order.** It is denoted by $^{n}P_{r}$ **or P(n, r).**

Example: Arrange the given 3 numbers 1, 2, 3 by taking two at a time.
Now these numbers can be arranged in 6 different ways: **(12, 21, 13, 31, 23, 32).**

Here,

12 and 21, 13 and 31 or 23 and 32 do not mean the same, because here order of numbers is important.

Difference between permutation and combination

- **What is combination?**

  Combination: Each of different groups or selections formed by taking some or all number of objects is called a combination.

  Combination is used in different cases which include team/group/committee.

  In combination, objects are selected randomly and here order of objects doesn't matter. It is denoted by **$^{n}C_{r}$ or C(n, r) or $^{n}C_{r} = {}^{n}C_{(n-r)}$.**

  Example: If we have to select two girls out of 3 girls X, Y, Z, then find the number of combinations possible.

  Now only two girls are to be selected and arranged. Hence, this is possible in 3 different ways: **(XY, YZ, XZ,).**

  Here,
  You cannot make a combination as XY and YX, because these combinations mean the same.

Permutation & Combination(Assignment)

Q. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?

A. 159 B. 194 C. 205 D. 209 E. None of these

Soln:

(1 boy and 3 girls) or (2 boys and 2 girls) or (3 boys and 1 girl) or (4 boys).

= (6C1 x 4C3) + (6C2 x 4C2) + (6C3 x 4C1) + (6C4)

= (6C1 x 4C1) + (6C2 x 4C2) + (6C3 x 4C1) + (6C2) → using $^nC_r = {}^nC_{(n-r)}$(to reduce calculation)

$$= (6 \times 4) + \left(\frac{6 \times 5}{2 \times 1} \times \frac{4 \times 3}{2 \times 1}\right) + \left(\frac{6 \times 5 \times 4}{3 \times 2 \times 1} \times 4\right) + \frac{6 \times 5}{2 \times 1}$$

= (24 + 90 + 80 + 15)

= 209

Ans: D

Permutation & Combination(Assignment)

Q. How many 4-letter words with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed?

A. 40

B. 400

C. 5040

D. 2520

Ans: C

Permutation & Combination(Assignment)

Q. In how many different ways can the letters of the word 'MATHEMATICS' be arranged so that the vowels always come together?

A. 10080

B. 4989600

C. 120960

D. None of these

Ans: C

Permutation & Combination(Assignment)

Q. In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together?

A. 120

B. 720

C. 4320

D. 2160

E. None of these

Ans: B

Permutation & Combination(Assignment)

Q. How many Permutations of the letters of the word APPLE are there?

A.600 B.120 C.240 D.60

Ans: D

Permutation & Combination(Assignment)

Q. How many different words can be formed using all the letters of the word ALLAHABAD?

A.7560

B.7890

C.7650

D. None of these

Ans: A

Permutation & Combination(Assignment)

Q. Find the value of ${}^{50}P_2$

A. 4500
B. 3260
C. 2450
D. 1470

Ans : C

Permutation & Combination(Assignment)

Q. How many words can be formed by using letters of the word ‘DELHI’?

a. 50
b. 72
c. 85
d. 120

Ans : D

Permutation & Combination(Assignment)

Q. Find the number of ways the letters of the word ‘RUBBER’ can be arranged?

A. 450
B. 362
C. 250
D. 180

Ans: D

Permutation & Combination(Assignment)

Q. Out of 5 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

A. 60
B. 200
C. 5230
D. 7200

Ans : D

Permutation & Combination(Assignment)

Q. In how many ways can a group of 5 men and 2 women be made out of a total of 7 men and 3 women?

A. 63

B. 90

C. 126

D. 45

E. 135

Ans: A

IMPORTANT FORMULAE

- **I**.1.Area of a rectangle=(length x breadth)
- Therefore length = (area/breadth) and breadth=(area/length)
- 2.Perimeter of a rectangle = 2 x (length + breadth)

- **II**.Area of a square = (side)^2 =1/2(diagonal)^2
- **III** Area of four walls of a room = 2*(length + breadth)*(height)

- **IV** 1.Area of the triangle=1/2(base*height)
- 2. Area of a triangle = (s*(s-a)(s-b)(s-c))^(1/2), where a,b,c are the sides of a triangle & s= ½(a+b+c)
- 3.Area of the equilateral triangle =((3^1/2)/4)*(side)^2

IMPORTANT FORMULAE

- **V.**1.Area of the parellogram =(base *height)
- 2.Area of the rhombus=1/2(product of the diagonals)
- 3.Area of the trapezium=1/2(size of parallel sides)*distance between them.

- **VI** 1.Area of a circle =pi*r^2,where r is the radius
- 2. Circumference of a circle = 2ΠR.
- 3. Length of an arc = 2ΠRθ/(360) where θ is the central angle
- 4. Area of a sector = (1/2) (arc x R) = pi*R^2*θ/360.

- **VII**. 1. Area of a semi-circle = (pi)*R^2.
- 2. Circumference of a semi-circle = (pi)*R.
- where, **pi** = 3.142

VOLUME AND SURFACE AREA – IMPORTANT FORMULAE

- **I. CUBOID**
- Let length = l, breadth = b and height = h units. Then,
- **1**. Volume = (l x b x h) cubic.units.
- **2. Surface area=** 2(lb + bh + lh) sq.units.
- **3. Diagonal**.=$\sqrt{l^2 + b^2+h^2}$ units

- **II. CUBE**
- Let each edge of a cube be of length a. Then,
- **1. Volume** = a^3 cubic units.
- **2. Surface area** = $6a^2$ sq. units.
- **3. Diagonal** =$\sqrt{3}$ a units.

- **III. CYLINDER**
- Let radius of base = r and Height (or length) = h. Then,
- **1. Volume** = (∏ r2h) cubic units.
- **2. Curved surface area** = (2∏ rh). units.
- **3. Total surface area** =2 ∏ r (h+r) sq. units

VOLUME AND SURFACE AREA – IMPORTANT FORMULAE

- **IV. CONE**
- Let radius of base = r and Height = h. Then,
- **1. Slant height, l =** $\sqrt{h2+r2}$
- **2. Volume** = (1/3) ∏ r^2h cubic units.
- **3. Curved surface area** = (∏ rl) sq. units.
- **4. Total surface area** = (∏ rl + ∏ r^2) sq. units.

- **V. SPHERE**
- Let the radius of the sphere be r. Then,
- **1. Volume** = (4/3) ∏ r^3 cubic units.
- **2. Surface area** = (4 ∏ r^2) sq. units.

- **VI. HEMISPHERE**
- Let the radius of a hemisphere be r. Then,
- **1. Volume** = (2/3) ∏ r^3 cubic units.
- **2. Curved surface area** = (2 ∏ r^2) sq. units.
- **3. Total surface area** = (3 ∏ r^2) units.

Surds and Indices

Rules of Indices: -

i. $a^n * a^m = a^{m+n}$

ii. $\frac{a^m}{a^n} = a^{m-n}$

iii. $(a^n)^m = a^{mn}$

iv. $(ab)^n = a^n * b^n$

v. $(\frac{a}{b})^n = \frac{a^n}{b^n}$

vi. $a^0 = 1$ (where a $\neq 0$)

vii. $a^{-n} = \frac{1}{a^n}$

Rules of Surds: -

i. $\sqrt[n]{a} = a^{\frac{1}{n}}$

ii. $\sqrt[n]{ab} = a^{\frac{1}{n}} * b^{\frac{1}{n}}$

iii. $\sqrt[n]{\frac{a}{b}} = \frac{a^{\frac{1}{n}}}{b^{\frac{1}{n}}}$

iv. $(\sqrt[n]{a})^n = a$

v. $(\sqrt[n]{a})^m = a^{\frac{m}{n}}$

Races

- A contest of speed in running, riding, driving, sailing or rowing is called a race.
- If in a race Ram is at starting point & Shyam starts from 20 mts ahead, then it is said that Ram has given Shyam a start of 20 mts or Ram gives Shyam 20 mts.
- This means that if they start from same point Ram would beat Shyam by 20 mts.

Races

Q. In a 100 mt race A gives B a start of 25 mt & still wins by 9 sec. Find the speed of A if speed of B is 6 kmph.

A.8 kmph B. 9 kmph C. 10 kmph D. 12 kmph

Soln

!----------100 m----------!

A<---25--->B<----------75m----------> A=t-9, B=t

Sb = 6 kmph = 6 x 5/18 = 5/3 m/s

Tb = Db/Sb = 75/(5/3) = 45 sec

Ta = Tb-9 = 36 sec

Sa = Da/Ta = 100/36 m/s

= 100/36 x 18/5

= 10 kmph

Ans C

Races(Assignment)

Q. In a 100 m race, A can beat B by 25 m and B can beat C by 4 m. In the same race, A can beat C by:

A. 21 m B. 26 m C. 28 m D. 29 m

- **Soln**:-

A : B = 100 : 75
B : C = 100 : 96

$A:C=(\frac{A}{B}\times\frac{B}{C})=(\frac{100}{75}\times\frac{100}{96})=100:72$

A beats C by (100−72)=28 m.

Ans: C

Circular Motion

- **Use of both relative speed & LCM**
- Let Sa, Sb = speeds of two persons.
  Sr = Their relative speed
  Distance traveled in 1 round = circumference

Case A : Both running in Same direction

Both meet again first time when → **Time = dist/Sr = Circumference/Sa-Sb**

Case B : Both running in opposite directions**(DistA+ DistB =Circumference)**

Both meet first time when → **Time = Circumference/Sa+Sb**

Case C : Both running in same/opposite directions

Both meet again at starting point at LCM of their Lap times.

Circular Motion(Races)

Q. Two friends P & Q start from same point at the same time on a circular track 336 meters long in opposite directions at 6 m/s & 8 m/s respectively. After how much time will they meet again at the starting point for the first time?

A. 56 sec B. 112 sec C. 168 sec D. 214 sec

Ans : C

Step1 – find the time taken by each member /player to complete 1 round

Step2 – Calculate LCM(Lap time)

$$\text{LapTm(P)} = \frac{\text{Circumference}}{\text{Sp}} = \frac{336}{6} = 56 \text{ sec}$$

$$\text{LapTm(Q)} = \frac{\text{Circumference}}{\text{SQ}} = \frac{336}{8} = 42 \text{ sec}$$

LCM(42,56) = 168 sec

Circular Motion(Assignment)

Q. A, B & C start together running along a circular track of 500 m at 8 km/hr, 5 km/hr & 3 km/hr respectively. After how much time will all three meet again at the starting point for the first time?

A. 20 min B. 24 min C. 30 min D. 36 min

Ans: C


THANK
YOU!