FREE NOTES · NCERT + JEE LEVEL

Permutations & Combinations

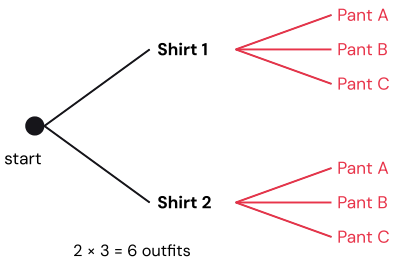
Counting ka fundamental principle, factorial, permutations (sab alag, repetition ke saath, ek jaisi cheezein, circular), combinations, ${}^{n}P_{r}$ aur ${}^{n}C_{r}$ ka rishta aur standard counting sawaal.

01 Counting ka fundamental principle
02 Factorial
03 Permutations (arrangements)
04 Special permutations
05 Combinations (selection)
06 ${}^{n}C_{r}$ ki properties
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01 Counting ka fundamental principle

- **Multiplication (AUR):** ek kaam m tareeke se aur uske baad doosra n tareeke se ho to dono milke **m × n** tareeke.
- **Addition (YA):** do kaam me se koi ek (dono nahi) ho to total = **m + n**.

Example: ROSE se bina repeat 3-letter "words" = 4 × 3 × 2 = 24.



Tree diagram: 2 shirts aur 3 pants

02 Factorial

$$n! = 1 \times 2 \times 3 \times \ldots \times n;\ 0! = 1$$

$$n! = n \times (n-1)!$$

5! = 120, 6! = 720, 7! = 5040. 8!/6! = 8 × 7 = 56.

03 Permutations (arrangements)

$$^{n}P_{r} = n!/(n - r)!$$

n alag cheezon me se r ki arrangements, order matter karta, repeat nahi. $^{n}P_{n} = n!$, $^{n}P_{0} = 1$. Repeat allowed ho to: $\mathbf{n^{r}}$.

04 Special permutations

Situation	Tareeke
n cheezein, p ek jaisi, q doosri jaisi...	$n!/(p!\ q!\ \ldots)$
Kuch cheezein hamesha saath	Unhe ek block maano, phir andar ki arrangements se guna
Kuch kabhi saath nahi	Total - saath wale
n ki circular arrangement	$(n - 1)!$
Haar / maala (clockwise = anticlockwise)	$(n - 1)!/2$

Example: MISSISSIPPI ki arrangements = 11!/(4! 4! 2!) = 34650.

05 Combinations (selection)

$$^{n}C_{r} = n!/(r!(n - r)!)$$

$$^{n}P_{r} = {}^{n}C_{r} \times r!$$

Order matter nahi karta. {A, B, C} me se 2 chunna: AB, AC, BC = $^{3}C_{2} = 3$ (par $^{3}P_{2} = 6$).

06 ${}^{n}C_{r}$ ki properties

$${}^{n}C_{r} = {}^{n}C_{n-r};\ {}^{n}C_{0} = {}^{n}C_{n} = 1$$

$${}^{n}C_{a} = {}^{n}C_b \Rightarrow a = b \text{ ya } a + b = n$$

$${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r} \text{ (Pascal's rule)}$$

$${}^{n}C_{0} + {}^{n}C_{1} + \ldots + {}^{n}C_{n} = 2^{n}$$

07 Selection vs arrangement: kaise pehchanein

Sawaal ke shabd	Kya lagao
arrange, order, line me, words, numbers, ranks, baithana	Permutation
select, chuno, committee, team, group, handshakes	Combination

- n-gon ke diagonals = ${}^{n}C_{2}$ − n. n points se lines (koi 3 collinear nahi) = ${}^{n}C_{2}$. Triangles = ${}^{n}C_{3}$.
- n logon me handshakes = ${}^{n}C_{2}$.

08 JEE Extra + Tricks

JEE LEVEL

- Gol arrangement: $(n - 1)!$; maala (palatne pe same): $(n - 1)!/2$.
- n same cheezein r groups me (≥ 0): ${}^{n+r-1}C_{r-1}$; har ek ≥ 1: ${}^{n-1}C_{r-1}$.
- Derangements: $D_n = n![1 - 1/1! + 1/2! - \ldots + (-1)^n/n!]$; $D_3 = 2$, $D_4 = 9$.
- $N = p^a q^b r^c$ ke divisors: $(a + 1)(b + 1)(c + 1)$; divisors ka jod $(p^{a+1} - 1)/(p - 1)$ ka guna.
- Dictionary me word ka rank: chhote letters se shuru hone wale words step by step gino.
- Gap method: baakiyon ko pehle rakho, restricted ko gaps me (koi do saath nahi).

09 Solved examples

Q1. 1–9 se bina repeat kitne 4-digit numbers?

${}^{9}P_{4} = 9 \times 8 \times 7 \times 6 =$ **3024**.

Q2. INDEPENDENCE ke letters kitne tareeke se arrange?

12 letters: N 3, E 4, D 2 ⇒ 12!/(3! 4! 2!) = **1663200**.

Q3. 5 ladkon aur 4 ladkiyon me se 3 ladke aur 2 ladkiyon ki committee?

${}^{5}C_{3} \times {}^{4}C_{2} = 10 \times 6 =$ **60**.

Q4. MOTHER se words jisme vowels saath hon?

O, E ek block: 5! × 2! = **240**.

Q5. ${}^{n}C_{8} = {}^{n}C_{2}$ ho to ${}^{n}C_{2}$?

n = 10 ⇒ ${}^{10}C_{2} =$ **45**.

10 Common mistakes

- Jab order matter na kare (team, committee) tab P lagana.
- Bhoolna ki number 0 se shuru nahi ho sakta.
- "Saath" wale block ki andar ki arrangement bhool jaana.
- Circular seating me (n - 1)! ki jagah n! lagana.

11 Formula sheet & practice

${}^{n}P_{r}$	$n!/(n-r)!$
${}^{n}C_{r}$	$n!/(r!(n-r)!)$
Repeat allowed	n^{r}
Ek jaisi cheezein	$n!/(p!\,q!\,\ldots)$
Circular	$(n-1)!$
Pascal	${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r}$

1. Hexagon ke diagonals?

2. 5 logon ko gol table pe kitne tareeke se?

3. ${}^{5}P_{r} = 2 \times {}^{6}P_{r-1}$ ho to r?

4. 1, 2, 3, 4, 6, 7 se 3-digit even numbers (bina repeat)?

ANSWERS

1) 9 · 2) 24 · 3) r = 3 · 4) 60

12 Quick revision: exam se 5 minute pehle

COUNTING

- AUR ⇒ ×, YA ⇒ +.
- 0! = 1.

PERMUTATION

- ${}^{n}P_{r} = n!/(n - r)!$.
- Ek jaisi: n!/(p!q!).
- Circle: (n - 1)!.

COMBINATION

- ${}^{n}C_{r} = {}^{n}P_{r}/r!$.
- ${}^{n}C_{r} = {}^{n}C_{n-r}$.

SHORTCUTS

- Diagonals ${}^{n}C_{2} - n$.
- Saath = block × andar.
- Kabhi saath nahi = total - saath.

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.