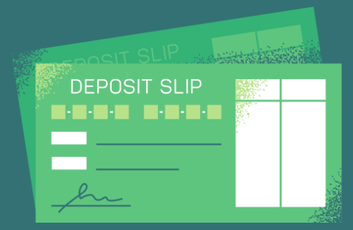
Permutations and Combinations



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Permutations?

Permutations refer to the number of ways to **arrange** a set of items **when order matters**.

In other words: Changing the order creates a different outcome.

Are you Hear about Permutations and Combinations?

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

n: total number of items

r: number of Item

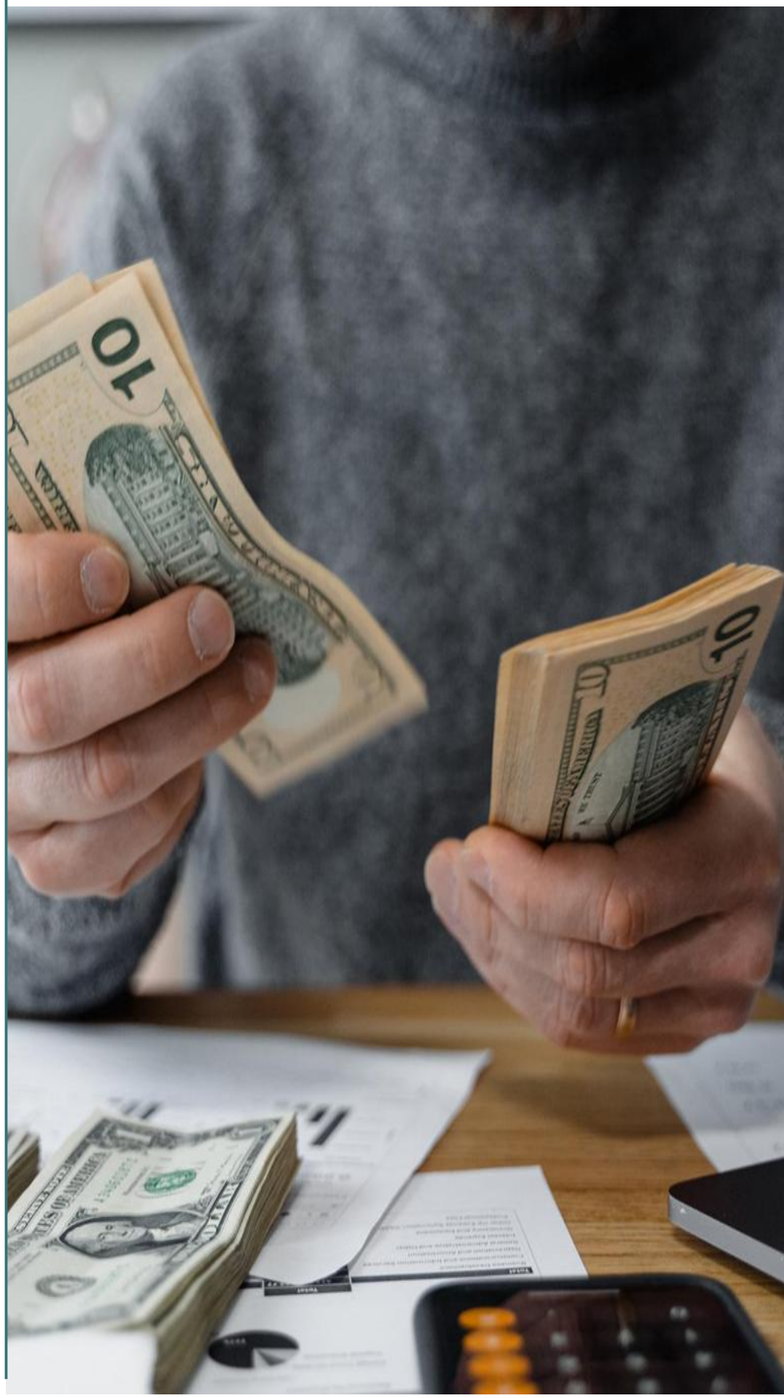
!: factorial

🛢️ Engineering Example:

Suppose an oil company has **3 engineers**:
Ahmed, Sara, and Ali.

They need to be **assigned to 3 different shifts** (morning, evening, night).

How Many different ways can we assign them?



Solve:

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

$$\text{P(3,3)} = \frac{3!}{(3-3)!}$$

$$\text{P(3,3)} = \frac{6}{1} = 6$$

So, there are **6 different ways** to assign the engineers.

Got questions?

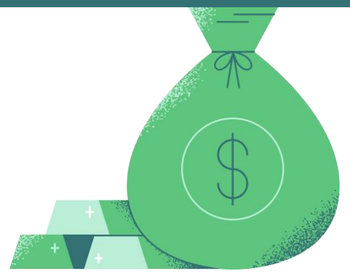
Class Work

A drilling company has **5 engineers**, and it wants to assign **3 of them** to different tasks **in a specific order** (e.g., morning, evening, night shifts).

How many different ways can the assignments be made?

- **Please Solve above Q and send it on Goggle Form**

What's Combinations



Combinations count the number of ways to **select items from a group when order does not matter**

- In **permutations**, order matters.
- In **combinations**, order does not matter.

$$C(n, r) = \binom{n}{r} = \frac{n!}{r!\,(n-r)!}$$

Where:

n = total number of items

r = number of items chosen

$!$ = factorial

Engineering Example:

An oil company has **5 engineers**, and it wants to select **3 of them** to attend a training course. The order of selection does not matter (we only care who is chosen, not in which order).?

$$C(5, 3) = \frac{5!}{3!\,(5-3)!} = \frac{120}{6 \cdot 2} = 10$$

So, there are 10 different combinations of 3 engineers chosen from 5.

Discussion as Team

- If we use the same previous example with arrange order **Permutations (P)**

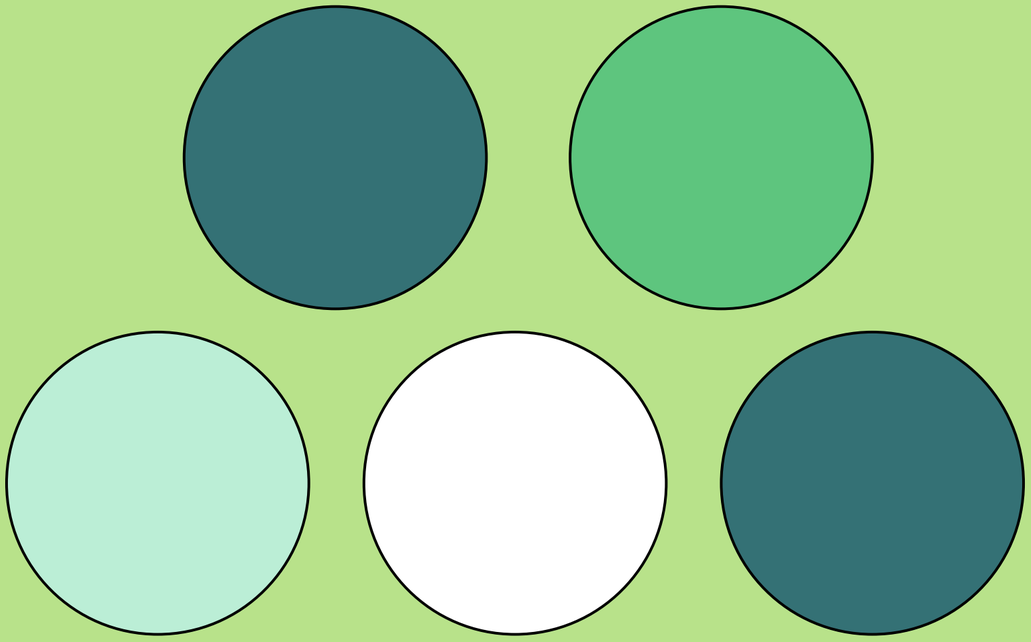
what is the difference?

Permutations (P): Assigning 3 engineers to 3 shifts → $P(5, 3) = 60$
Combinations (C): Choosing 3 engineers for training → $C(5, 3) = 10$
Same numbers, but **permutations are larger** because order creates more arrangements.

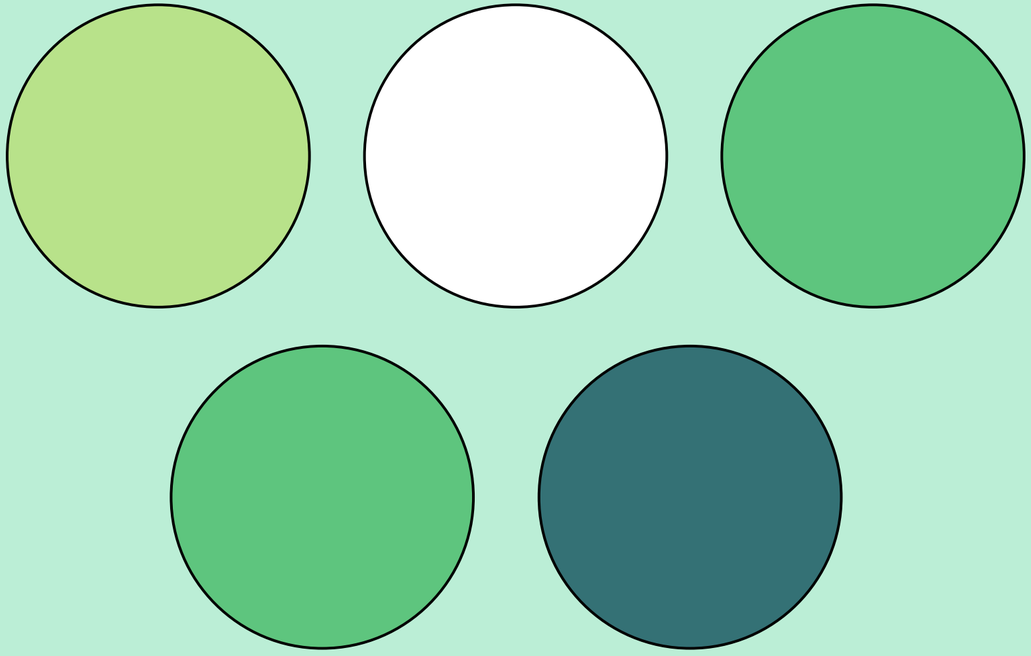
Class Active

Permutations vs. Combinations

Examples



Examples



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Which of the following is a **combination** scenario?

a) Assigning engineers to shifts
b) Choosing engineers for training
c) Ranking wells by depth
d) Scheduling tasks by time

Explain the difference between mutually exclusive and independent events using oilfield examples.

The number of combinations is always greater than the number of permutations for the same n and r.

✅ **True** ❌ **Fals**

Thank U for Attending the lect.