

Permutations vs combinations — when order matters (clinic)

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Practice problems

1. A club has 15 members. In how many ways can a president, a vice president, and a secretary be chosen?
2. A pizza shop offers 10 different toppings. How many different 3-topping pizzas can be made if toppings cannot be repeated?
3. A security code consists of 5 characters. Each character can be any of the 26 uppercase letters of the alphabet. How many such codes are possible?

Solutions

1. A club has 15 members. In how many ways can a president, a vice president, and a secretary be chosen?

- Step 1: Check if order matters. Since the roles are different, swapping the president and secretary creates a different outcome. Order matters.
- Step 2: Check for repetition. One person cannot hold more than one office. Repetition is not allowed.
- Step 3: Use the permutation formula $P(n, r)$ with $n = 15$ and $r = 3$.
- Step 4: Compute $15 \times 14 \times 13$.

Answer: 2730

2. A pizza shop offers 10 different toppings. How many different 3-topping pizzas can be made if toppings cannot be repeated?

- Step 1: Check if order matters. A pizza with pepperoni, mushrooms, and onions is the same as one with onions, mushrooms, and pepperoni. Order does not matter.
- Step 2: Check for repetition. The problem states toppings cannot be repeated.
- Step 3: Use the combination formula $\binom{n}{k}$ with $n = 10$ and $k = 3$.
- Step 4: Compute $\frac{10 \times 9 \times 8}{3 \times 2 \times 1}$.

Answer: 120

3. A security code consists of 5 characters. Each character can be any of the 26 uppercase letters of the alphabet. How many such codes are possible?

- Step 1: Check if order matters. In a security code, the sequence of letters is critical. Order matters.
- Step 2: Check for repetition. There is no restriction saying letters cannot be repeated, so repetition is allowed.
- Step 3: Since repetition is allowed, use the multiplication principle n^r .
- Step 4: Compute 26^5 .

Answer: 11881376