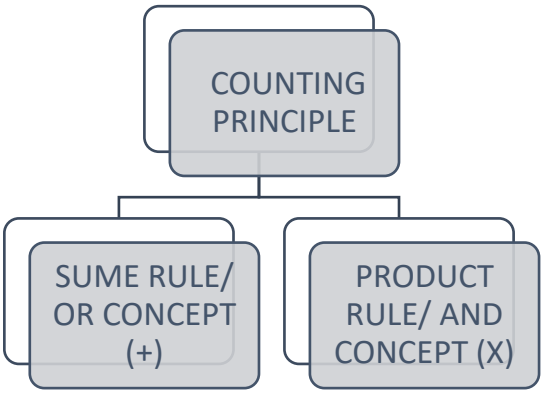
BASIC COUNTING RULES



COMBINATION OF SUM AND PRODUCT RULE

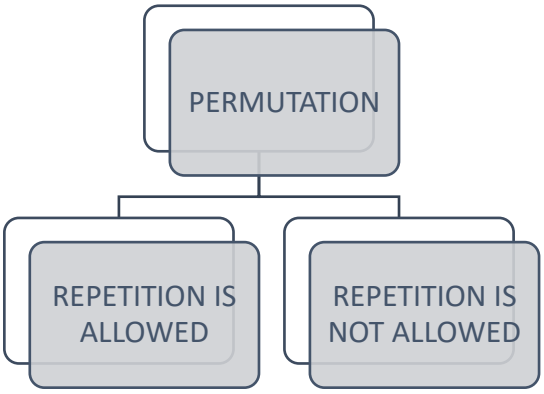
Example 1: Pastry shop menu:

6 kinds of muffins, 8 kinds of sandwiches, hot coffee, hot tea, ice tea, cola, orange juice

Buy either a muffin and a hot beverage, or a sandwich and a cold beverage. How many possible purchases?

Solution: $(6 \times 2) + (8 \times 3) = 36$

PERMUTATION



REPETITION IS ALLOWED

Example:

How many different passwords can be made if each password contains a sequence of three letters followed by three digits? (Note: Repetition of English letters and digits are allowed)

Solutions:

$$26 \times 26 \times 26 \times 10 \times 10 \times 10 = 17576000$$

REPETITION IS NOT ALLOWED

Example 1:

There are 16 balls tagged with number 1 till 16. How many ways can we pick **3 balls without repeating the same balls.**

Solutions:

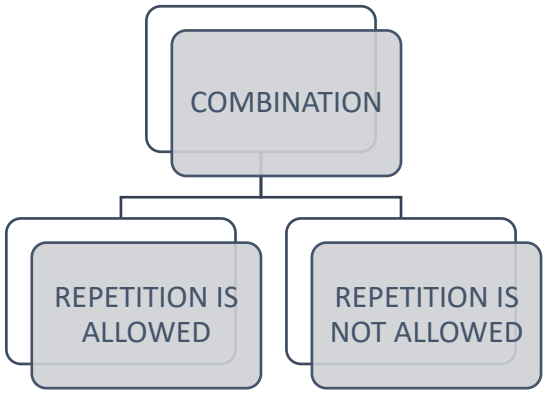
$$^{16}P_3 = P(16,3) = \frac{16!}{(16-3)!} = \frac{16!}{(13)!} = 3{,}360 \text{ ways}$$

Example 2: Find the number of arrangements for the word BENZENE

Solutions: BENZENE has repetition letters which are E & N. E is repeated 3 times and N is repeated 2 times.

$$P(7; 3,2) = \frac{7!}{3!\,2!} = 420$$

COMBINATION



REPETITION IS ALLOWED

Formula:

$$C(n+r-1,\ r) = C(n+r-1,\ n-1) = \frac{(n+r-1)!}{r!\ (n-1)!}$$

Example:

There are five flavors of ice cream: banana, chocolate, lemon, strawberry and vanilla. You can have three scoops. How many variations will there be?

Solution:

You can have 3 scoops and repetition is allowed, so it may be CCC, CCB, CCL ...etc.

By using formula;

$$C(5+3-1,\ 5-1) = \frac{(5+3-1)!}{3!\ (5-1)!}$$

$$= \frac{7!}{3!4!}$$

$$= 35 \text{ variations}$$

REPETITION IS NOT ALLOWED

Formula:

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

Example: There are 16 balls tagged with number 1 till 16. How many ways can we pick 3 combination balls without repeating the same balls?

Solution:

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

$$^{16}C_{3} = \frac{16!}{3!(16-3)!} = \frac{16!}{3!(13)!} = 560 \text{ combinations}$$

e.g: 123 (a combination), 345, 678, 124, 125, 126, ...,