[Theory of Probability]

Vandermonde's Identity

$$^{m+n}C_k = \sum_{j=0}^{k} \left(^m C_j\right) \times \left(^n C_{k-j}\right) \quad : \; m, n \geqslant k$$

Understanding :-

m n

(j) $\underbrace{\qquad}_{m+n}$ $(k-j)$

$j = 0, 1, 2, \ldots, k$

How many ways are there of selecting k things where order does not matter.

$$\sum_{j=0}^{k} \left(^m C_j\right) \times \left(^n C_{k-j}\right) = \; ^{m+n}C_k$$
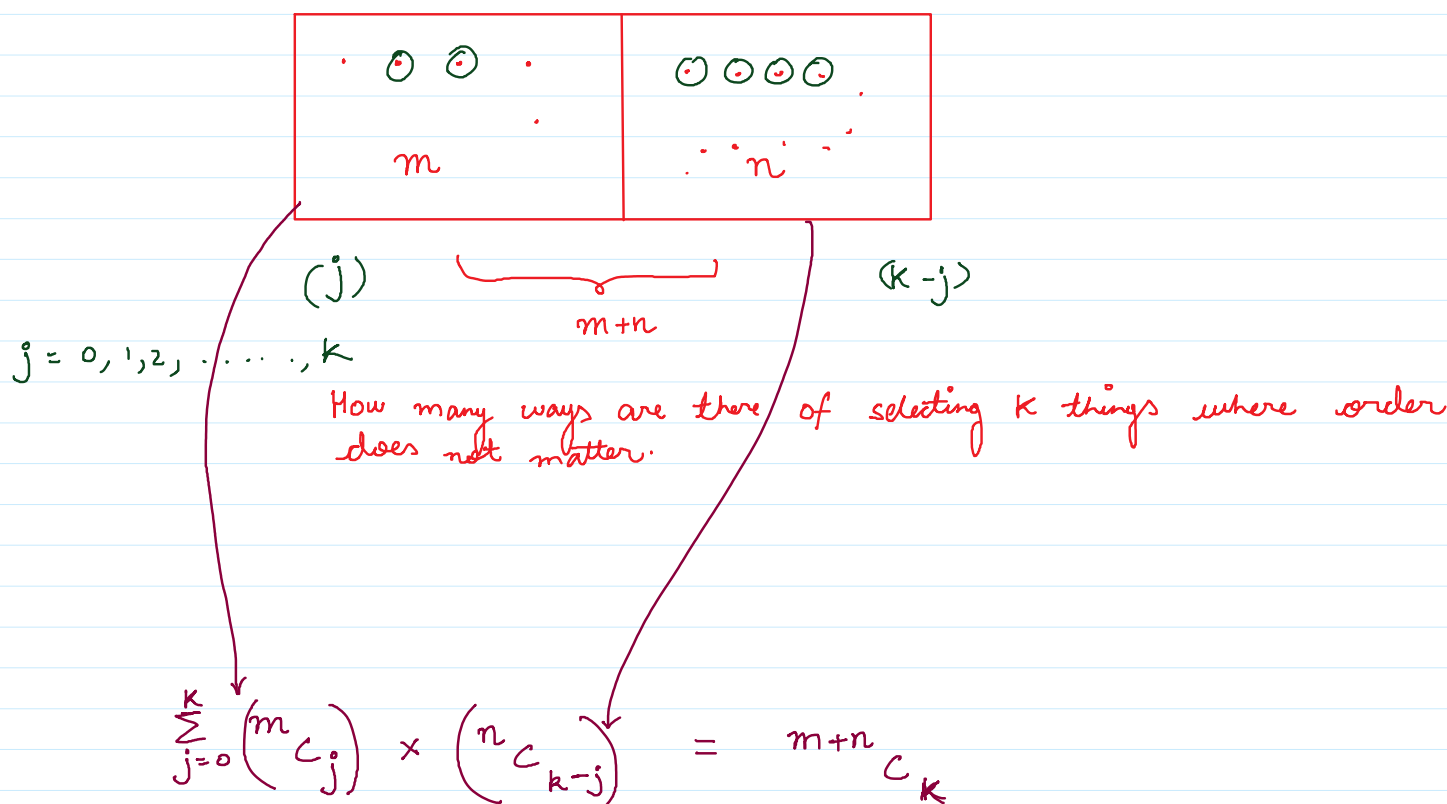
[Usecase of Vandermonde's Identity :- Simplifying Calculation]

Eg:- $^7C_2 = \boxed{^{3+4}C_2 = \sum_{j=0}^{2} \, ^3C_j \times \, ^4C_{2-j}}$

$\longrightarrow$

$\longleftarrow$ (more often)