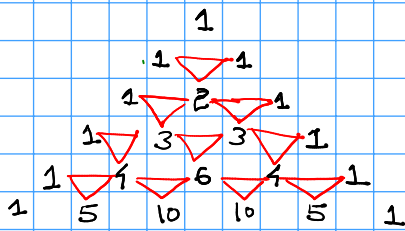


## Pascal's Triangle



permutation → "arrangements"  
Combination → "selections"

In a class of 10 students, how many ways can you select a pair of students?

$${}^{10}C_2 = \frac{10 \times 9}{1 \times 2} = 45$$

$${}^nC_r = \frac{n!}{(n-r)!r!}$$

You have a dollar, a quarter and a cent. In how many ways can I select the coins such that the total value is more than 100¢?

$$\begin{aligned} {}^5C_2 &= \frac{5!}{(5-2)! \times 2!} = \frac{5!}{3! \times 2!} \\ &= \frac{5 \times 4 \times 3!}{3! \times 2!} \\ &= \frac{20}{2 \times 1} = 10 \end{aligned}$$

- 1) Q, D, C
  - 2) C, D, Q
  - 3) D, Q, C
  - 4) Q, C, D
  - 5) C, Q, D
  - 6) Q, C, D
- } 1 way

Q, D  
C, D

$${}^3C_3 = 1$$

$$\begin{aligned} {}^3C_r &= \frac{3!}{(3-3)! \times 3!} \\ &= \frac{3!}{0! \times 3!} = \frac{1}{1} = 1 \end{aligned}$$

$${}^5C_3 = \frac{5 \times 4 \times 3!}{(5-3)! \times 3!} = \frac{20}{2} = 10$$

$${}^3C_1 = {}^3C_2 = \frac{3!}{(3-1)! \times 1!} = \frac{3!}{2! \times 1!} = \frac{3 \times 2!}{2! \times 1} = 3$$

$${}^3C_0 = {}^3C_3 = 1$$

$${}^5C_2 = {}^5C_3 = 10$$

$${}^5C_1 = {}^5C_4 = 5$$

$${}^5C_2 = \frac{5 \times 4}{1 \times 2} = 10$$

$${}^3C_1 = \frac{3}{1} = 3$$

$${}^5C_3 = \frac{5 \times 4 \times 3}{1 \times 2 \times 3} = 10$$

$${}^3C_2 = \frac{3 \times 2}{1 \times 2} = 3$$



$${}^4C_2 = \frac{4 \times 3}{1 \times 2} = 6$$

## Combination

Given 'n' (total no. of objects) and 'r' (no. of objects to be selected), find out what are the total no. of ways to select  $({}^nC_r)$

$$\frac{n!}{(n-r)!r!}$$

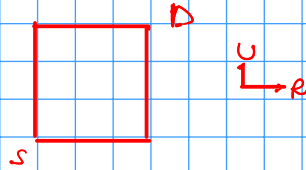
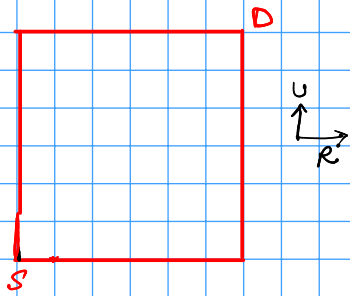
$$n=5$$

$$r=4$$

$${}^nC_r = \frac{5!}{(5-4)!4!} = \frac{5!}{1!4!} = \frac{5 \times 4!}{1! \times 4!} = 5 = {}^5C_1$$

$${}^5C_3 = {}^5C_2$$

$$\frac{90!}{(90-6!)6!} = \frac{90!}{84!6!} = \frac{90 \times 89 \times 88 \times 87 \times 86 \times 85 \times \cancel{84!}}{\cancel{84!} 6!} = 622614630$$



- i) U, U, U, R, R, R
- ii) R, U, R, U, R, U
- ⋮
- RRR, UUU

$$\frac{6!}{3!3!} = \frac{\cancel{6} \times 5 \times 4 \times \cancel{3!}}{3!3!} = \underline{20 \text{ ways}}$$