

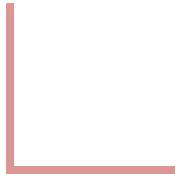
# Mathematical Foundations for Computer Applications

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## Permutations and Combinations

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# Mathematical Foundations for Computer Applications

## Combinations or Permutations?

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1. In how many ways can you choose 5 out of 10 friends to invite to a dinner party?

- $$C(10,5) = \frac{P(10,5)}{5!} = \frac{10(9)(8)(7)(6)}{5(4)(3)(2)(1)} = \frac{10(9)(8)(7)}{(5)(4)} = 2(9)(2)(7) = 252$$

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## Combinations or Permutations?

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2. How many ways can you arrange 10 books on a bookshelf that has space for only 5 books?

- Does order matter? The answer is yes.

$$\begin{aligned}\text{we have } P(10,5) &= 10(9)(8)(7)(6) \\ &= 30,240\end{aligned}$$

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## Combinations or Permutations?

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3. A certain state lottery consists of selecting a set of 6 numbers randomly from a set of 49 numbers. To win the lottery, you must select the correct set of six numbers. How many possible lottery tickets are there?

- The order of the numbers is not important here
- To determine the total number of lottery tickets, the number of combinations of 49 items taken 6 at a time.
- $C(49,6) = 13,983,816$

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4. In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together?

Three vowels can be grouped and considered as a single letter. That is, PTCL(OIA).

Hence we can assume total letters as 5 and all these letters are different.

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Number of ways to arrange these letters

$$=5!=5\times4\times3\times2\times1=120$$

All the 3 vowels (OIA) are different

Number of ways to arrange these vowels among themselves  $=3!=3\times2\times1=6$

Hence, required number of ways  $=120\times6=720$

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5. Suppose ramu draws 5 cards from a standard deck of 52 cards . In how many ways can his selection result in a hand with no clubs.

Number of ways where he can draw cards when hand does not contain any clubs =  ${}^{39}C_5$

$$= \frac{39!}{(39-5)! 5!} = 575757 \text{ Ways}$$

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6. How many 5 cards selection that contain at least one club.

Number of ways where selection of 5 cards that contains only one club :  $^{13}C_1 * ^{39}C_4$

Contains 2 clubs :  $^{13}C_2 * ^{39}C_3$

Contains 3 clubs :  $^{13}C_3 * ^{39}C_2$

Contains 4 clubs :  $^{13}C_4 * ^{39}C_1$

Contains 5 clubs :  $^{13}C_5 * ^{39}C_0$

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$$\begin{aligned}\text{Required Answer} &= {}^{13}C_1 * {}^{39}C_4 + {}^{13}C_2 * {}^{39}C_3 + {}^{13}C_3 * {}^{39}C_2 \\ &+ {}^{13}C_4 * {}^{39}C_1 + {}^{13}C_5 * {}^{39}C_0 \\ &= 2023203\end{aligned}$$

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## Combinations or Permutations?

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7. How many number of subsets containing three elements can be formed from the set  $S = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 \}$

**Solution:** Number of elements in the set = 10

- Number of elements in the subset = 3
- Therefore, the number of possible subsets containing 3 elements =  ${}^{10}C_3$

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## Combinations or Permutations?

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$$= \frac{10!}{(10-3)! \times 3!}$$

$$= \frac{10 \times 9 \times 8 \times 7!}{7! \times 3 \times 2 \times 1}$$

$$= \frac{720}{6}$$

$$= 120$$

Therefore, the number of possible subsets containing 3 elements from the set  $S = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 \}$  is 120.



# THANK YOU

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