Mathematical Foundations for Computer Applications
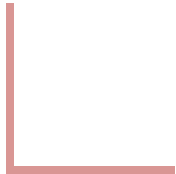
Combinations

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Combinations

- The number of *r*-combinations of a set with *n* elements, where *n* is non-negative and $0 \leq r \leq n$ is:

    (Where order does not matter)

Combination Formula

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

Combination Formula Using Permutation

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

$$C(n, r) = \frac{P(n,r)}{r!}$$

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Combinations-Problems

1. Father asks his son to choose 4 items from the table. If the table has 18 items to choose, how many different answers could the son give?

Given,
r = 4 (item sub-set)
n = 18 (larger item)

Combination = C(n,r) = $\dfrac{n!}{(n-r)!\ r!}$

$= 18! / (18-4)!\ 4!$
= **3,060 possible answers.**

2. How many committees of 3 people can be formed by 8 people.

Given n=8, r=3

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

$$= \frac{8!}{(8-3)!\,3!}$$

= 56 ways

3. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

Number of ways of selecting 3 consonants from 7 = $^7C_3$

Number of ways of selecting 2 vowels from 4= $^4C_2$

Required = $^7C_3 \times ^4C_2$

=(7×6×5 / 3×2×1) × (4×3 / 2×1)

=210

Combinations-Problems

we can have 210 groups where each group contains total 5 letters *(3 consonants and 2 vowels)*.

Number of ways of arranging 5 letters among themselves = 5! = 5×4×3×2×1 = 120

Hence, required number of ways =210 × 120 = **25200**

Combinations-Problems

4. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?

Hence we have **4 options** as given below
We can select 4 boys ...(option 1)
Number of ways to this = $^6C_4$
We can select 3 boys and 1 girl ...(option 2)
Number of ways to this = $^6C_3 \times {}^4C_1$

Combinations-Problems

We can select 2 boys and 2 girls ...(option 3)

Number of ways to this = $^6C_2 \times {}^4C_2$

We can select 1 boy and 3 girls ...(option 4)

Number of ways to this = $^6C_1 \times {}^4C_3$

Total number of ways

$= {}^6C_4 + ({}^6C_3 \times {}^4C_1) + ({}^6C_2 \times {}^4C_2) + ({}^6C_1 \times {}^4C_3)$

$= 209$

Combinations-Problems

5. Suppose that there are 9 faculty members in the mathematics department and 11 in the computer science department. How many ways are there to select a committee to develop a discrete mathematics course at a school if the committee is to consist of three faculty members from the mathematics department and four from the computer science department?

C(9, 3) · C(11, 4) = 9! / 3! 6! * 11! / 4! 7!

= 27,720

THANK YOU

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