



SLIIT

Discover Your Future



Counting

Mathematics for Computing – IT1030



SLIIT
FACULTY OF COMPUTING

SEQUENCES

- A Sequence is a list of things (usually numbers) that are in order; Infinite or Finite

Sequence:



("term", "element" or "member" mean the same thing)

INFINITE OR FINITE SEQUENCES

- When the sequence goes on forever it is called an infinite sequence, otherwise it is a finite sequence.

Eg: $\{1,2,3,4,\dots\}$ is an infinite sequence $\{2,4,6\}$ is a finite sequence with 3 terms

SET VS. SEQUENCE

| Set | Sequence |
|-------------------------------|------------------------|
| Terms need not to be in order | Terms must be in order |
| Values cannot repeat | Values can repeat |

- Eg: $\{0, 1, 0, 1, 0, 1, \dots\}$ is the sequence of alternating 0s and 1s. The set is just $\{0,1\}$ or $\{1,0\}$.

ARITHMETIC SEQUENCE

- It has a common difference between successive terms.

Eg: 2, 4, 6, 8, ...

Q: Find the 10th term and the sum of first 10 terms of the following sequence A_n . $A_n : \{3, 8, 13, 18, 23, \dots\}$

The diagram shows the formula for the n^{th} term of an arithmetic sequence: $a_n = a_1 + (n-1)d$. Arrows point from labels to parts of the formula: 'term position' points to n , ' n^{th} term' points to a_n , 'first term' points to a_1 , and 'common difference' points to d .

Sum of n th terms =

$$\frac{n}{2}(2a + (n-1)d)$$

GEOMETRIC SEQUENCE

- It has a common ratio between successive terms.

Eg: 2, 4, 8, 16, ...

Q: Find the 11th term and the sum of first 11 terms of the following sequence A_n . $A_n : \{3, 6, 12, 24, \dots\}$

The diagram shows the formula $a_n = a_1 * r^{n-1}$ in green text. Red arrows point from labels to parts of the formula: 'General Term' points to a_n , 'First Term' points to a_1 , and 'Common Ratio' points to r . A red arrow labeled 'Same General Term' points from the text above to the formula.

$$a_n = a_1 * r^{n-1}$$

General Term First Term Common Ratio

$$S_n = \frac{a_1(1 - r^n)}{1 - r}$$

SIGMA NOTATION

- It represents summation of many similar terms.

The diagram illustrates the components of the sigma notation $a = \sum_{n=1}^{10} a_n = a_1 + a_2 + \dots + a_9 + a_{10}$. Annotations include:

- Value of n in the final term (may be ∞)**: Points to the upper limit 10 of the summation.
- The Greek letter sigma means "sum."**: Points to the summation symbol Σ .
- Terms of the sum**: Points to the sequence of terms $a_1 + a_2 + \dots + a_9 + a_{10}$.
- The index n labels each term. $n = 1, 2, 3, \dots$** : Points to the index n in the general term a_n .
- n ranges from 1 up to 10, counting by 1**: Points to the lower limit $n = 1$ of the summation.

FACTORIAL of N

$$n! = 1 * 2 * 3 * \dots n$$

$$0! = 1! = 1$$

Number

5



The Factorial of 5 is

$$5 \times 4 \times 3 \times 2 \times 1 = 120$$

n_{C_r} and n_{P_r} Notations

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

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

PERMUTATIONS

- A permutation is an arrangement of objects in specific order.
- The order of the arrangement is important.
Example: How many distinct, 3 letter words can be arranged using {a, b, c} ?? (6 arrangements)
- For any integer $n \geq 1$, the number of permutation of n elements is $n!$

EXAMPLE

(i) How many ways can the letters in the word COMPUTER be arranged in a row?

All the eight letters are in the word COMPUTER are distinct, so the number of ways,

$$8! = 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 40,320$$

(ii) How many ways can the letters in the word COMPUTER be arranged if the letters “CO” must remain next to each other (in order) as a unit?

$$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5040.$$

PERMUTATIONS OF SELECTED ELEMENTS

- If n and r are integers and $1 \leq r \leq n$, then the number of r permutations of a set of n elements is given by the formula

Example: A license plate begins with three letters. If the possible letters are A, B, C, D and E, how many different permutations of these letters can be made if no letter is used more than once? (Ans: 60)

COMBINATIONS

- The number of combinations of n things taken r at a time is given by:

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

- The order of the arrangement is not important.
Example: In how many ways can a coach choose three swimmers from among five swimmers? (10 ways)

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EXAMPLE

- (i) 16 teams enter a competition. They are divided up into four Pools (A, B, C and D) of four teams each. Every team plays one match against the other teams in its Pool.

After the Pool matches are completed:

- the winner of Pool A plays the second placed team of Pool B
- the winner of Pool B plays the second placed team of Pool A
- the winner of Pool C plays the second placed team of Pool D
- the winner of Pool D plays the second placed team of Pool C
- The winners of these four matches then play semi-finals, and the winners of the semi-finals play in the final.

How many matches are played altogether?

QUESTION

- How many “Mahajana sampatha” Tickets can be printed in a single draw ?? (numbers are selected from 0 to 9 and it can repeat)





End of Lecture 07



Next Lecture:
Graph Theory