SMIT SIKKIM MANIPAL UNIVERSITY
SIKKIM MANIPAL INSTITUTE OF TECHNOLOGY

Engineering Mathematics III

Discrete Mathematics

Lecture 28

Lexicographical Ordering

This course is taught to Computer Science Engineering students in SMIT, India during Jun-Dec, 2019.

What is Lexicographical Order?

How does the following words be ordered in a dictionary?

letter, class, later

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Ans: class, later, letter

Problem

How does the following words be ordered in a dictionary?

ABCD, ACDB, ABDC, ACBD

Problem

How does the following words be ordered in a dictionary?

ABCD, ACDB, ABDC, ACBD

Ans: ABCD, ABDC, ACBD, ACDB

You know what?

This is Lexicographical Order

List all the permutations of the letter of the word "ABCD" in lexicographical order.

ABCD → ABDC → ACBD → ACDB → ADBC → ADCB

→ BACD → BADC → BCAD → BCDA → BDAC → BDCA

→ …

→ DABC → DACB → DBAC → DBCA→ DCAB → DCBA

Algorithm to find lexicographical order

Let $k_1 k_2 \ldots k_n$ be a word.

- **Step 1:** Find the largest i such that $k_{i-1} < k_i$.
- **Step 2:** Find the largest j such that $k_{i-1} < k_j$.
- **Step 3:** Interchange k_{i-1} and k_j
- **Step 4:** Reverse the order of $k_i, k_{i+1}, \ldots, k_n$

What is the permutation next to the given permutation 32574?

Reverse Lexicographical ordering

Algorithm to find Reverse lexicographical order

Let $k_1 k_2 \ldots k_n$ be a word.

- **Step 1:** Find the smallest i such that $k_i < k_{i+1}$.
- **Step 2:** Find the smallest j such that $k_j < k_{i+1}$.
- **Step 3:** Interchange k_{i+1} and k_j
- **Step 4:** Reverse the order of $k_1, k_2, \ldots, k_i$

Problems

1. find the permutation next to the permutation 632541 in lexicographical order
2. find the permutation next to the permutation 632541 in reverse lexicographical order

Questions?

Thank you