

Parallel programming

Homework 1

Data storage optimization





Storing lot of data

.We are given n records

– A *record* is a sequence of integers, e.g.,

• 1, 6, 3, 5, 1, 4

.Our goal is to store them to disk in the most memory-efficient way possible.

1, 6, 3, 5, 1, 4
8, 2, 3, 1
2, 3, 1, 0
3, 0, 9





Storing records efficiently

- How to store the records in memory-efficient way?
 - Find the *edit difference* between the records and store only the differences
 - Edit difference = Levenshtein distance
 - The original records then can be restored by re-applying the differences

1, 6, 3, 5, 1, 4
 8, 2, 3, 1
 2, 3, 1, 0
 3, 0, 9



1, 6, 3, 5, 1, 4
 8, 2, 3, 1, 1,
 1, 6, 3, 5, 1, 4
 , 2, 3, , 1, 0
 1, 6, 3, 5, 1, 4
 , , 3, , 0, 9

13 edit operations

Original records

Edit differences of records from
 1, 6, 3, 5, 1, 4



Which differences??!

Clearly, the number of stored edit differences depends on the record from which the difference is computed

1, 6, 3, 5, 1, 4
 8, 2, 3, 1
 2, 3, 1, 0
 3, 0, 9



, , 3, , 0, 9
 1, 6, 3, 5, 1, 4

, 3, 0, 9
 8, 2, 3, 1

, 3, 0, 9
 2, 3, 1, 0

12 edit operations

Original records

Edit differences of records from
 3, 0, 9

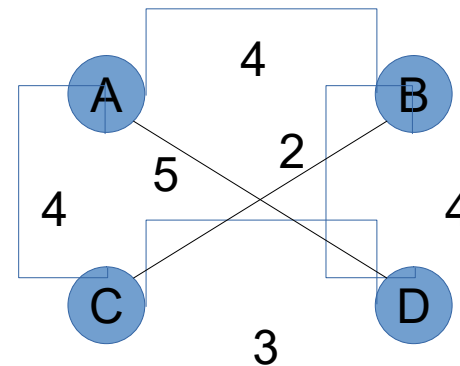


Tree of distances

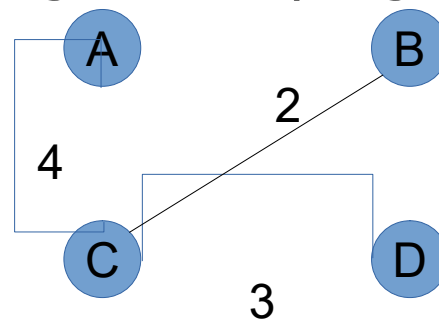
.Better approach

- Compute the edit difference between every pair of records

A: 1, 6, 3, 5, 1, 4
 B: 8, 2, 3, 1
 C: 2, 3, 1, 0
 D: 3, 0, 9



- Find the *minimum spanning tree* on the complete graph (e.g., using Prim's algorithm)



9 edit operations



Your assignment

- Implement **parallel** version of the data storage optimization using **OpenMP**
- Create a **complete graph** by computing the **edit difference** between **every pair** of records.
- Find the minimum spanning tree on the complete graph. Return the **cost** of the **minimum spanning tree**.
- Use prepared template **Storage.cpp**