

Multidimensional Linked List

Group Members

- 1.T Shivaprasad Nayak(181IT149)
- 2.Ashok Bhobhiya(181IT154)
- 3.Channamallikarjuna(181IT212)
- 4.Samarth S H(181IT240)

INTRODUCTION

- Multi-dimension linked lists is a new data structure, which has powerful function and well visiting performance.
- This data structure is mainly based on one dimensional linked list.
- In this project we implementing 2D and 3D linked list, above order imagination is very difficult.

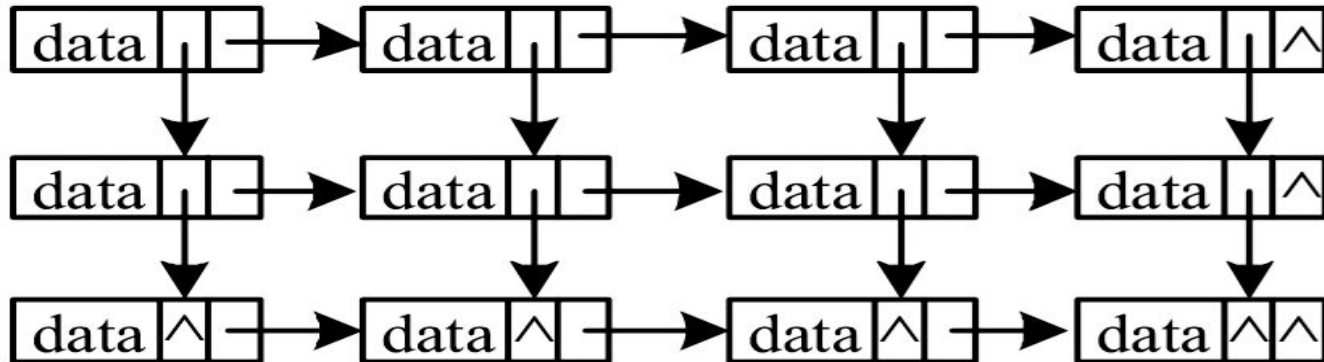
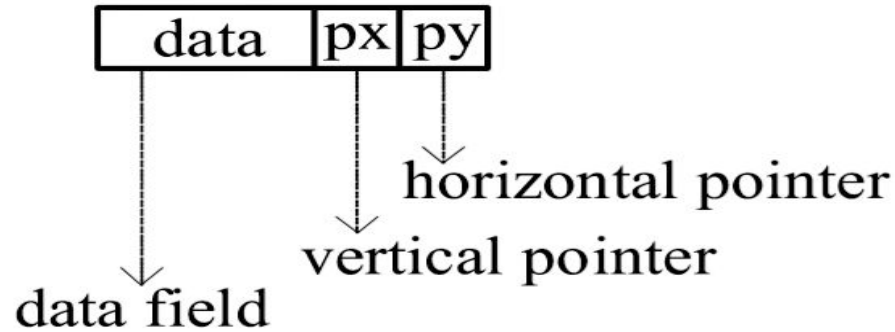
LITERATURE SURVEY

Paper Title and Authors	Work Done
Name-Create Multi-dimension Linked Lists on Recursive Algorithm and the Applications Authors-Chen Guangyi,He Zhaoyong	The Paper presents the Implementation of a new type of Data Structure called as Multi-dimension Linked Lists and their Applications.

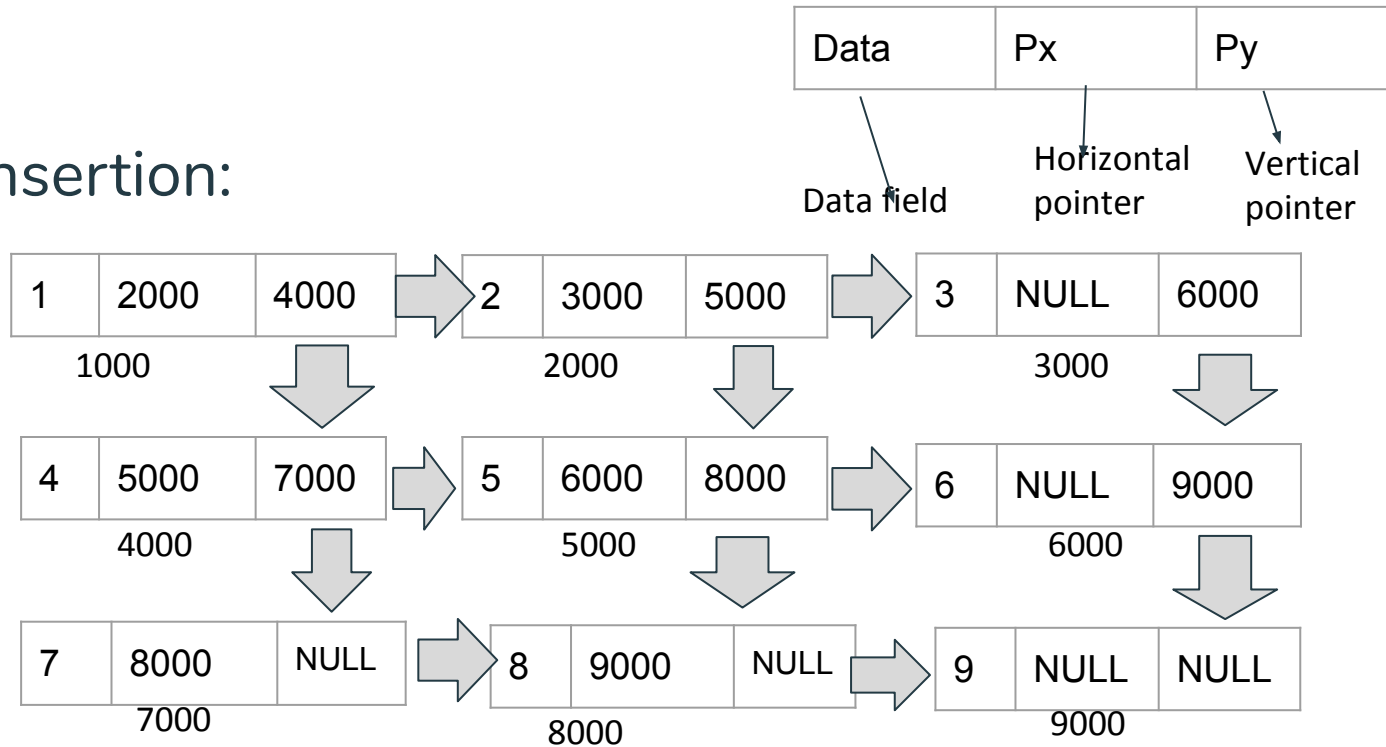
Objective

Our objective is to implement 2D, 3D linked list using dynamic memory allocation and singly linked list concept.

2 Dimensional linked list



Insertion:



Algorithm Steps for 2D linked list

Insert: Creating a new node, type of struct

Step-1: Make a root node

Step-2: Adding node in first row, put px=NULL for last node in a row

Step-3: updating row to next row (when no. of node in row=total no. of node in X direction)

Step-4: Inserting a node in 2nd row and onward

4.1- adding node at first column

similarly updating vertical pointer at above node

4.2- adding node other than 4.1 part

Traverse and Search:

Step-1: pickup root node go through all the link

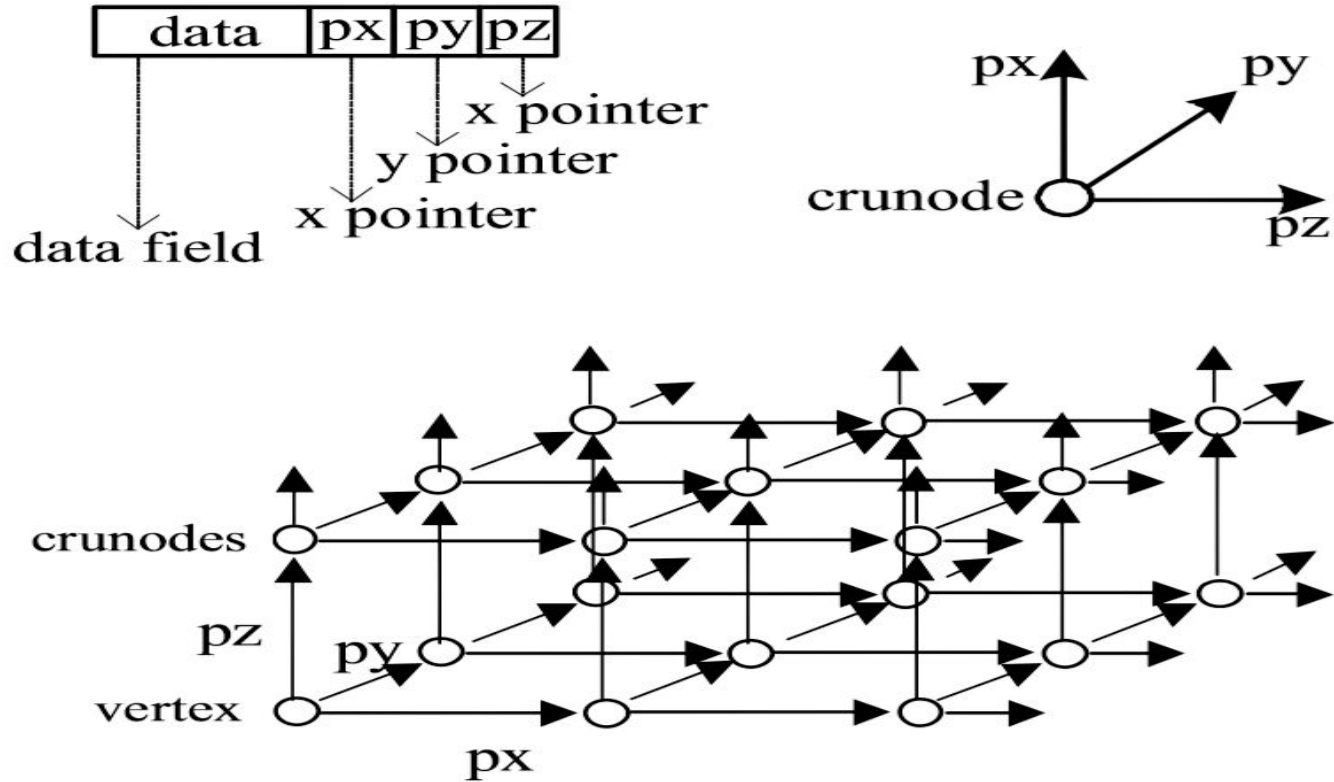
Step-2: for search return a node with same element

Delete A node:

Step-1: Search given element

Step-2: put a blank space at given node location

3 Dimensional linked list



Algorithm Steps for 3D linked list

Insertion: Creating a new node, of type struct

Step-1: Make a Root Node;

Any newly inserted node will be linked to xlink of the previous node until the length in x direction equals to given size of m;

Step-2:

After that any newly created node will be linked to its previous node by its ylink and again step 1 is performed until the length in y direction equals to given size of n;

Step-3:

After that any newly created node will be linked by z-link of its corresponding node and again step 2 is performed and the size of z-length is not fixed and it will be varying Dynamically.

Searching:

Step 1: A given element will be compared by one by one node in x-direction.

Step 2: A pointer will move to next line by the help of y-link of the first node in every line and Step 1 will be repeated.

Step 3: If it is not found in the nth level then with the help of z-link pointer will be moved to next level again Step 2 will be repeated.

Step 4: The Index of the value will be returned.

Deletion:

A Searching function will be called, and the node will be updated by a blank space.

Display:

It's almost like Searching and the data of the node will be printed in different-different directions.

APPLICATIONS

- Multi-dimensional linked lists have very important application in scientific computing, data structures, database and so on.
- For example, the computer can apply the quick searching characteristic of multi-dimensional linked list to index data in database.

Advantages

- The speed of database searches is very quick. Also, the time complexity of getting the data of N dimension linked lists is $O(n^{1/N})$.
- Using multi-dimensional we can overcome the disadvantage of requiring multidimensional array EMS memory assignment is continuous.
- Furthermore, multi-dimensional linked lists' structure is simple, so we can apply this algorithm to realize complex data relation.
- It's very helpful for making a not complete matrix without wasting memory.

Summary

Time Complexity:

- 2 dimensional:

For insertion it will take constant time

Searching, traversing and delete all are in $O(n)$

- 3 dimensional:

Same as 2 dimensional

Conclusion

- At present, multi-dimension linked lists mostly are used in the application based on rectangular coordinate system, so the multi-dimension linked lists is not more than three dimension in practice.
- With the development of computer science, multi-dimension linked lists may be applied in other rectangular coordinate system spatial expression.

Reference

- [1]. <https://ieeexplore.ieee.org/document/4346954/>
- [2]. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein “3rd Introduction to Algorithms”

Thank You