SKIP LIST – RANDOMIZED DATA STRUCTURE

Data Structure and Algorithms

AGENDA OF SESSION

- What and Why Skip List
- Build of a Skip List
- Searching in Skip List
- Insertion in Skip List
- Deletion in Skip List

WHAT IS SKIP LIST

- Easy to Implement
- Maintains a dynamic set of n elements in O(log n) time per operation(Searching, Insertion and Deletion).

WHY SKIP LIST

- Linked List does not support Binary Search even though the list is in sorted fashion and that's the reason of having O(n) time complexity of searching in Linked List.
- Skip List mainly allows faster search and insertion.
- Search : O(log n)
- Insertion : O(log n)

BUILD SKIP LIST

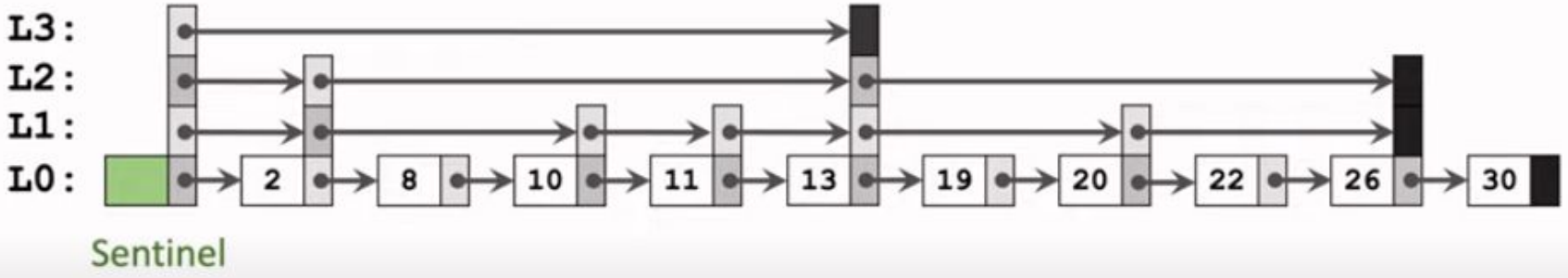
- New layer is added on top of the bottom list. This new layer will include any given element from the previous layer with probability p (Event should be unbiased and have each p = ½).

BUILD SKIP LIST

- For every layer, head node you have to pick up from L0 to L_n {where number of layers = log N}.

BUILD SKIP LIST

- For every node, we are making random choices to whether we should grow a height for that particular node or not.
- L0 layer is fully connected layer and afterwards all above layers are skipping.



BUILD SKIP LIST

SEARCH SKIP LIST 2 LINKED LIST

- Walk right in top linked list (L1) until going right would go too far.
- Walk down to bottom list(L0) and walk right in L0 until the element is found(or not)

SEARCH SKIP LIST

- Suppose key = 8, we want to search
- Start from L3 Layer and we know that key < 13. So, move towards bottom layer which is L2.
- Now, at L2 value of the node is 2 which is less than key, so we move forward and arrive at node 13 and again key < 13, move to bottom layer L1.

SEARCH SKIP LIST

- Now, at L1 value is 2 we move forward and got 10 and now key < 10. So, move bottom to L0 layer.
- Now, at L0 we start from 2 and go to 8 and we found out the key.
- Now, at L2 value of the node is 2 which is less than key, so we move forward and arrive at node 13 and again key < 13, move to bottom layer L1.

INSERTION SKIP LIST

- To insert an element X into a skip list, we need to search(x) to see where X fits into the bottom list(Actual fully connected list).
- Always do the insertion into the bottom list.
- Insert into some of the lists above according to randomization rule.

DELETION SKIP LIST

- To delete any element in a skip list, search(x) for that particular element that we want to delete.
- After searching, delete that element from all the levels.
- Reference Book : Introduction To Algorithms - Cormen

THANK YOU