

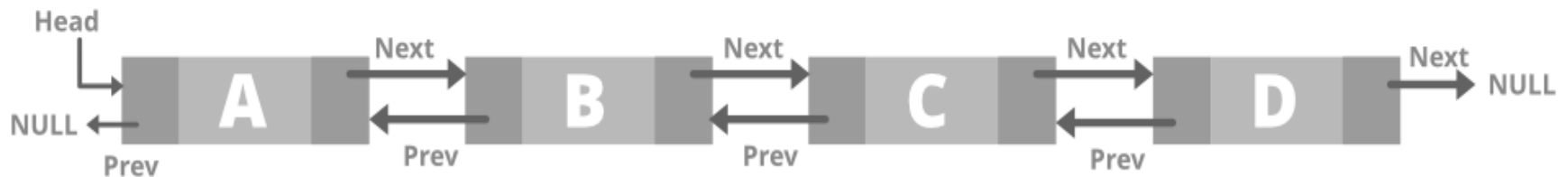
Data Structures and Algorithms

Lecture 13: Linked List – Two way lists

Doubly Linked List

- A doubly linked list or a two-way linked list is a more complex type of linked list that contains a pointer to the next as well as the previous node in sequence.
- Therefore, it contains three parts of data, a pointer to the next node, and a pointer to the previous node.

Doubly Linked List



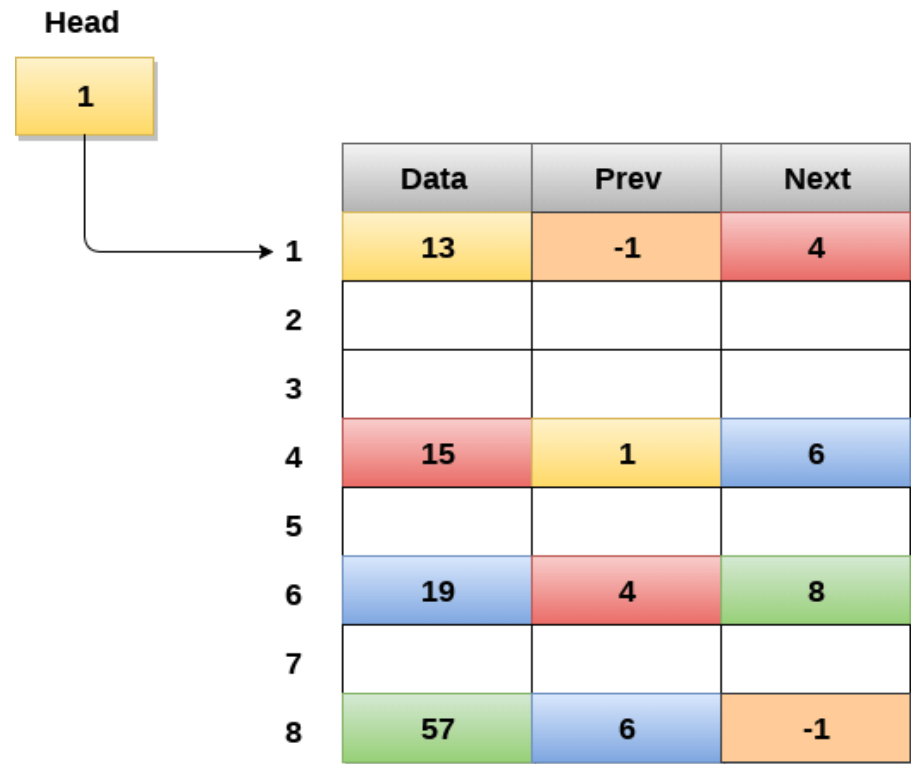
Doubly Linked List

- The prev part of the first node and the next part of the last node will always contain null indicating end in each direction.

```
struct node
{
    struct node *prev;
    int data;
    struct node *next;
}
```

Memory Representation of a doubly linked list

- The first element of the list that is i.e. 13 stored at address 1. The head pointer points to the starting address 1. Since this is the first element being added to the list therefore the prev of the list contains null. The next node of the list resides at address 4 therefore the first node contains 4 in its next pointer.
- We can traverse the list in this way until we find any node containing null or -1 in its next part.



Memory Representation of a Doubly linked list

Operations - Doubly Linked List

Following are the basic operations supported by a list.

- Insertion – Adds an element at the beginning of the list.
- Deletion – Deletes an element at the beginning of the list.
- Insert Last – Adds an element at the end of the list.
- Delete Last – Deletes an element from the end of the list.
- Insert After – Adds an element after an item of the list.
- Delete – Deletes an element from the list using the key.
- Display forward – Displays the complete list in a forward manner.
- Display backward – Displays the complete list in a backward manner.

Applications - Doubly Linked List

Applications of Doubly Linked List:

- Doubly linked list can be used in navigation systems where both forward and backward traversal is required.
- It can be used to implement different tree data structures.
- It can be used to implement undo/redo operations.

Real-Time Applications of Doubly Linked List:

- Doubly linked lists are used in web page navigation in both forward and backward directions.
- It can be used in games like a deck of cards.

Recall:

Two way list – Definition, representation, operations and applications.

