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**CMP 305 L – Data Structures and Algorithms**

**Lab. Assignment 4 – Doubly Linked List**

***Objectives:***

* To understand the implementation of doubly linked lists.
* To practice list processing and using doubly linked lists.

***Note:***

***Lab:*** Exercises 1 and 2 (10 marks)

***Bonus*:** Exercise 3 (1 mark)

**Exercise1:**

You are required to implement the following functions for *doubly linked lists.*

Note that code for creating a doubly linked list from an array of values is given to you, as well as testing code (driver program) to make sure that all functions work as expected.

1. find: Returns true if the given value is found in the list, and false otherwise.

template <typename Object>

bool findInDLL(DoubleNode<Object>\* head, Object value);

1. insertBefore: Finds a given value and inserts a new node before it with a new value. Returns true if the insertion is successful, else false.

template <typename Object>

bool insertBeforeDLL(DoubleNode<Object>\*& head, Object value, Object newValue);

1. erase: Finds a given value and deletes the matching node from the linked list. Returns true if the insertion is successful, else false.

template <typename Object>

bool eraseInDLL(DoubleNode<Object>\*& head, Object value)

Sample output:

Printing Double linked list:

1 2 4 7 6 8

Finding 7 in the List:

7 exist in the list

Inserting 3 before 4 :

1 2 3 4 7 6 8

Inserting 0 before 1 (inserting at the start of the list):

0 1 2 3 4 7 6 8

Deleting 3:

0 1 2 4 7 6 8

Deleting 9 (deleting last element in the list):

Value not Found!

Deleting 0 (deleting first element in the list):

1 2 4 7 6 8

Deleting -99 (trying to delete an element which is not present in the list):

Value not Found!

**Exercise 2:**

You are to code some simple music player application making appropriate use of doubly linked lists, as described hereafter.

Create a doubly linked list for a music playlist.

* 1. Provide a Song class that has a title and a singer as data members.
  2. Create a doubly linked list, with a head node (musicPlaylist) pointing to the first song on the list.
  3. Display a menu for the user to choose an option, as follows:
     + 1. Add a song
       2. Delete a song
       3. Play a song
       4. Skip forward
       5. Skip backward
       6. Exit

Adding and deleting songs (#1-2) should update the playlist accordingly. Adding a song places it at the end of the list.

Playing a song (#3) will prompt the user to enter the title of the song and print both the title and singer (e.g., “Now playing … by …”)

Skipping forward or backward (#4-5) will jump to the previous song or the next song, respectively, and display its title and singer (as per above). Skip forward on the last song takes you to the beginning of the list. Skip backward on the first song takes you to the last song of the list.

Exit will quit the program.

\*You may use provided main function in Ex2Driver.cpp file to continue.

**Bonus**

**Exercise3:**

You are to use doubly linked lists to implement mathematical sets. Note that in a set each element is unique.Write the below functions,

1. insert: Inserts a new node with a newValue if it does not exist in the list (set). Returns true if the insertion is successful, else false.

template <typename Object>

bool insertSet(DoubleNode<Object>\*& head, Object newValue);

1. setUnion: Returns a pointer to a newly created list (set) that is the union of two lists: head1 and head2. The union contains all elements that are either in list1 or in list2.

template <typename Object>

DoubleNode<Object>\* setUnion(DoubleNode<Object>\* head1,DoubleNode<Object>\* head2);

1. setIntersection: Returns a pointer to newly created list (set) that is the intersection of two lists (sets): head1 and head2. The intersection containing all elements that are both in list1 and in list2.

template <typename Object>

DoubleNode<Object>\* setIntersection(DoubleNode<Object>\* head1,DoubleNode<Object>\* head2);