CSIEB0100 Data Structures

Assignment 3
Linked Lists & Trees

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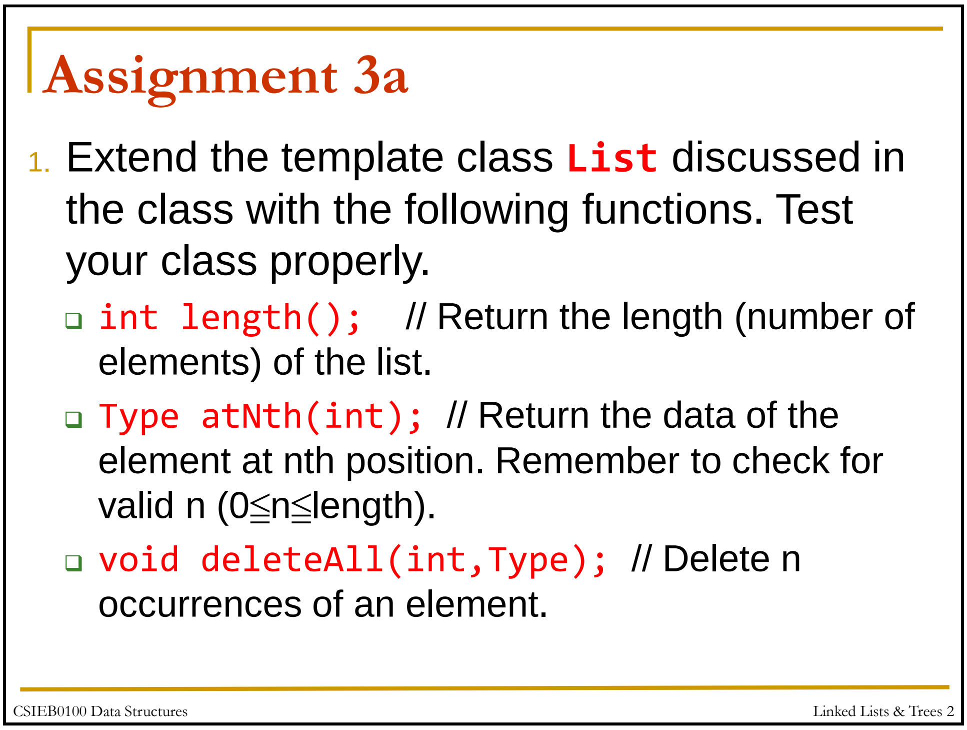
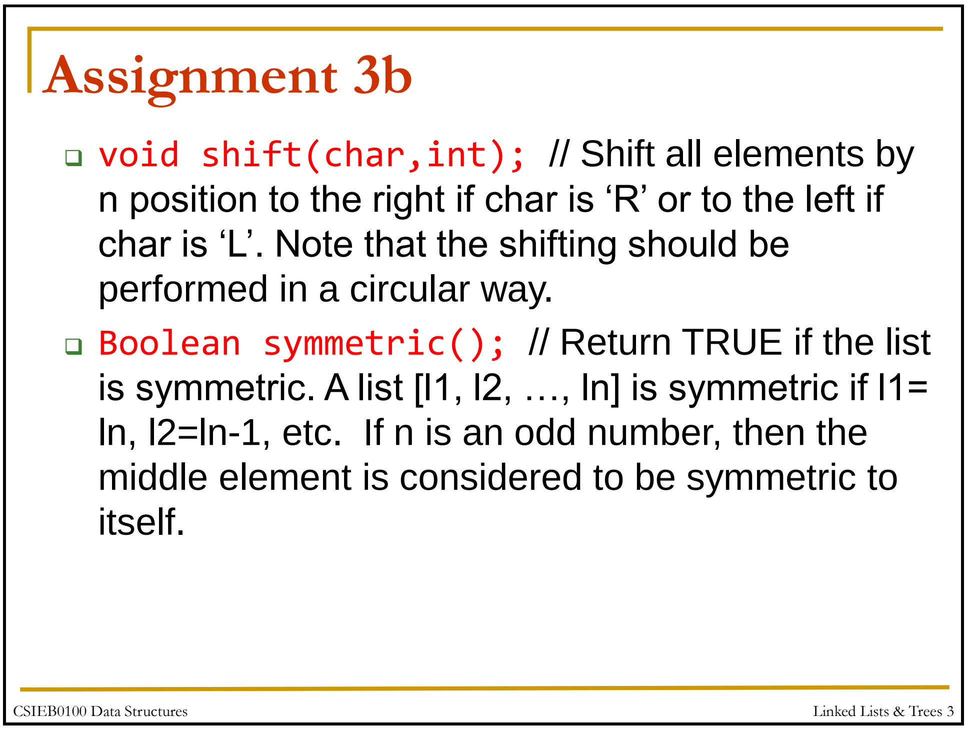


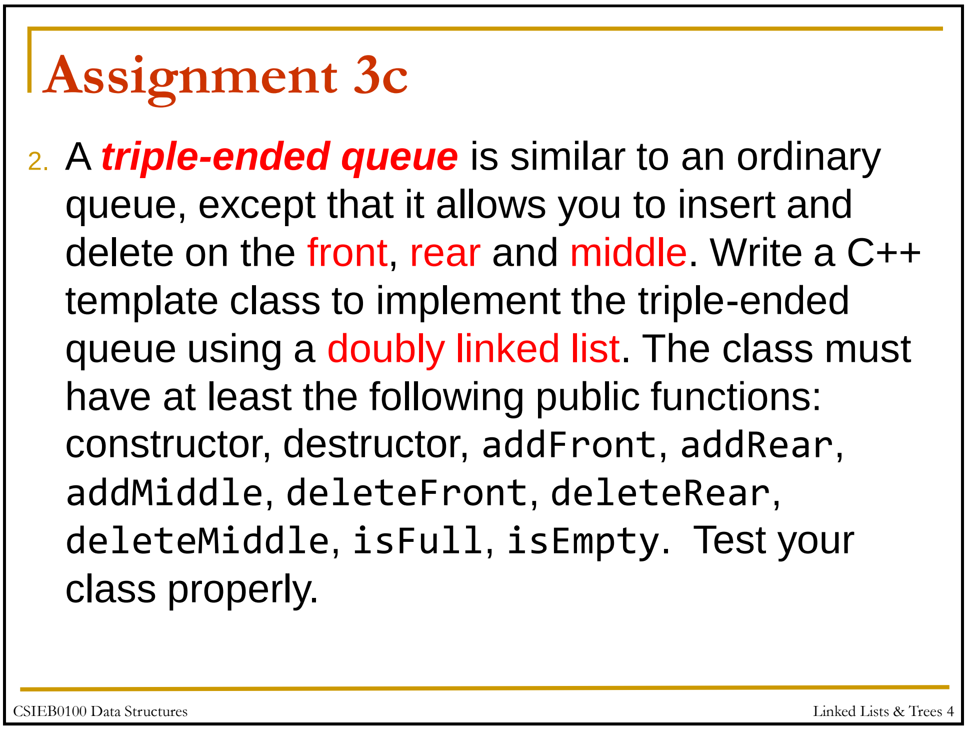
Assignment 3a

1. Extend the template class **List** discussed in the class with the following functions. Test your class properly.
   - `int length();` // Return the length (number of elements) of the list.
   - `Type atNth(int);` // Return the data of the element at nth position. Remember to check for valid n (0≦n≦length).
   - `void deleteAll(int,Type);` // Delete n occurrences of an element.



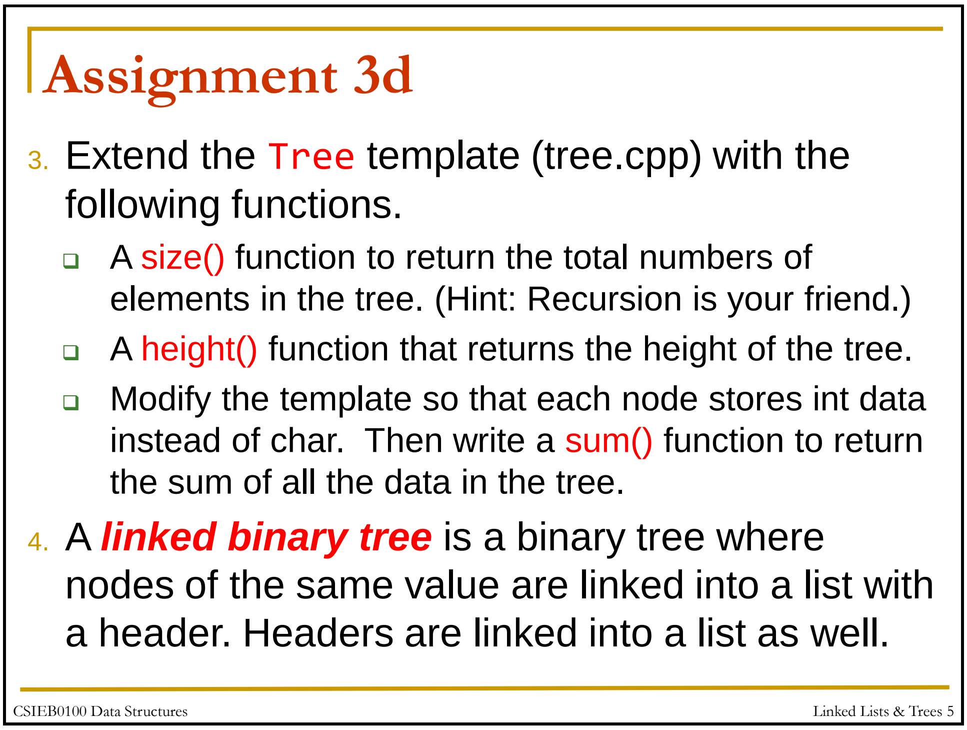
Assignment 3b

- `void shift(char,int);` // Shift all elements by n position to the right if char is ‘R’ or to the left if char is ‘L’. Note that the shifting should be performed in a circular way.
- `Boolean symmetric();` // Return TRUE if the list is symmetric. A list [l1, l2, …, ln] is symmetric if l1= ln, l2=ln-1, etc. If n is an odd number, then the middle element is considered to be symmetric to itself.



Assignment 3c

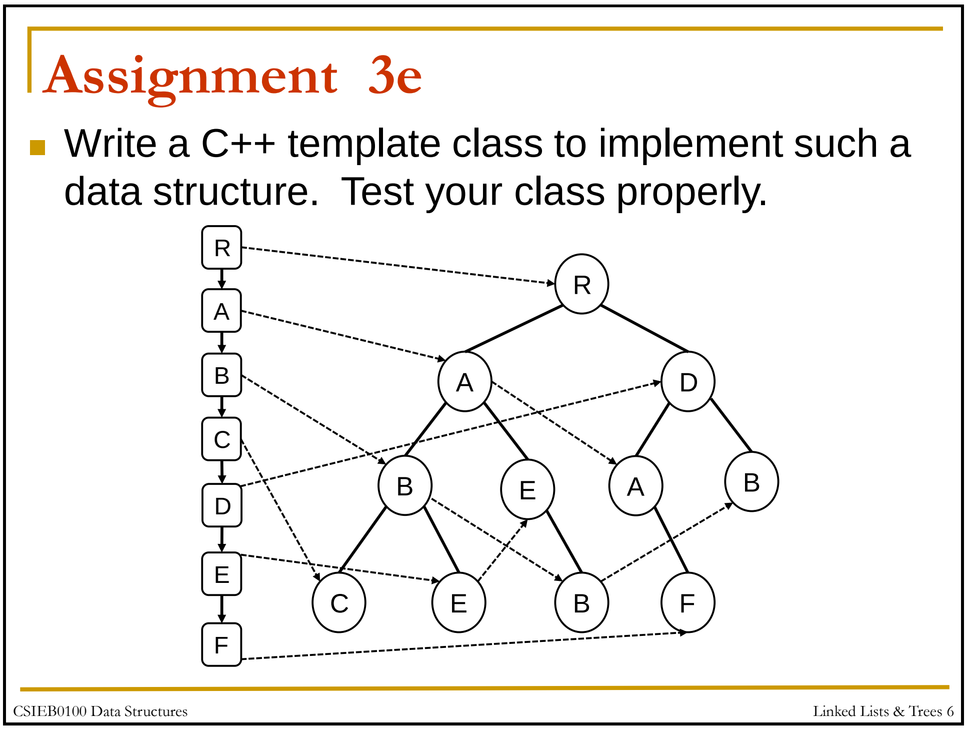
2. A ***triple-ended queue*** is similar to an ordinary queue, except that it allows you to insert and delete on the front, rear and middle. Write a C++ template class to implement the triple-ended queue using a doubly linked list. The class must have at least the following public functions: constructor, destructor, `addFront`, `addRear`, `addMiddle`, `deleteFront`, `deleteRear`, `deleteMiddle`, `isFull`, `isEmpty`. Test your class properly.



Assignment 3d

3. Extend the `Tree` template (tree.cpp) with the following functions.
   - A size() function to return the total numbers of elements in the tree. (Hint: Recursion is your friend.)
   - A height() function that returns the height of the tree.
   - Modify the template so that each node stores int data instead of char. Then write a sum() function to return the sum of all the data in the tree.
4. A ***linked binary tree*** is a binary tree where nodes of the same value are linked into a list with a header. Headers are linked into a list as well.

CSIEB0100 Data Structures Linked Lists & Trees 5



Assignment 3e

- Write a C++ template class to implement such a data structure. Test your class properly.

CSIEB0100 Data Structures Linked Lists & Trees 6