ECE250 - Project 1
Deque Driver
Design Document

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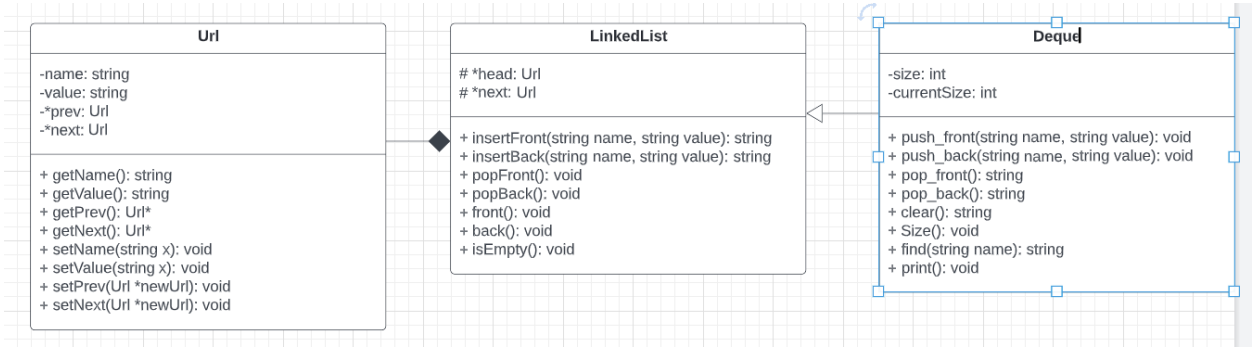
Overview of Classes

Class: Url
Description: Represents each node in a doubly linked list as a website url with a name and a url address. Also holds the prev and next node.
Member Variables: string name, string value, Url *prev, Url *next.
Member Functions:
Setters for the string name, string value, Url *previous, and Url *next.
Getters for the string name, string value, Url *previous, and Url *next.

Class: LinkedList
Description: Represents the urls as nodes in a doubly linked list.
Member Variables: Url *head, Url *tail.
Member Functions:
String insertFront(string name, string value) - create node and insert at front of list
String insertBack(string name, string value) - create node and insert at back of list
Void popFront() - remove first element in the list and reduce size of list by one
Void popBack() - remove last element in the list and reduce size of list by one
String front() - return name and url address of the first item in the list
String back() - return name and url address of the last item in the list
Void isEmpty() - check if list is empty

Class: Deque
Description: Represents a double-ended queue that inherits the LinkedList class.
Member Variables: int size, int currentSize
Member Functions:
String push_front(string name, string value) - call insertFront() if deque isn't full, otherwise call popBack() and then insertFront().
String push_back(string name, string value) - call insertBack() if deque isn't full, otherwise call popFront() and then insertBack().
Void pop_front() - if deque is not empty otherwise call popFront().
Void pop_back() - if deque is not empty otherwise call popBack().
String clear() - while the deque is not empty, call popBack().
Void Size() - print how many elements are in the deque.
String Find(string name) - iterate through deque to see if name exists in deque.
Void print() - iterate through deque backwards and print each url name and address.



Design Decisions:

Url Class: I have default constructor, and a constructor that takes in a name and value and sets name and value respectively and next and prev pointers to nullptr. I have a deconstructor that deletes the next pointer and sets the address to nullptr.

LinkedList Class: I have a constructor that sets head and tail to nullptr. I have a destructor that deletes the head pointer and sets its address to nullptr.

Deque Class: I have a constructor that creates deque of size m, that inherits the doubly linked list class. I have an empty destructor.

***** I did not override any operators and I did not have to pass each parameter by reference or use of the keyword “const”.

Test Cases:

We were told that input would be standard and valid. Base case for creating the deque was tested. I tested pushing front and back urls in multiple different orders including when the list was full. I also tested pushing front and back, popping front and back, getting the front url, and clearing the whole deque in multiple different orders. I then verified these inputs by periodically testing the size, printing the deque, checking if it is empty, and searching for specific urls. I tested locally and on eceubuntu.

Time Complexity:
push_front, push_back, pop_front, and pop_back, front, back, Size, and empty are all O(1) constant time. push_front, push_back, pop_front, and pop_back only add to or delete the front or back of the deque, making it constant time. front and back checks if the deque is empty, if it is not, they return the front and back url making it constant time. Size and empty check if the current size of the deque is zero and then returns an appropriate statement, making it constant time.

Find, print, and clear functions are all O(n) time complexity. Find, print, and clear iterate through the deque at most linearly once, making it O(n).