| Student ID: | Student Name: | Signature: | |
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| Ougstine 2 (50 mts) -) (5 | | | |

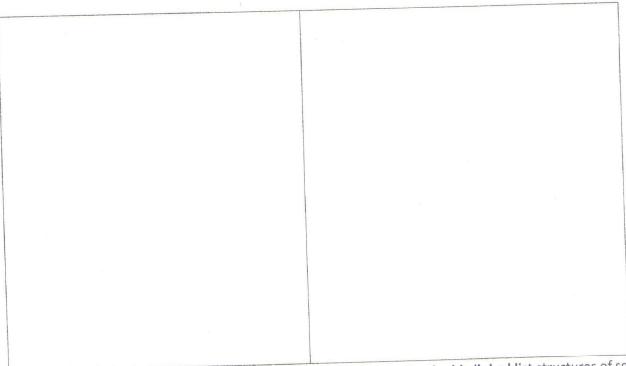
Question 3. (50 pts) a) (5 pts) Write a single link list in C++. This list should consist of node structiures having only an integer member as the data part. The methods that will be invoked on this linked list are: "add", "remove", "traverse", and "empty_list". Write the necessary C++ structures for this single linked list:

- a) (20 pts) Write the implementations of the methods "add", "remove", "traverse", and "empty_list" in item (a) fullfilling the following criteria:
 - The "add" function always adds a node to the <u>beginning</u> of the list, and "remove" always deletes one item from the beginning of the list. If there is no node to delete, display appropriate message to the screen ("list is empty").
 - The "add", "remove", and "empty_list" do not return any values.
 - "add" takes a node as input, and "traverse" takes a node_data as input.
 - "traverse" searches for a node with this specific node_data and return its index (count number).

 Assume node_data numbers are unique for each node. If the node is not found return -1;

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- b) (15 pts) 1)Rewrite the structures in your previous answer to make this single linked list a **doubly linked** list. This **doubly linked list** should contain "add" and "remove" methods.
 - 2) Write the implementations of the methods "add", and "remove", for this doubly linked list fullfilling the following criteria:
 - the "add" method can add items to the <u>beginning</u> of the list.
 - the "remove" method removes the first item on the list.



c) (10 pts) Write the necessary changes that should be made to the **doubly linked list** structures of section (b) to convert this list to a **circular doubly linked list**. Write the **"add"** function which adds a node to the end of the list. What would be the advantages and disadvantages of this new list to the list in (a) and (b)?