Student ID: **Student Name:** **Signature:** .

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 beginning 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;

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 beginning 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)?