Instructor: Dr. Jie Shen

2021 Winter CIS200 – Lab 8

Release date: March. 19, 2021
Due date: March. 24, 2021

Student Name: Demetrius Johnson

*Special note: see my lab uploads of the .CPP and .EXE files for ease of access and testing any of the programs for any question.

Table of Contents

Question 1

Question: If we want to change it to a circular linked list, what should we do?

If we want to have a circularly linked list, then we simply need to make sure that the last node (tail) in the list points to the head node of the list.

Source code (USED C++ COMPILER on Microsoft Windows 10)

```
// CIS-200-LAB_8-DemetriusJohnson.cpp : This file contains the 'main' function. Program execution begins and ends there.

/*
//Author: Demetrius E Johnson
//Date: April 26, 2021
//Last Modification Date: April 26, 2021
//Purpose: This program demonstrates the use of a linked list using a struct and some basic functions


*/

/*
Question 1:

//Write a function called listsize that takes a pointer to the start of a linked list and returns the number of elements in the list,
//and another function called listsum that also takes a pointer to the start of a linked list and returns the sum of the values of all elements in the list.
//In your main routine, you need to print out the results of these two functions on computer screen.

*/



#include <iostream>
//#include<assert.h>
using namespace std;


//FUNCTION DECLARATIONS
struct listrec
{
   int value;
   struct listrec* next;
};

int listsize(listrec* LinkedList_Ptr); // takes a pointer to the start of a linked list and returns the number of elements in the list
int listsum(listrec* LinkedList_Ptr); //takes a pointer to the start of a linked list and returns the sum of the values of all elements in the list

//FUNCTION DECLARATIONS
```

```
int main()
{
   cout << "---Welcome: This program demonstrates the use of a linked list using a struct and some basic functions\n--By Demetrius Johnson\n\n";

   listrec int_LinkedList; //create a linked list; this node will keep the starting address of the list as well
   listrec* int_linkedList_Ptr = &int_LinkedList; //use this ptr to navigate through the linked list

   int_linkedList_Ptr->value = 4; //set value of FIRST node
   int_linkedList_Ptr->next = new listrec; //allocate memory for next node
   int_linkedList_Ptr = int_linkedList_Ptr->next; //move to next node
   int_linkedList_Ptr->value = 5; //set value of SECOND node
   int_linkedList_Ptr->next = new listrec; //allocate memory for next node
   int_linkedList_Ptr = int_linkedList_Ptr->next; //move to next node
   int_linkedList_Ptr->value = 3; //set value of THIRD node
   int_linkedList_Ptr->next = nullptr; //we have inserted all items; set end of list to nullptr so we have a denotation for the end.

   cout << "The Number of elements in the int linked list is: " << listsize(&int_LinkedList) << endl << endl;
   cout << "The sum of all the values stored by all the elements in the int linked list is: " << listsum(&int_LinkedList) << endl << endl;

   cout << endl << endl << "The program has finished execution....now exiting...thank you....\n\n";
   system("pause");

   return 0;
}


//FUNCTION DEFINITIONS BELOW THIS LINE

int listsize(listrec* LinkedList_Ptr) {

   int element_counter = 0; //use this to keep track of the size of the linked list

   while (LinkedList_Ptr != nullptr) {

      element_counter++; // current node not null; so increase counter to add an element
      LinkedList_Ptr = LinkedList_Ptr->next; //move to next node

   }

   return element_counter; //return the number of elements

} // takes a pointer to the start of a linked list and returns the number of elements in the list

int listsum(listrec* LinkedList_Ptr) {

   int sum = 0; //use this to keep track of the sum of the element values in the linked list

   while (LinkedList_Ptr != nullptr) {

      sum += LinkedList_Ptr->value; // current node not null; so add value of the current element
      LinkedList_Ptr = LinkedList_Ptr->next; //move to next node
```

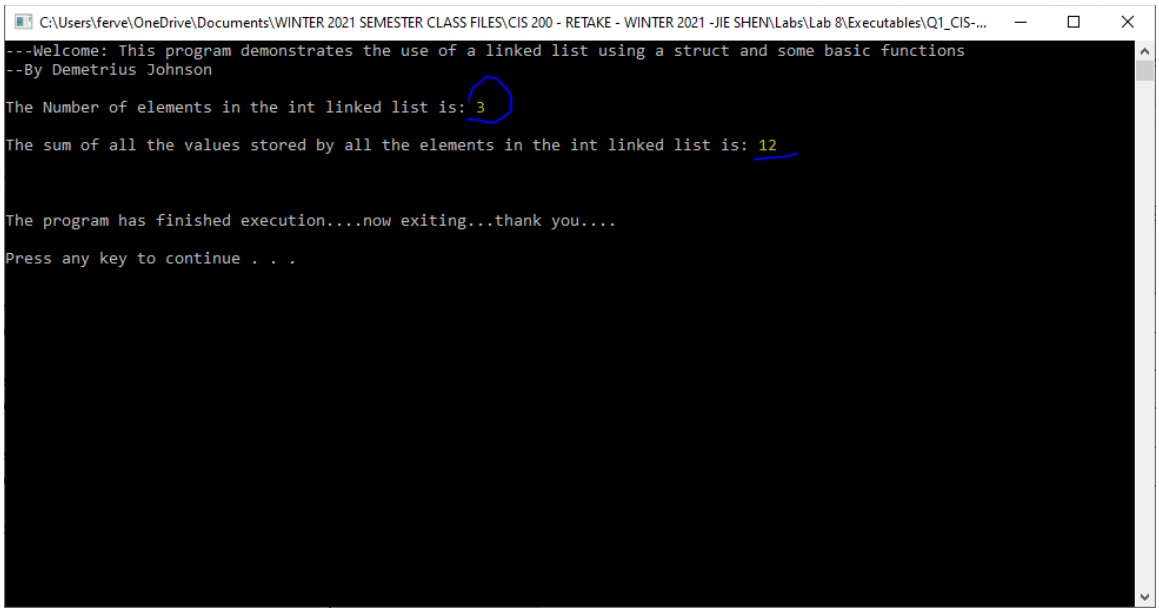
```
    }

    return sum; //return sum of all the elements

} //takes a pointer to the start of a linked list and returns the sum of the values of all elements in the list
```

Test data and expected results

Test Table:

Test #	Valid / Invalid Data	Description of test	Input Value	Expected Output	Actual Output	Test Pass / Fail
1	valid	Call functions that tell size of the linked list and the sum of the values stored by each element	Called listsize and listsum	3 elements, and the sum of the 3 elements should be 12	See screenshot	pass

TEST 1:



Question 2

Question: If we want to change to a doubly-linked list, what should we do?

For a doubly linked list, you simply have two pointers for each node: one for the next node, and one for the previous node; in this way the list is doubly linked and you can move forward and backward in the list.

Source code (USED C++ COMPILER on Microsoft Windows 10)

```
// CIS-200-LAB_8-DemetriusJohnson.cpp : This file contains the 'main' function. Program execution begins and ends there.

/*
//Author: Demetrius E Johnson
//Date: April 26, 2021
//Last Modification Date: April 26, 2021
//Purpose: This program demonstrates the use of a linked list using a struct and some basic functions


*/

/*
Question 2:

//Write a function called listsize that takes a pocharer to the start of a linked list and returns the number of elements in the list,
//and another function called listsum that also takes a pocharer to the start of a linked list and returns the sum of the values of all elements in the list.
//In your main routine, you need to prchar out the results of these two functions on computer screen.

*/



#include <iostream>
//#include<assert.h>
using namespace std;


//FUNCTION DECLARATIONS
struct listrec
{
   char value;
   struct listrec* next;
};

void printlist(listrec* start_of_linked_list);  // print out all the nodes in the list


//FUNCTION DECLARATIONS



int main()
{
```

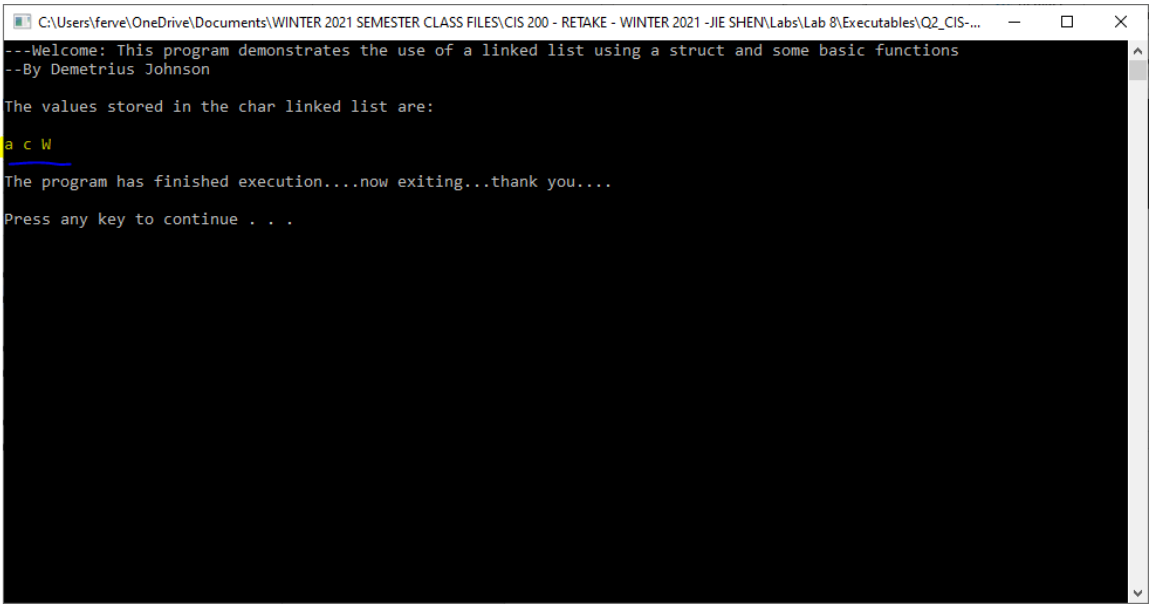
```
    cout << "---Welcome: This program demonstrates the use of a linked list using a struct and some basic functions\n--By Demetrius Johnson\n\n";

    listrec char_LinkedList; //create a linked list; this node will keep the starting address of the list as well
    listrec* char_linkedList_Ptr = &char_LinkedList; //use this ptr to navigate through the linked list

    char_linkedList_Ptr->value = 'a'; //set value of FIRST node
    char_linkedList_Ptr->next = new listrec; //allocate memory for next node
    char_linkedList_Ptr = char_linkedList_Ptr->next; //move to next node
    char_linkedList_Ptr->value = 'c'; //set value of SECOND node
    char_linkedList_Ptr->next = new listrec; //allocate memory for next node
    char_linkedList_Ptr = char_linkedList_Ptr->next; //move to next node
    char_linkedList_Ptr->value = 'W'; //set value of THIRD node
    char_linkedList_Ptr->next = nullptr; //we have inserted all items; set end of list to nullptr so we have a denotation for the end.

    cout << "The values stored in the char linked list are: \n\n";
    printlist(&char_LinkedList);

    cout << endl << endl << "The program has finished execution....now exiting...thank you....\n\n";
    system("pause");

    return 0;
}


//FUNCTION DEFINITIONS BELOW THIS LINE

void printlist(listrec* LinkedList_Ptr) {

    while (LinkedList_Ptr != nullptr) {

        cout << LinkedList_Ptr->value << " "; //cout value of current node
        LinkedList_Ptr = LinkedList_Ptr->next; //move to next node

    }

}  // print out all the nodes in the list
```

Test data and expected results

Test Table:

Test #	Valid / Invalid Data	Description of test	Input Value	Expected Output	Actual Output	Test Pass / Fail
1	valid	Print out values in the list	a, c, and W; call print function for the list	a c W	See screenshot	pass

TEST 1:


C:\Users\ferve\OneDrive\Documents\WINTER 2021 SEMESTER CLASS FILES\CIS 200 - RETAKE - WINTER 2021 -JIE SHEN\Labs\Lab 8\Executables\Q2_CIS-...
---Welcome: This program demonstrates the use of a linked list using a struct and some basic functions
--By Demetrius Johnson
The values stored in the char linked list are:
a c W
The program has finished execution....now exiting...thank you....
Press any key to continue . . .

Question 3

Source code (USED C++ COMPILER on Microsoft Windows 10)

```
// CIS-200-LAB_8-DemetriusJohnson.cpp : This file contains the 'main' function. Program execution begins and ends there.

/*
//Author: Demetrius E Johnson
//Date: April 27, 2021
//Last Modification Date: April 27, 2021
//Purpose: This program demonstrates how to output beginning memory addresses


*/

/*
Question 2:

//In the following main( ) function, try to find a way to print out the beginning memory address of each variable.

*/

#include <iostream>
//#include<assert.h>
using namespace std;




int add(int x, int y)
{
   return (x + y);
}

int main()
{
  cout << "---Welcome: This program demonstrates how to output beginning memory addresses\n--By Demetrius Johnson\n\n";


  int a = 10;
  float b = 3.14;
  char c = 'j';
  char d[80];

   // print out the beginning memory address of the above 4 variables
   // as well as the memory address of function add( )
  cout << "The beggning memory address of an array or function is its name;\nfor normal variables, the beginning address is simply the name using the & operator.\n";
  cout << "A sepcial case for normal variables or for an array, is when you have a char variable or char array,\nthe &operator or ";
  cout << "name of char array fails so you must cast it as a (void*) pointer" << endl;
```

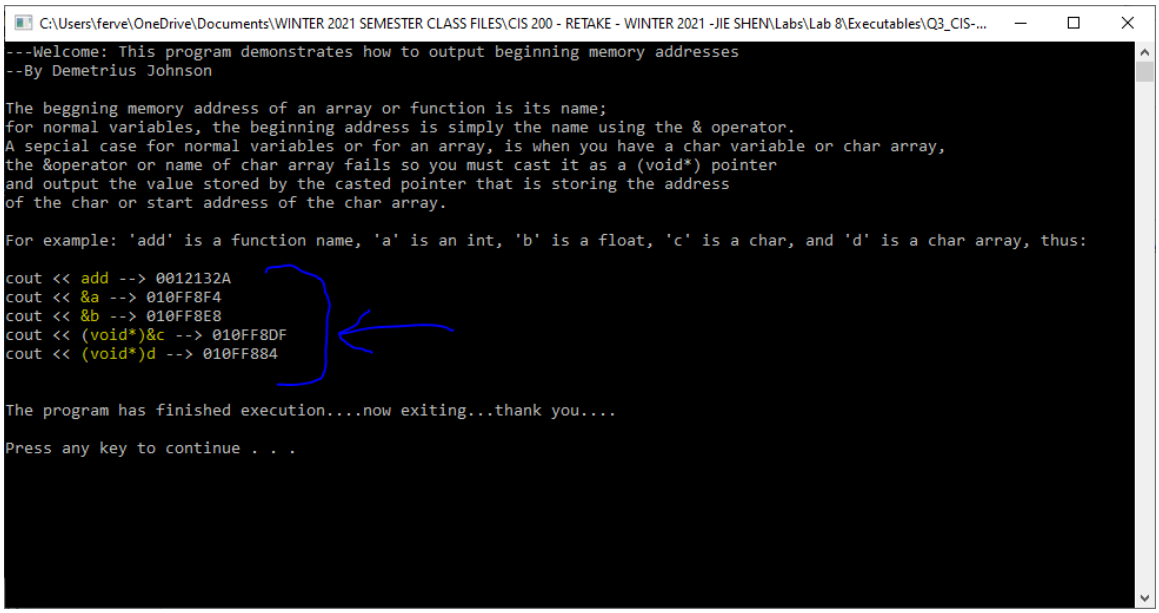
```
   cout << "and output the value stored by the casted pointer that is storing the address\nof the char or start address of the char array.\n\n";


   cout << "For example: 'add' is a function name, 'a' is an int, 'b' is a float, 'c' is a char, and 'd' is a char array, thus:\n\n";
   cout << "cout << add --> " << add << endl;
   cout << "cout << &a --> " << &a << endl;
   cout << "cout << &b --> " << &b << endl;
   cout << "cout << (void*)&c --> " << (void*)&c << endl;
   cout << "cout << (void*)d --> " << (void*)d << endl;

   cout << endl << endl << "The program has finished execution....now exiting...thank you....\n\n";
   system("pause");

    return 0;


}
```

Test data and expected results

Test Table:

Test #	Valid / Invalid Data	Description of test	Input Value	Expected Output	Actual Output	Test Pass / Fail
1	valid	Output the addresses of the different data types and function	See screenshot	See screenshot	See screenshot	pass

TEST 1:



Submission

(1) The Word document should contain the following information

- Your name
- Machine type (Unix, Mac, Linux or PC machine ?)
- Compiler type
- Description of your code design and implementation
- Inclusion of your source
- A reasonable number of comment lines in your source code
- Screen shot of your test run