

**Phat Panhareach**

**Professor Name: Buo Channa**

**Subject Name: Advance Algorithm**

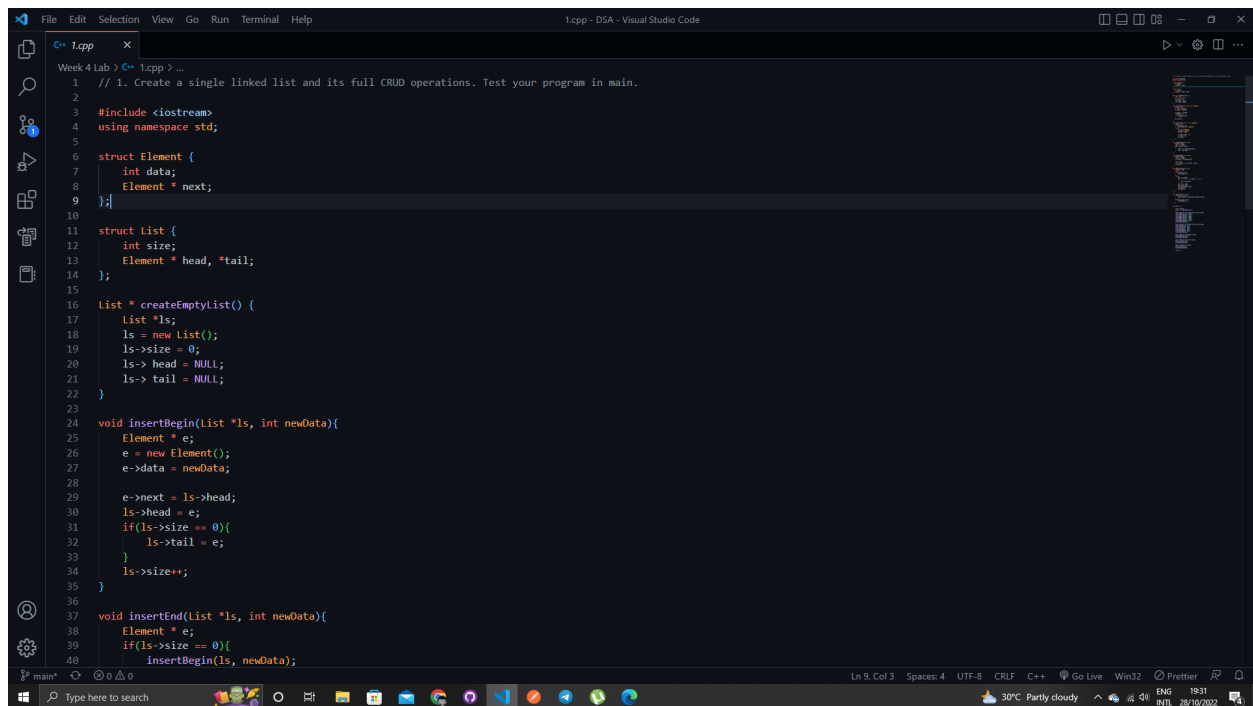
**Major: Computer Science (Gen 8)**

**Group: B**

## **Report Advanced Algorithm Lab 4**

Exercise 1:

1. Create a single linked list and its full CRUD operations. Test your program in main.



```
1 // 1. Create a single linked list and its full CRUD operations. Test your program in main.
2
3 #include <iostream>
4 using namespace std;
5
6 struct Element {
7     int data;
8     Element * next;
9 };
10
11 struct List {
12     int size;
13     Element * head, *tail;
14 };
15
16 List * createEmptyList() {
17     List *ls;
18     ls = new List();
19     ls->size = 0;
20     ls->head = NULL;
21     ls->tail = NULL;
22 }
23
24 void insertBegin(List *ls, int newData){
25     Element * e;
26     e = new Element();
27     e->data = newData;
28
29     e->next = ls->head;
30     ls->head = e;
31     if(ls->size == 0){
32         ls->tail = e;
33     }
34     ls->size++;
35 }
36
37 void insertEnd(List *ls, int newData){
38     Element * e;
39     if(ls->size == 0){
40         insertBegin(ls, newData);
```

```

File Edit Selection View Go Run Terminal Help
1.cpp - DSA - Visual Studio Code

C++ 1.cpp x
Week 4 Lab > C++ 1.cpp > ...
35 }
36
37 void insertEnd(List *ls, int newData){
38     Element * e;
39     if(ls->size == 0){
40         insertBegin(ls, newData);
41     }else{
42         e = new Element();
43         e->data = newData;
44         e->next = NULL;
45
46         ls->tail->next = e;
47         ls->tail = e;
48         ls->size++;
49     }
50 }
51
52 void displayData(List *ls){
53     Element *tmp;
54     tmp = ls->head;
55     while (tmp != NULL)
56     {
57         cout<<" "<<tmp->data<<endl;
58         tmp = tmp->next;
59     }
60 }
61
62 void deleteBegin(List *ls){
63     Element *tmp;
64     tmp = ls->head;
65     ls->head = ls->head->next;
66
67     delete tmp;
68     if(ls->size == 1) ls->tail = NULL;
69     ls->size--;
70 }
71
72 void deletelast(List *ls){
73     Element * tmp;
74     int i;

```

```

File Edit Selection View Go Run Terminal Help
1.cpp - DSA - Visual Studio Code

C++ 1.cpp x
Week 4 Lab > C++ 1.cpp > ...
70 }
71
72 void deletelast(List *ls){
73     Element * tmp;
74     int i;
75     if(ls->size == 1){
76         deleteBegin(ls);
77     }
78     else{
79         tmp = ls->head;
80         for ( i = 1; i <= ls->size - 2; i++)
81         {
82             tmp = tmp->next;
83         }
84         ls->tail = tmp;
85         tmp = tmp->next;
86         ls->tail->next = NULL;
87         delete(tmp);
88         ls->size--;
89     }
90 }
91
92 void deleteAll(List *ls){
93     if(ls->size <= 0){
94         cout<<"There is nothing to delete"<<endl;
95     }
96     while(ls->size > 0){
97         deleteBegin(ls);
98     }
99 }
100
101 int main () {
102
103     List * myList;
104     myList = createEmptyList();
105
106     cout<<"Insert to the end of the list"<<endl;
107     insertBegin(myList, 1000);
108     insertBegin(myList, 1001);

```

```

1.cpp
Week 4 Lab > C++ 1.cpp > ...
99 }
100
101 int main () {
102
103     List * myList;
104     myList = createEmptyList();
105
106     cout<<"Insert to the end of the list"<<endl;
107     insertBegin(myList, 1000);
108     insertBegin(myList, 1001);
109     insertBegin(myList, 1002);
110     insertBegin(myList, 1000);
111     insertBegin(myList, 1001);
112     insertBegin(myList, 1002);
113     displayData(myList);
114
115     cout<<"Insert to the end of the list"<<endl;
116     insertEnd(myList, 10);
117     insertEnd(myList, 101);
118     insertEnd(myList, 102);
119     insertEnd(myList, 103);
120     insertEnd(myList, 104);
121     displayData(myList);
122
123     cout<<"Delete from begin"<<endl;
124     deleteBegin(myList);
125     displayData(myList);
126
127     cout<<"Delete from last"<<endl;
128     deleteLast(myList);
129     displayData(myList);
130
131     cout<<"Delete All"<<endl;
132     deleteAll(myList);
133     displayData(myList);
134
135     return 0;
136 }

```

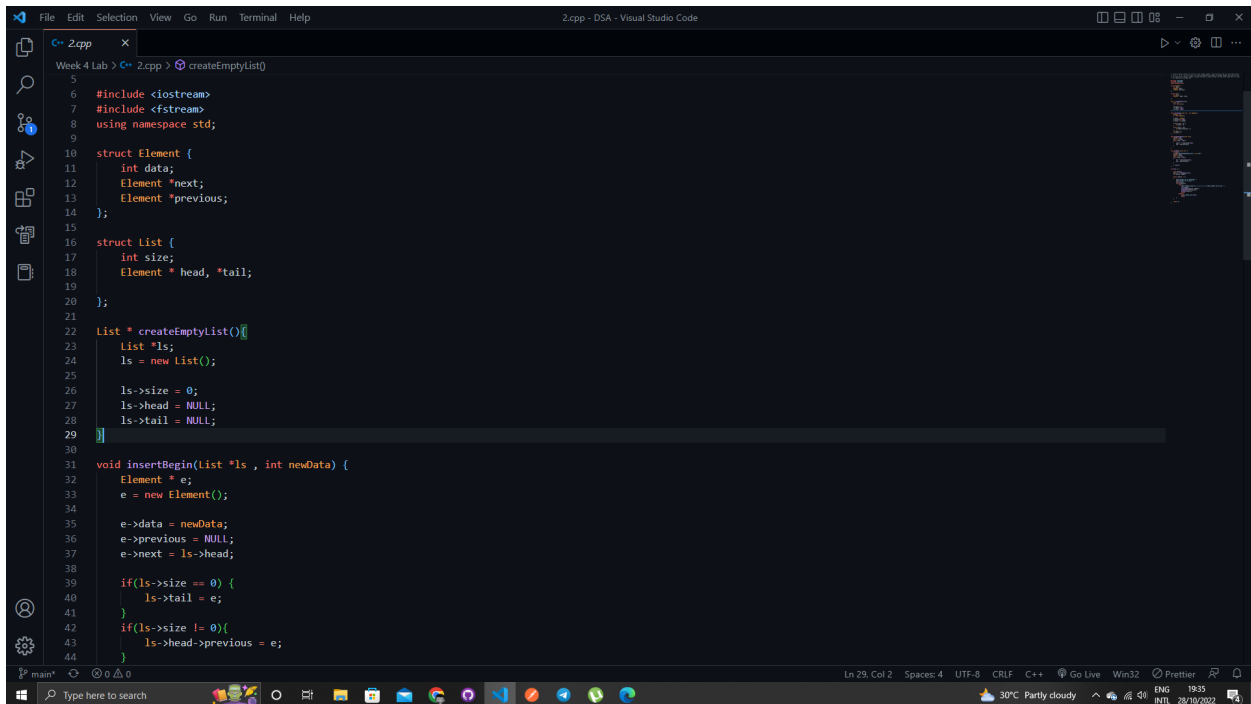
```

1.cpp: In function 'List* createEmptyList()':
1.cpp:22:1: warning: no return statement in function returning non-void [-Wreturn-type]
22 | }
   | ^
Insert to the end of the list
1002
1001
1000
1002
1001
1000
Insert to the end of the list
1002
1001
1000
10
101
102
103
104
Delete from begin
1001
1000
1002
1001
1000
10
101
102
103
104
Delete from last
1001
1000
1002
1001
1000
10
101
102
103
Delete All

```

## Exercise 2:

Create a double linked list that can store integer numbers. Then initialize the list with these values [1, 2, 3, 5, 0, -1]. Ask a user for n which represents the number of integer numbers then ask the user to input each of those n numbers. Display the data in double linked list and write those data in a text file Output-Ex1-YourName.txt.



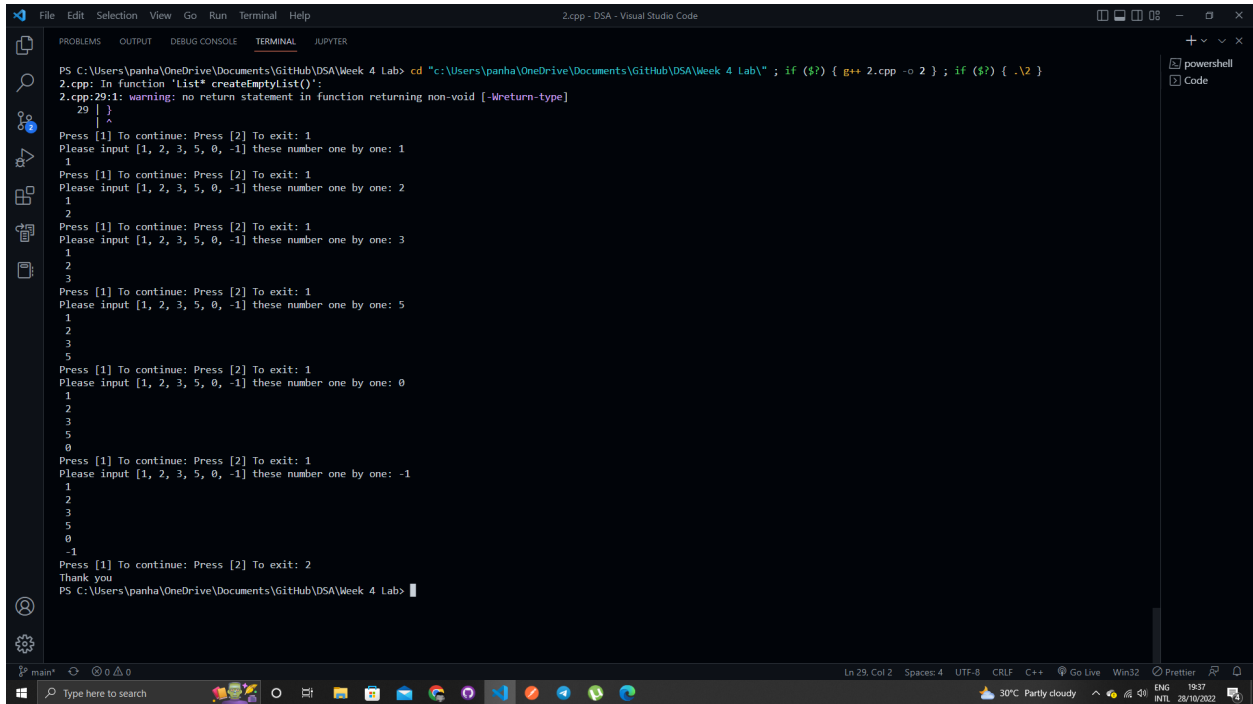
```
Week 4 Lab > C++ 2.cpp > createEmptyList()
5
6 #include <iostream>
7 #include <fstream>
8 using namespace std;
9
10 struct Element {
11     int data;
12     Element *next;
13     Element *previous;
14 };
15
16 struct List {
17     int size;
18     Element * head, *tail;
19 };
20
21
22 List * createEmptyList(){
23     List *ls;
24     ls = new List();
25
26     ls->size = 0;
27     ls->head = NULL;
28     ls->tail = NULL;
29 }
30
31 void insertBegin(List *ls , int newData) {
32     Element * e;
33     e = new Element();
34
35     e->data = newData;
36     e->previous = NULL;
37     e->next = ls->head;
38
39     if(ls->size == 0) {
40         ls->tail = e;
41     }
42     if(ls->size != 0){
43         ls->head->previous = e;
44     }
45 }
```

The image shows a Visual Studio Code editor window with a C++ file named `Z.cpp`. The code implements a linked list with the following components:

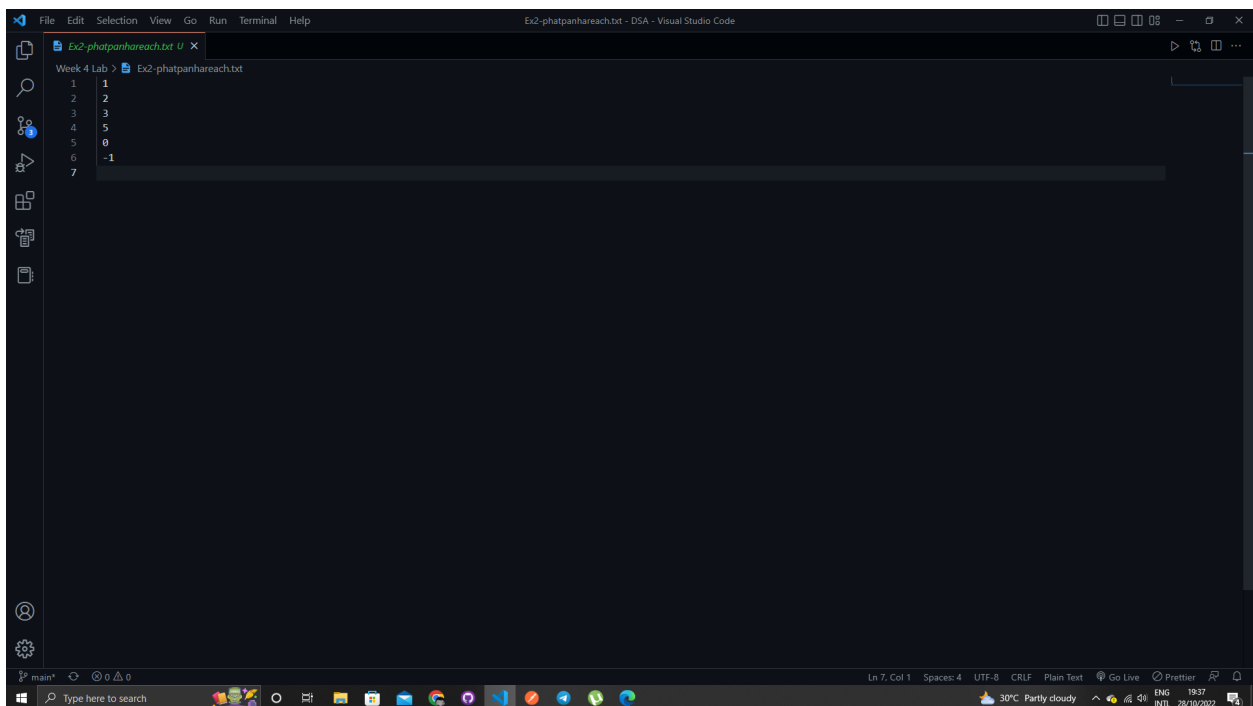
- `createEmptyList()`: A function that creates a new linked list with one node containing the value 1.
- `saveData(List *ls)`: A function that saves the data of a linked list to a file named `Ex1-phatpanhareach.txt`.
- `main()`: The main function that prompts the user to input a choice (1 to continue, 2 to exit) and a number to insert into the linked list. It uses a `switch` statement to handle the choices.

```
1 // Week 4 Lab > C++ Z.cpp > createEmptyList()
2
3 }
4
5 void saveData (List *ls) {
6     ofstream f;
7     f.open("Ex1-phatpanhareach.txt", ios::out);
8     Element *tmp;
9     tmp = ls->tall;
10    while (tmp != NULL)
11    {
12        f<<" "<<tmp->data<<endl;
13        tmp = tmp->previous;
14    }
15    f.close();
16 }
17
18 int main () {
19
20     List *mylist;
21     mylist = createEmptyList();
22     int choice, number;
23
24     while (choice != 2)
25     {
26         cout<<"Press [1] To continue: ";
27         cout<<"Press [2] To exit: ";
28         cin>>choice;
29         switch(choice){
30             case 1:
31                 cout<<"Please input [1, 2, 3, 5, 0, -1] these number one by one: ";
32                 cin>>number;
33                 insertBegin(mylist, number);
34                 displayFromTail(mylist);
35                 saveData(mylist);
36                 break;
37             default:
38                 cout<<"Thank you"<<endl;
39                 break;
40         }
41     }
42 }
```

The status bar at the bottom indicates the file is named `main*`, the cursor is at line 29, column 2, and the file encoding is UTF-8. The system tray shows the date and time as 19/3/2023, 19:38.



```
PS C:\Users\panha\OneDrive\Documents\Github\DSA\Week 4 Lab> cd "c:\Users\panha\OneDrive\Documents\Github\DSA\Week 4 Lab\" ; if ($?) { g++ 2.cpp -o 2 } ; if ($?) { .\2 }
2.cpp: In function 'List* createEmptyList()':
2.cpp:29:1: warning: no return statement in function returning non-void [-Wreturn-type]
    29 | }
       | ^
Press [1] To continue: Press [2] To exit: 1
Please input [1, 2, 3, 5, 0, -1] these number one by one: 1
1
Press [1] To continue: Press [2] To exit: 1
Please input [1, 2, 3, 5, 0, -1] these number one by one: 2
2
Press [1] To continue: Press [2] To exit: 1
Please input [1, 2, 3, 5, 0, -1] these number one by one: 3
3
Press [1] To continue: Press [2] To exit: 1
Please input [1, 2, 3, 5, 0, -1] these number one by one: 5
5
Press [1] To continue: Press [2] To exit: 1
Please input [1, 2, 3, 5, 0, -1] these number one by one: 0
0
Press [1] To continue: Press [2] To exit: 1
Please input [1, 2, 3, 5, 0, -1] these number one by one: -1
-1
Press [1] To continue: Press [2] To exit: 2
Thank you
PS C:\Users\panha\OneDrive\Documents\Github\DSA\Week 4 Lab>
```



```
Week 4 Lab > Ex2-phatpanhareach.txt
1 1
2 2
3 3
4 5
5 0
6 -1
7
```

## Exercise 3:

3. Create a Double linked list that can stores the English alphabet (A-Z). Display data from A to Z in double linked list. In addition, display data from Z to A in double linked list.

```

1  #include <iostream>
2  #include <fstream>
3  using namespace std;
4
5  struct Element {
6      int dataStart, dataLast;
7      Element *next;
8      Element *previous;
9  };
10
11 struct List {
12     int size;
13     Element *head, *tail;
14 };
15
16 List * createEmptyList(){
17     List *ls;
18     ls = new List();
19
20     ls->size = 0;
21     ls->head = NULL;
22     ls->tail = NULL;
23 }
24
25 void insertBegin(List *ls, int start, int last) {
26     Element *e;
27     e = new Element();
28
29     e->dataStart = start;
30     e->dataLast = last;
31     e->previous = NULL;
32     e->next = ls->head;
33
34     if(ls->size == 0) {
35         ls->tail = e;
36     }
37     if(ls->size != 0){
38         ls->head->previous = e;
39     }
40     ls->head = e;
41     ls->size ++;
42 }
43
44 void displayFromHead(List *ls){
45     Element *tmp;
46     tmp = ls->head;
47     while(tmp != NULL){
48
49
50     }
51 }
52
53 int main() {
54     // ...
55 }

```

```

3.cpp
Week 4 Lab > 3.cpp > ...
46     ls->size++;
47 }
48
49 void displayfromHead(list *ls){
50     Element *tmp;
51     tmp = ls->head;
52     while (tmp != NULL)
53     {
54         for (int i = tmp->dataLast; i >= tmp->dataStart; i--) {
55             cout<<(char) i<<" ";
56         }
57         tmp = tmp->next;
58     }
59 }
60
61
62 void displayfromTail(list *ls){
63     Element *tmp;
64     tmp = ls->tail;
65     while (tmp != NULL)
66     {
67         for (int i = tmp->dataStart; i <= tmp->dataLast; i++) {
68             cout<<(char) i<<" ";
69         }
70         tmp = tmp->previous;
71     }
72 }
73
74
75 }
76
77 int main () {
78
79     list *myList;
80     myList = createEmptyList();
81
82     InsertBegin(myList, 07, 122);
83     displayfromTail(myList);
84     cout<<"\n*****<<<endl;
85     displayfromHead(myList);
86
87     return 0;
88 }

```

```

3.cpp - DSA - Visual Studio Code
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL JUPYTER
PS C:\Users\panha\OneDrive\Documents\GitHub\DSA\Week 4 Lab> cd "c:\Users\panha\OneDrive\Documents\GitHub\DSA\Week 4 Lab" ; if ($?) { g++ 3.cpp -o
3 } ; if ($?) { .\3 }
3.cpp: In function 'list* createEmptyList()':
3.cpp:28:1: warning: no return statement in function returning non-void [-Wreturn-type]
   28 | }
      | ^
a b c d e f g h i j k l m n o p q r s t u v w x y z
*****
z y x w v u t s r q p o n m l k j i h g f e d c b a
PS C:\Users\panha\OneDrive\Documents\GitHub\DSA\Week 4 Lab>

```



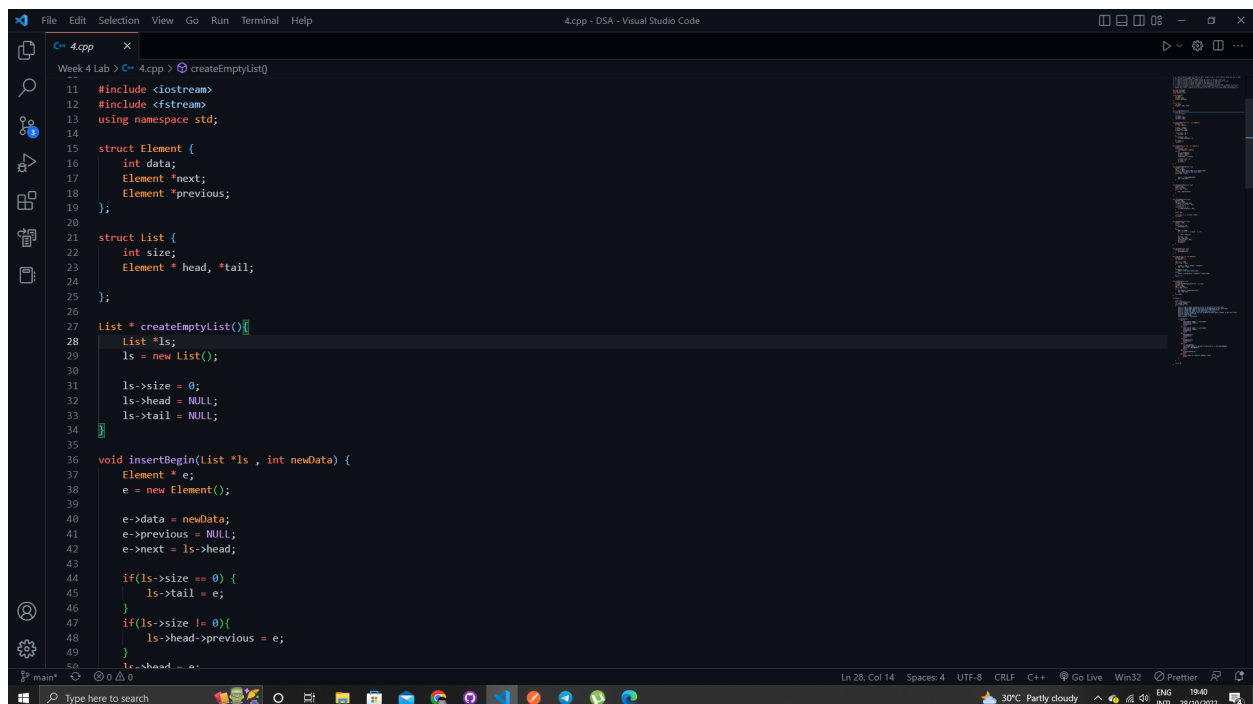
## Exercise 4:

4. Create a Double linked list that can store integer numbers. Write functions below and test in your main program to implement double link list

- Create a function to add a number entered by a user to the end of the list
- Create a function to add a number entered by a user to the beginning of the list
- Create a function to delete the number at the beginning of the list
- Create a function to delete the number at the beginning of the list
- Create a function to search a number in the list. Display how many times in appear in the list.

In your main program, try to add numbers, delete numbers and search for a number (test with any numbers you prefer). Finally store the data in the list into a file named

Ouput-Ex3e-YourName.txt



```

Week 4 Lab > C++ 4.cpp > createEmptyList()
11 #include <iostream>
12 #include <fstream>
13 using namespace std;
14
15 struct Element {
16     int data;
17     Element *next;
18     Element *previous;
19 };
20
21 struct List {
22     int size;
23     Element * head, *tail;
24 };
25
26
27 List * createEmptyList(){
28     List *ls;
29     ls = new List();
30
31     ls->size = 0;
32     ls->head = NULL;
33     ls->tail = NULL;
34 }
35
36 void insertBegin(List *ls, int newData) {
37     Element * e;
38     e = new Element();
39
40     e->data = newData;
41     e->previous = NULL;
42     e->next = ls->head;
43
44     if(ls->size == 0) {
45         ls->tail = e;
46     }
47     if(ls->size != 0){
48         ls->head->previous = e;
49     }
50     ls->head = e;
51     ls->size++;
52 }
53
54 int main() {
55     List *ls;
56     ls = createEmptyList();
57
58     insertBegin(ls, 10);
59     insertBegin(ls, 20);
60     insertBegin(ls, 30);
61
62     // Display the list
63     // ...
64 }

```

```

File Edit Selection View Go Run Terminal Help
4.cpp - DSA - Visual Studio Code

C++ 4.cpp x
Week 4 Lab > C++ 4.cpp > createEmptyList()
53
54 void insertEnd(List *ls, int newData) {
55     Element *e;
56     if(ls->size == 0){
57         insertBegin(ls, newData);
58     }else {
59         e = new Element();
60         e->data = newData;
61         e->next = NULL;
62         e->previous = ls->tail;
63
64         ls->tail->next = e;
65         ls->tail = e;
66         ls->size++;
67     }
68 }
69
70 void displayFromHead(List *ls){
71     Element *tmp;
72     tmp = ls->head;
73     if(tmp == NULL) cout<<"There is no data"<<endl;
74     else cout<<"All data in the list"<<endl;
75     while (tmp != NULL)
76     {
77         cout<<" "<<tmp->data<<endl;
78         tmp = tmp->next;
79     }
80 }
81
82
83
84 void displayFromTail(List *ls){
85     Element *tmp;
86     tmp = ls->tail;
87     while (tmp != NULL)
88     {
89         tmp = tmp->previous;
90     }
91 }
92
93
94
Ln 28, Col 14  Spaces: 4  UTF-8  CRLF  C++  Go Live  Win32  Prettier
main*  Type here to search  30°C Partly cloudy  ENG 19:40 28/10/2022

```

```

File Edit Selection View Go Run Terminal Help
4.cpp - DSA - Visual Studio Code

C++ 4.cpp x
Week 4 Lab > C++ 4.cpp > createEmptyList()
95 void deleteBegin(List *ls){
96     Element *tmp;
97     tmp = ls->head;
98     ls->head = ls->head->next;
99     // ls->head->previous = NULL;
100     // delete tmp;
101     if(ls->size >= 2) {
102         ls->head->previous = NULL;
103     }
104
105     delete tmp;
106
107     if(ls->size == 1) ls->tail = NULL;
108     ls->size--;
109 }
110
111 void deleteLast(List *ls){
112     Element *tmp;
113     int i;
114     if(ls->size == 1){
115         deleteBegin(ls);
116     }
117     else{
118         tmp = ls->head;
119         for ( i = 1; i <= ls->size - 2; i++)
120         {
121             tmp = tmp->next;
122         }
123         ls->tail = tmp;
124         tmp = tmp->next;
125         ls->tail->next = NULL;
126         delete(tmp);
127         ls->size--;
128     }
129 }
130
131
132
133 void deleteAll(List *ls){
134     while(ls->size > 0){

```

```

C++ 4.cpp
Week 4 Lab > C++ 4.cpp > createEmptyList()
132
133 void deleteAll(List *ls){
134     while(ls->size > 0){
135         deleteBegin(ls);
136     }
137 }
138
139 void search(List *ls, int newData){
140     Element *tmp;
141     int counter = 0;
142
143     tmp = ls -> head;
144     while (tmp != NULL)
145     {
146         if(tmp -> data == newData ) counter++;
147         tmp = tmp -> next;
148     }
149     if(counter == 0) {
150         cout<<"\nNo data found"<<endl;
151     }else{
152         cout<<"\nFound data "<<counter<<" times"<<endl;
153     }
154     cout<<"\n";
155 }
156
157 void saveData(List *ls){
158     ofstream f1;
159     f1.open("Ex4-PhatPanhareach.txt", ios::out);
160     Element *tmp;
161     tmp = ls->head;
162     while (tmp != NULL)
163     {
164         f1<<"Number: "<<tmp->data<<endl;
165         tmp = tmp->next;
166     }
167     f1.close();
168 }
169
170 int main() {
171
Ln 28, Col 14  Spaces: 4  UTF-8  CRLF  C++  Go Live  Win32  Prettier
Type here to search  30°C Partly cloudy  ENG 19:40  INTL 28/10/2022

```

```

C++ 4.cpp
Week 4 Lab > C++ 4.cpp > createEmptyList()
171 int main() {
172
173     List * ls;
174     ls = createEmptyList();
175     int choice, number;
176     while (choice != 7)
177     {
178         cout<<"1. Add a number entered by a user to the end of the list"<<endl;
179         cout<<"2. Add a number entered by a user to the beginning of the list"<<endl;
180         cout<<"3. Delete the number at the beginning of the list"<<endl;
181         cout<<"4. Delete the number at the end of the list"<<endl;
182         cout<<"5. Search a number in the list. Display how many times in appear in the list"<<endl;
183         cout<<"6. Display All"<<endl;
184         cout<<"7. Exit"<<endl;
185         cout<<"Choice: "; cin>>choice;
186
187         switch(choice){
188             case 1:
189                 cout<<"Enter number: "; cin>>number;
190                 insertEnd(ls, number);
191                 saveData(ls);
192                 break;
193             case 2:
194                 cout<<"Enter number: "; cin>>number;
195                 insertEnd(ls, number);
196                 saveData(ls);
197                 break;
198             case 3:
199                 deleteBegin(ls);
200                 saveData(ls);
201                 break;
202             case 4:
203                 deleteLast(ls);
204                 saveData(ls);
205                 break;
206             case 5:
207                 int searchNumber;
208                 cout<<"What number do you want to search for?: "; cin>>searchNumber;
209                 search(ls, searchNumber);
210                 break;
211
Ln 28, Col 14  Spaces: 4  UTF-8  CRLF  C++  Go Live  Win32  Prettier
Type here to search  30°C Partly cloudy  ENG 19:40  INTL 28/10/2022

```

```

Week 4 Lab > C++ 4.cpp
179 cout<<"2. Add a number entered by a user to the beginning of the list"<<endl;
180 cout<<"3. Delete the number at the beginning of the list"<<endl;
181 cout<<"4. Delete the number at the end of the list"<<endl;
182 cout<<"5. Search a number in the list. Display how many times in appear in the list"<<endl;
183 cout<<"6. Display All"<<endl;
184 cout<<"7. Exit"<<endl;
185 cout<<"Choice: "; cin>>choice;
186
187 switch(choice){
188     case 1:
189         cout<<"Enter number: "; cin>>number;
190         insertEnd(ls, number);
191         saveData(ls);
192         break;
193     case 2:
194         cout<<"Enter number: "; cin>>number;
195         insertEnd(ls, number);
196         saveData(ls);
197         break;
198     case 3:
199         deleteBegin(ls);
200         saveData(ls);
201         break;
202     case 4:
203         deleteLast(ls);
204         saveData(ls);
205         break;
206     case 5:
207         int searchNumber;
208         cout<<"What number do you want to search for?: "; cin>>searchNumber;
209         search(ls, searchNumber);
210         break;
211     case 6:
212         displayFromHead(ls);
213         break;
214     default:
215         cout<<"Thank for using our program."<<endl;
216         break;
217 }
218

```

```

PS C:\Users\panha\OneDrive\Documents\GitHub\DSA\Week 4 Lab> cd "c:\Users\panha\OneDrive\Documents\GitHub\DSA\Week 4 Lab" ; if ($?) { g++ 4.cpp -o 4 } ; if ($?) { .\4 }
4.cpp: In function 'list* createEmptylist()':
4.cpp:34:1: warning: no return statement in function returning non-void [-Wreturn-type]
34 | }
    | ^
1. Add a number entered by a user to the end of the list
2. Add a number entered by a user to the beginning of the list
3. Delete the number at the beginning of the list
4. Delete the number at the end of the list
5. Search a number in the list. Display how many times in appear in the list
6. Display All
7. Exit
Choice: 1
Enter number: 10
1. Add a number entered by a user to the end of the list
2. Add a number entered by a user to the beginning of the list
3. Delete the number at the beginning of the list
4. Delete the number at the end of the list
5. Search a number in the list. Display how many times in appear in the list
6. Display All
7. Exit
Choice: 2
Enter number: 20
1. Add a number entered by a user to the end of the list
2. Add a number entered by a user to the beginning of the list
3. Delete the number at the beginning of the list
4. Delete the number at the end of the list
5. Search a number in the list. Display how many times in appear in the list
6. Display All
7. Exit
Choice: 6
All data in the list
10
20
1. Add a number entered by a user to the end of the list
2. Add a number entered by a user to the beginning of the list
3. Delete the number at the beginning of the list
4. Delete the number at the end of the list
5. Search a number in the list. Display how many times in appear in the list
6. Display All
7. Exit
Choice:

```

The screenshot shows a Visual Studio Code editor window with a C++ project named '4cpp - DSA - Visual Studio Code'. The 'TERMINAL' tab is active, displaying the output of a program. The program is a linked list implementation with the following menu options:

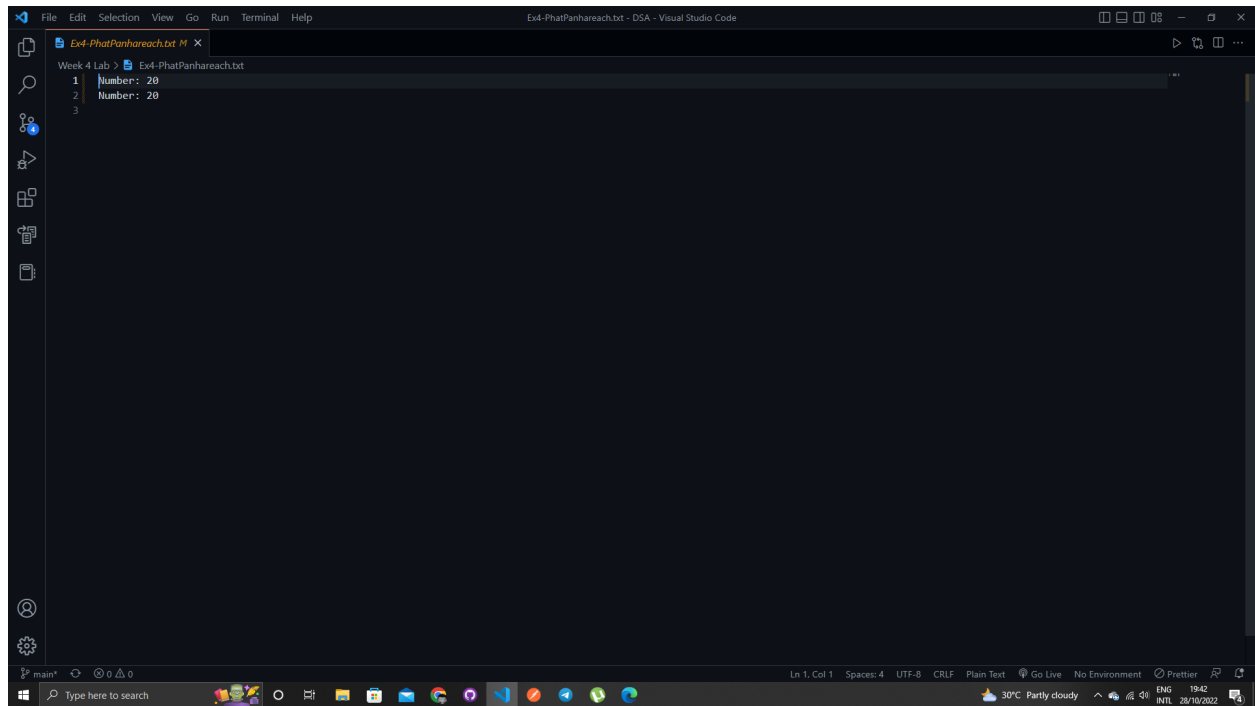
```

7. Exit
Choice: 6
All data in the list
10
20
1. Add a number entered by a user to the end of the list
2. Add a number entered by a user to the beginning of the list
3. Delete the number at the beginning of the list
4. Delete the number at the end of the list
5. Search a number in the list. Display how many times in appear in the list
6. Display All
7. Exit
Choice: 1
Enter number: 20
1. Add a number entered by a user to the end of the list
2. Add a number entered by a user to the beginning of the list
3. Delete the number at the beginning of the list
4. Delete the number at the end of the list
5. Search a number in the list. Display how many times in appear in the list
6. Display All
7. Exit
Choice: 1
Enter number: 30
1. Add a number entered by a user to the end of the list
2. Add a number entered by a user to the beginning of the list
3. Delete the number at the beginning of the list
4. Delete the number at the end of the list
5. Search a number in the list. Display how many times in appear in the list
6. Display All
7. Exit
Choice: 6
All data in the list
10
20
20
30
1. Add a number entered by a user to the end of the list
2. Add a number entered by a user to the beginning of the list
3. Delete the number at the beginning of the list
4. Delete the number at the end of the list
5. Search a number in the list. Display how many times in appear in the list
6. Display All
7. Exit
Choice: 1

```

The program is currently at the 'Exit' option, and the user has entered '1'. The status bar at the bottom shows the file is in 'main', the cursor is at 'Ln 200, Col 30', and the project is using 'Spaces: 4'. The system tray at the bottom shows the date and time as '15:41' on '11/24/2023'.

The image shows a Windows desktop environment. The primary focus is a Visual Studio Code (VS Code) editor window titled "4cpp - DSA - Visual Studio Code". The editor's interface includes a sidebar on the left with icons for Explorer, Search, and Run and Debug. The main editor area displays a C++ program with a menu-driven interface. The program's output, visible in the TERMINAL pane, shows the execution flow: a menu with options 1-6, user input for choices 3, 6, and 7, and the corresponding operations performed on a list (adding, deleting, and displaying elements). The status bar at the bottom of the VS Code window indicates the current line (Ln 200), column (Col 30), and other details like "Spaces: 4", "UTF-8", "CRLF", and "C++". To the right of the VS Code window, a portion of a Windows taskbar is visible, showing the Start button, a search bar, and several pinned application icons. The system tray on the far right displays the date and time as "19:41 30/08/2022".



The image shows a screenshot of the Visual Studio Code editor interface. The title bar at the top reads "Ex4-PhatPanhareach.txt - DSA - Visual Studio Code". The menu bar includes File, Edit, Selection, View, Go, Run, Terminal, and Help. The Explorer sidebar on the left shows a file named "Ex4-PhatPanhareach.txt" under a "Week 4 Lab 2" folder. The main editor area displays the following code:

```
1 Number: 20  
2 Number: 20  
3
```

The status bar at the bottom indicates "Ln 1, Col 1", "Spaces: 4", "UTF-8", "CRLF", "Plain Text", "Go Live", "No Environment", and "Prettier". The Windows taskbar at the very bottom shows the search bar, taskbar icons, and system tray information including "30°C Partly cloudy", "ENG", "19:42", and "28/10/2022".