

Exercise 1

The screenshot shows the Code::Blocks IDE interface with the following details:

- Title Bar:** Lab4-leapchanvuthy-ex1.cpp - Code::Blocks 20.03
- Menu Bar:** File, Edit, View, Search, Project, Build, Debug, Fortran, wxSmith, Tools, Tools+, Plugins, DoxyBlocks, Settings, Help.
- Toolbar:** Includes icons for file operations (New, Open, Save, Print), search, build, and run.
- Project Explorer:** Management - Resources (Resources folder).
- Code Editor:** Start here - Lab4-leapchanvuthy-ex1.cpp. The code implements a singly linked list with `Element` and `List` structures, and two functions: `createEmptyList()` and `insertBegin()`.
- Output Window:** Shows the execution results of the program. It includes three sections:
 - Insert to the end of the list:
1002
1001
1000
1002
1001
1000
 - Insert to the end of the list:
1002
1001
1000
1002
1001
1000
 - Delete from begin:
1001
1000
1002
1001
1000
10
101
102
103
104
- Status Bar:** C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algor..., C/C++, Windows (CR+LF), WINDOWS-1252, Line 17, Col 18, Pos 251, Insert, Read/Write, default, USA flag.
- Taskbar:** Icons for File Explorer, Task View, Chat, File Explorer, Microsoft Edge, Task View, Visual Studio Code, File Explorer, and Task View.
- System Tray:** Icons for battery, network, volume, and notifications (showing 2 notifications).

Lab4-leapchanvuthy-ex1.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global> createEmptyList() : List

Management Start here Lab4-leapchanvuthy-ex1.cpp

```
34
35     void insertEnd(List *ls, int newData) {
36         Element * e;
37         if(ls->size == 0){
38             insertBegin(ls, newData);
39         }else{
40             e = new Element();
41             e->data = newData;
42             e->next = NULL;
43
44             ls->tail->next = e;
45             ls->tail = e;
46             ls->size++;
47         }
48     }
49
50     void displayData(List *ls) {
51         Element *tmp;
52         tmp = ls->head;
53         while (tmp != NULL)
54         {
55             cout<<" "<<tmp->data<<endl;
56             tmp = tmp->next;
57         }
58     }
59
60     void deleteBegin(List *ls) {
```

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
Process returned 0 (0x0) execution time : 0.063 s
Press any key to continue.

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algor... C/C++ Windows (CR+LF) WINDOWS-1252 Line 15, Col 14, Pos 210 Insert Read/Write default

9:45 PM 10/31/2022 2

Lab4-leapchanvuthy-ex1.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran Tools Tools+ Plugins DoxyBlocks Settings Help

<global> createEmptyList() : List

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp

```
55     cout<<" "<<tmp->data<<endl;
56     tmp = tmp->next;
57 }
58 }

59 void deleteBegin(List *ls){
60     Element *tmp;
61     tmp = ls->head;
62     ls->head = ls->head->next;

63     delete tmp;
64     if(ls->size == 1) ls->tail = NULL;
65     ls->size--;
66 }

67 }

68 }

69 }

70 void deleteLast(List *ls){
71     Element * tmp;
72     int i;
73     if(ls->size == 1){
74         deleteBegin(ls);
75     }
76     else{
77         tmp = ls->head;
78         for ( i = 1; i <= ls->size - 2; i++)
79         {
80             tmp = tmp->next;
81         }
82     }
83 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\..." 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
Process returned 0 (0x0) execution time : 0.063 s
Press any key to continue.

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algor... C/C++ Windows (CR+LF) WINDOWS-1252 Line 15, Col 14, Pos 210 Insert Read/Write default USA 9:45 PM 10/31/2022 2

Lab4-leapchanvuthy-ex1.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global> createEmptyList() : List

Management Start here Lab4-leapchanvuthy-ex1.cpp

```
79     {
80         tmp = tmp->next;
81     }
82     ls->tail = tmp;
83     tmp = tmp->next;
84     ls->tail->next = NULL;
85     delete (tmp);
86     ls->size--;
87 }
88
89
90 void deleteAll(List *ls){
91     if(ls->size <= 0) {
92         cout<<"There is nothing to delete"=<<endl;
93     }
94     while(ls->size > 0){
95         deleteBegin(ls);
96     }
97 }
98
99 int main () {
100
101     List * myList;
102     myList = createEmptyList();
103
104     cout<<"Insert to the end of the list"=<<endl;
105     insertBegin(myList, 1000);
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algor... -> X

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

```
Process returned 0 (0x0) execution time : 0.063 s
Press any key to continue.
```

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algor... C/C++ Windows (CR+LF) WINDOWS-1252 Line 15, Col 14, Pos 210 Insert Read/Write default USA

9:46 PM 10/31/2022 2

Lab4-leapchanvuthy-ex1.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global> createEmptyList() : List

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp

```
97 }
98
99 int main () {
100
101     List * myList;
102     myList = createEmptyList ();
103
104     cout<<"Insert to the end of the list" << endl;
105     insertBegin (myList, 1000);
106     insertBegin (myList, 1001);
107     insertBegin (myList, 1002);
108     insertBegin (myList, 1000);
109     insertBegin (myList, 1001);
110     insertBegin (myList, 1002);
111     displayData (myList);
112
113     cout<<"Insert to the end of the list" << endl;
114     insertEnd (myList, 10);
115     insertEnd (myList, 101);
116     insertEnd (myList, 102);
117     insertEnd (myList, 103);
118     insertEnd (myList, 104);
119     displayData (myList);
120
121     cout<<"Delete from begin" << endl;
122     deleteBegin (myList);
123     displayData (myList);
```

"C:\Users\Leap chanvuthy\Documents\TERM III\..." 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
Process returned 0 (0x0) execution time : 0.063 s
Press any key to continue.

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algor... C/C++ Windows (CR+LF) WINDOWS-1252 Line 15, Col 14, Pos 210 Insert Read/Write default ENG 9:46 PM 10/31/2022 2

Lab4-leapchanvuthy-ex1.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global> createEmptyList() : List

Management Start here Lab4-leapchanvuthy-ex1.cpp

```
108     insertBegin(myList, 1000);
109     insertBegin(myList, 1001);
110     insertBegin(myList, 1002);
111     displayData(myList);

113     cout<<"Insert to the end of the list"=<<endl;
114     insertEnd(myList, 10);
115     insertEnd(myList, 101);
116     insertEnd(myList, 102);
117     insertEnd(myList, 103);
118     insertEnd(myList, 104);
119     displayData(myList);

121     cout<<"Delete from begin"=<<endl;
122     deleteBegin(myList);
123     displayData(myList);

125     cout<<"Delete from last"=<<endl;
126     deleteLast(myList);
127     displayData(myList);

129     cout<<"Delete All"=<<endl;
130     deleteAll(myList);
131     displayData(myList);

133     return 0;
134 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\... 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
Process returned 0 (0x0) execution time : 0.063 s
Press any key to continue.

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algor... C/C++ Windows (CR+LF) WINDOWS-1252 Line 15, Col 14, Pos 210 Insert Read/Write default 9:46 PM 10/31/2022 2

Exercise 2

The screenshot shows the Code::Blocks IDE interface. The main window displays a C++ code editor with the file `Lab4-leapchanvuthy-ex2.cpp`. The code implements a singly linked list with nodes containing integer data. It includes functions to create an empty list and insert a new node at the beginning. A terminal window is open, showing the execution of the program. The user inputs the numbers 1, 2, 3, 5, 0, and -1, which are inserted into the list. The program then prints "Thank you" and "Process returned 0 (0x0) execution time : 16.714 s". The system tray at the bottom right shows the date and time as 10/31/2022 9:55 PM.

```
#include <iostream>
#include <fstream>
using namespace std;

struct Element {
    int data;
    Element *next;
    Element *previous;
};

struct List {
    int size;
    Element * head, *tail;
};

List * createEmptyList() {
    List *ls;
    ls = new List();

    ls->size = 0;
    ls->head = NULL;
    ls->tail = NULL;
}

void insertBegin(List *ls , int newData) {
    Element * e;
    e = new Element();

    e->data = newData;
    e->previous = NULL;
    e->next = ls->head;
    ls->head = e;
}
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm... — □ ×

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: 1 2 3 5 0 -1
1
1
Press [1] To continue: Press [2] To exit: Thank you

Process returned 0 (0x0) execution time : 16.714 s
Press any key to continue.

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default ENG 9:55 PM 10/31/2022 2

Lab4-leapchanvuthy-ex2.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources {}

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp

```
37     if(ls->size != 0){  
38         ls->head->previous = e;  
39     }  
40     ls->head = e;  
41     ls->size ++;  
42 }  
43  
44 void displayFromTail(List *ls){  
45     Element *tmp;  
46     tmp = ls->tail;  
47     while (tmp != NULL)  
48     {  
49         cout<< " " <<tmp->data << endl;  
50         tmp = tmp->previous;  
51     }  
52 }  
53  
54  
55 void saveData (List *ls) {  
56     fstream f;  
57     f.open("Ex1-phatpanhareth.txt", ios::out);  
58     Element *tmp;  
59     tmp = ls->tail;  
60     while (tmp != NULL)  
61     {  
62         f<< " " <<tmp->data << endl;  
63         tmp = tmp->previous;  
64     }  
65  
66     f.close();  
67 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm..." 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: 1 2 3 5 0 -1 1 1 Press [1] To continue: Press [2] To exit: Thank you Process returned 0 (0x0) execution time : 16.714 s Press any key to continue.

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default ENG 9:55 PM 10/31/2022 2

Lab4-leapchanvuthy-ex2.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp

```
65     f.close();
66 }
67 }

68 int main () {
69     List *myList;
70     myList = createEmptyList();
71     int choice, number;
72
73     while (choice != 2)
74     {
75         cout<<"Press [1] To continue: ";
76         cout<<"Press [2] To exit: ";
77         cin>>choice;
78         switch(choice) {
79             case 1:
80                 cout<<"Please input [1, 2, 3, 5, 0, -1] the";
81                 cin>>number;
82                 insertBegin(myList, number);
83                 displayFromTail(myList);
84                 saveData(myList);
85                 break;
86             default:
87                 cout<<"Thank you"<<endl;
88                 break;
89         }
90     }
91
92     return 0;
93 }
94 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm..." —

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: 1 2 3 5 0 -1
1
1
Press [1] To continue: Press [2] To exit: Thank you

Process returned 0 (0x0) execution time : 16.714 s
Press any key to continue.

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default

9:55 PM 10/31/2022 2

Lab4-leapchanvuthy-ex2.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp

```
65     f.close();
66 }
67
68 int main () {
69     List *myList;
70     myList = createEmptyList();
71     int choice, number;
72
73     while (choice != 2)
74     {
75         cout<<"Press [1] To continue: ";
76         cout<<"Press [2] To exit: ";
77         cin>>choice;
78         switch(choice){
79             case 1:
80                 cout<<"Please input [1, 2, 3, 5, 0, -1] the";
81                 cin>>number;
82                 insertBegin(myList, number);
83                 displayFromTail(myList);
84                 saveData(myList);
85                 break;
86             default:
87                 cout<<"Thank you" << endl;
88                 break;
89         }
90     }
91
92     return 0;
93 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm..." -

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: 1 2 3 5 0 -1
1
1
Press [1] To continue: Press [2] To exit: Thank you
Process returned 0 (0x0) execution time : 16.714 s
Press any key to continue.

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

9:55 PM 10/31/2022 2

Exercise 3

The screenshot shows the Code::Blocks IDE interface with the following details:

- Title Bar:** Lab4-leapchanvuthy-ex3.cpp - Code::Blocks 20.03
- Menu Bar:** File, Edit, View, Search, Project, Build, Debug, Fortran, wxSmith, Tools, Tools+, Plugins, DoxyBlocks, Settings, Help
- Toolbar:** Includes icons for file operations (New, Open, Save, Print), search, and various build and debug tools.
- Project Manager:** Shows three files: Lab4-leapchanvuthy-ex1.cpp, Lab4-leapchanvuthy-ex2.cpp, and Lab4-leapchanvuthy-ex3.cpp.
- Code Editor:** Displays the code for Lab4-leapchanvuthy-ex3.cpp. The code defines a `Node` class with `value`, `next`, and `previous` pointers, and two functions: `printforwar` and `printbackward`. The `main` function calls these two functions.
- Output Window:** Shows the output of the program: "Forward Letter is : A B C D E F G H I J K L M N O P P".
- Status Bar:** C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We..., C/C++, Windows (CR+LF), WINDOWS-1252, Line 1, Col 1, Pos 0, Insert, Read/Write, default, USA flag.
- System Tray:** Shows standard Windows icons for network, search, file explorer, task manager, and other system functions. The date and time are 9:59 PM on 10/31/2022.

```
#include<iostream>
using namespace std;

class Node{
public:
    string value;
    Node* next;
    Node* previous;
};

void printforwar(Node*head){
    Node *travelser = head;
    while (travelser != nullptr){
        cout<<travelser->value<<endl;
        travelser = travelser ->next;
    }
}

void printbackward(Node*tail){
    Node *travelser = tail;
    while(travelser != nullptr){
        cout<<travelser->value;
        travelser = travelser ->previous;
    }
}

int main(){
```

Lab4-leapchanvuthy-ex3.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp Lab4-leapchanvuthy-ex3.cpp

```
28
29     Node *head;
30     Node *tail;
31
32     Node* node = new Node();
33     node -> value = "A";
34     node ->next = nullptr;
35     node -> previous = nullptr;
36     head = node;
37     tail = node;
38
39     node = new Node();
40     node -> value = "B";
41     node -> next = nullptr;
42     node -> previous = tail;
43     tail -> next = node;
44     tail = node ;
45
46     node = new Node();
47     node -> value = "C";
48     node -> next = nullptr;
49     node -> previous = tail;
50     tail -> next = node;
51     tail = node ;
52
53     node = new Node();
54     node -> value = "D";
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We..." C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

Forward Letter is :

A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
P

9:59 PM 10/31/2022 2

Lab4-leapchanvuthy-ex3.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp Lab4-leapchanvuthy-ex3.cpp

```
67     node = new Node();
68     node -> value = "F";
69     node -> next = nullptr;
70     node -> previous = tail;
71     tail -> next = node;
72     tail = node;

73     node = new Node();
74     node -> value = "G";
75     node -> next = nullptr;
76     node -> previous = tail;
77     tail -> next = node;
78     tail = node;

79     node = new Node();
80     node -> value = "H";
81     node -> next = nullptr;
82     node -> previous = tail;
83     tail -> next = node;
84     tail = node;

85     node = new Node();
86     node -> value = "I";
87     node -> next = nullptr;
88     node -> previous = tail;
89     tail -> next = node;
90     tail = node;

91     node = new Node();
92     node -> value = "J";
93     node -> next = nullptr;
94     node -> previous = tail;
95     tail -> next = node;
96     tail = node;

97 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We..." C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

Forward Letter is :

A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P

9:59 PM 10/31/2022 2

Lab4-leapchanvuthy-ex3.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management x Resources x Start here x Lab4-leapchanvuthy-ex1.cpp x Lab4-leapchanvuthy-ex2.cpp x Lab4-leapchanvuthy-ex3.cpp x

```
82     node -> value = "H";
83     node -> next = nullptr;
84     node -> previous = tail;
85     tail -> next = node;
86     tail = node ;
87
88     node = new Node();
89     node -> value = "I";
90     node -> next = nullptr;
91     node -> previous = tail;
92     tail -> next = node;
93     tail = node ;
94
95     node = new Node();
96     node -> value = "J";
97     node -> next = nullptr;
98     node -> previous = tail;
99     tail -> next = node;
100    tail = node ;
101
102    node = new Node();
103    node -> value = "K";
104    node -> next = nullptr;
105    node -> previous = tail;
106    tail -> next = node;
107    tail = node ;
108
109    node = new Node();
110    node -> value = "L";
111    node -> next = nullptr;
112    node -> previous = tail;
113    tail -> next = node;
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We..." -

M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z

Backward Letter is :
ZYXWVUTSRQPONMLKJIHGFE
Process returned 0 (0x0) execution time : 0.072 s

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default

9:59 PM 10/31/2022 2

Lab4-leapchanvuthy-ex3.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management x Start here x Lab4-leapchanvuthy-ex1.cpp x Lab4-leapchanvuthy-ex2.cpp x Lab4-leapchanvuthy-ex3.cpp x

```
151     node = new Node();
152     node -> value = "Q";
153     node -> next = nullptr;
154     node -> previous = tail;
155     tail -> next = node;
156     tail = node ;
157
158     node = new Node();
159     node -> value = "R";
160     node -> next = nullptr;
161     node -> previous = tail;
162     tail -> next = node;
163     tail = node ;
164
165     node = new Node();
166     node -> value = "S";
167     node -> next = nullptr;
168     node -> previous = tail;
169     tail -> next = node;
170     tail = node ;
171
172     node = new Node();
173     node -> value = "T";
174     node -> next = nullptr;
175     node -> previous = tail;
176     tail -> next = node;
177     tail = node ;
178
179     node = new Node();
180     node -> value = "U";
181     node -> next = nullptr;
182     node -> previous = tail.
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... -

M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z

Backward Letter is :
ZYXWVUTSRQPONMLKJIHGfedcba
Process returned 0 (0x0) execution time : 0.072 s

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

10:00 PM 10/31/2022 2

Lab4-leapchanvuthy-ex3.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management x Resources x Resources

Start here x Lab4-leapchanvuthy-ex1.cpp x Lab4-leapchanvuthy-ex2.cpp x Lab4-leapchanvuthy-ex3.cpp x

```
201     node -> value = "X";
202     node -> next = nullptr;
203     node -> previous = tail;
204     tail -> next = node;
205     tail = node ;
206
207     node = new Node();
208     node -> value = "Y";
209     node -> next = nullptr;
210     node -> previous = tail;
211     tail -> next = node;
212     tail = node ;
213
214     node = new Node();
215     node -> value = "Z";
216     node -> next = nullptr;
217     node -> previous = tail;
218     tail -> next = node;
219     tail = node ;
220
221     cout <<"Forward Letter is :"<<endl;
222     printforwar(head);
223
224     cout<<"Backward Letter is :"<<endl;
225     printbackward(tail);
226
227
228
229
230 }
231
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... - X

M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z
Backward Letter is :
ZYXWVUTSRQPPONMLKJIHGFE
Process returned 0 (0x0) execution time : 0.072 s

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default

10:00 PM 10/31/2022 2

Exercise 4

The screenshot shows the Code::Blocks IDE interface. On the left, there is a code editor with a file named "Lab4-leapchanvuthy-ex4.cpp". The code defines a linked list structure with elements and operations like insertion at the beginning and search. On the right, a terminal window displays a menu of operations:

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 it appears in the list
6. Display All
7. Exit

Choice: 1
Enter number: 2

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 it appears in the list
6. Display All
7. Exit

Choice: 2
Enter number: 2

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 it appears in the list
6. Display All
7. Exit

Choice: 3
1. Add a number entered by a user to the end of the list

The terminal window has a black background with white text. The menu options are numbered 1 through 7. The user's choice is indicated by "Choice: <number>" followed by the user's input. The terminal window title bar shows the path "C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-Week4...".

Lab4-leapchanvuthy-ex4.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp Lab4-leapch...

```
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 insertEnd(List *ls , int newData) {
45     Element * e;
46     if(ls->size == 0){
47         insertBegin(ls, newData);
48     }else {
49         e = new Element();
50         e->data = newData;
51         e->next = NULL;
52         e->previous = ls->tail;
53
54         ls->tail->next = e;
55         ls->tail = e;
56         ls->size++;
57     }
58 }
59
60 void displayFromHead(List *ls){
61     Element *tmp;
62     tmp = ls->head;

```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-Week4..."

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 it appears in the list
6. Display All
7. Exit
Choice: 4
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 it appears in the list
6. Display All
7. Exit
Choice: 5
What number do you want to search for?: 1
No data found
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 it appears in the list
6. Display All
7. Exit
Choice:

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

10:11 PM 10/31/2022 2

Lab4-leapchanvuthy-ex4.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp Lab4-leapch...

```
64     else cout<<"All data in the list"<<endl;
65     while (tmp != NULL)
66     {
67
68         cout<<" " <<tmp->data<<endl;
69         tmp = tmp->next;
70     }
71
72 }
73
74 void displayFromTail(List *ls){
75     Element *tmp;
76     tmp = ls->tail;
77     while (tmp != NULL)
78     {
79         tmp = tmp->previous;
80     }
81
82 }
83
84
85 void deleteBegin(List *ls){
86     Element *tmp;
87     tmp = ls->head;
88     ls->head = ls->head->next;
89     // ls->head->previous = NULL;
90     // delete tmp;
91     if(ls->size >= 2) {
92         ls->head->previous = NULL;
93     }
94
95     delete tmp;

```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-Week4..."

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 it appears in the list
6. Display All
7. Exit

Choice: 4

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 it appears in the list
6. Display All
7. Exit

Choice: 5

What number do you want to search for?: 1

No data found

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 it appears in the list
6. Display All
7. Exit

Choice: -

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

10:12 PM 10/31/2022 2

Lab4-leapchanvuthy-ex4.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp Lab4-leapch...

```
97     if(ls->size == 1) ls->tail = NULL;
98     ls->size--;
99 }
100
101 void deleteLast(List *ls) {
102     Element * tmp;
103     int i;
104     if(ls->size == 1){
105         deleteBegin(ls);
106     }
107     else{
108         tmp = ls->head;
109         for ( i = 1; i <= ls->size - 2; i++)
110         {
111             tmp = tmp->next;
112         }
113         ls->tail = tmp;
114         tmp = tmp->next;
115         ls->tail->next = NULL;
116         delete(tmp);
117         ls->size--;
118     }
119 }
120
121 void deleteAll(List *ls) {
122     while(ls->size > 0){
123         deleteBegin(ls);
124     }
125 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-Week4..."

```
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 it appears in the list
6. Display All
7. Exit
Choice: 4
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 it appears in the list
6. Display All
7. Exit
Choice: 5
What number do you want to search for?: 1
No data found
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 it appears in the list
6. Display All
7. Exit
Choice: -
```

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

10:12 PM 10/31/2022 2

Lab4-leapchanvuthy-ex4.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp Lab4-leapch...

```
127 }
128
129 void search(List *ls, int newData) {
130     Element *tmp;
131     int counter = 0;
132
133     tmp = ls->head;
134     while (tmp != NULL)
135     {
136         if(tmp->data == newData) counter++;
137         tmp = tmp->next;
138     }
139     if(counter == 0) {
140         cout<<"\n\tNo data found"<<endl;
141     }else{
142         cout<<"\n\tFound data "<<counter<<" times"<<endl;
143     }
144     cout<<"\n";
145 }
146
147
148 void saveData(List *ls) {
149     fstream f1;
150     f1.open ("Ex4-PhatPanhreach.txt", ios::out);
151     Element *tmp;
152     tmp = ls->head;
153     while (tmp != NULL)
154     {
155         f1<<"Number: "<<tmp->data<<endl;
156         tmp = tmp->next;
157     }
158 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-Week4..."

```
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 it appears in the list
6. Display All
7. Exit
Choice: 4
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 it appears in the list
6. Display All
7. Exit
Choice: 5
What number do you want to search for?: 1
No data found

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 it appears in the list
6. Display All
7. Exit
Choice: -
```

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

10:12 PM 10/31/2022 2

Lab4-leapchanvuthy-ex4.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp Lab4-leapchanvuthy-ex4.cpp

```
157     }
158     f1.close();
159 }
160
161 int main() {
162
163     List * ls;
164     ls = createEmptyList();
165     int choice, number;
166     while (choice != 7)
167     {
168         cout<<"1. Add a number entered by a user to the end of the list
169         cout<<"2. Add a number entered by a user to the beginning of the list
170         cout<<"3. Delete the number at the beginning of the list
171         cout<<"4. Delete the number at the end of the list
172         cout<<"5. Search a number in the list. Display how many times it appears in the list
173         cout<<"6. Display All
174         cout<<"7. Exit<<endl;
175         cout<<"Choice: "; cin>>choice;
176
177         switch(choice){
178             case 1:
179                 cout<<"Enter number: "; cin>>number;
180                 insertEnd(ls, number);
181                 saveData(ls);
182                 break;
183             case 2:
184                 cout<<"Enter number: "; cin>>number;
185                 insertEnd(ls, number);
186                 saveData(ls);
187                 break;
188             default:
189                 cout<<"Invalid choice. Please enter a number between 1 and 7."<<endl;
190         }
191     }
192 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-Week4..."

```
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 it appears in the list
6. Display All
7. Exit
Choice: 4
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 it appears in the list
6. Display All
7. Exit
Choice: 5
What number do you want to search for?: 1
No data found

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 it appears in the list
6. Display All
7. Exit
Choice:
```

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

10:12 PM 10/31/2022 2

Lab4-leapchanvuthy-ex4.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global>

Management Resources Resources

Start here Lab4-leapchanvuthy-ex1.cpp Lab4-leapchanvuthy-ex2.cpp Lab4-leapch...

```
182     break;
183 case 2:
184     cout<<"Enter number: "; cin>>number;
185     insertEnd(ls, number);
186     saveData(ls);
187     break;
188 case 3:
189     deleteBegin(ls);
190     saveData(ls);
191     break;
192 case 4:
193     deleteLast(ls);
194     saveData(ls);
195     break;
196 case 5:
197     int searchNumber;
198     cout<<"What number do you want to search for? ";
199     search(ls, searchNumber);
200     break;
201 case 6:
202     displayFromHead(ls);
203     break;
204 default:
205     cout<<"Thank for using our program."<<
206     break;
207 }
208 }
209
210 return 0;
211 }
```

"C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-Week4-..."

```
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 it appears in the list
6. Display All
7. Exit
Choice: 4
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 it appears in the list
6. Display All
7. Exit
Choice: 5
What number do you want to search for?: 1
No data found

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 it appears in the list
6. Display All
7. Exit
Choice:
```

C:\Users\Leap chanvuthy\Documents\TERM III\Advanced Algorithm\kab4-We... C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write default USA

10:12 PM 10/31/2022 2