VIT®

Vellore Institute of Technology

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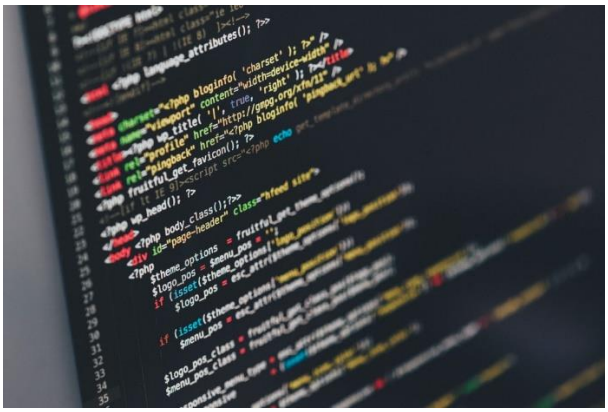
LAB REPORT

CSE2011 – DATA STRUCTURES AND ALGORITHMS LAB



(B.Tech. CSE Specialisation in Bioinformatics)

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VIT – A Place to Learn; A Chance to Grow

QUESTIONS, CODE && OUTPUT

1 . Write a menu driven program to perform following functions in a doubly linked list.

i) Insertion in the beginning of the list

ii) Insertion at the end of the list

iii) Insertion in a particular location of the list

iv) Deletion based on a particular value

v) Display the contents of the list

CODE

```
#include <stdio.h>
#include <iostream>
#include <string.h>

using namespace std;

void display();

struct node{
    int data;
    struct node *next;
    struct node *prev;
}*head,*temp,*newnode;
void insert_at_beg()
{
    int num;
    newnode=new struct node;//DMA in cpp
    cout<<"Enter the number to be inserted"<<endl;
    cin>>num;
    newnode->data=num;
    if(head==NULL)
    {
        newnode->next=NULL;
        newnode->prev=NULL;
        head=temp=newnode;
    }
    else
    {
        temp=head;
        newnode->next=temp;
```

```
        newnode->prev=NULL;
        head=newnode;
    }
}

void insert_at_end()
{
    int num;
    newnode=new struct node;
    cout<<"Enter the number to be inserted"<<endl;
    cin>>num;
    newnode->data=num;
    temp=head;
    while(temp->next!=NULL)
    {
        temp=temp->next;
    }
    newnode->next=NULL;
    temp->next=newnode;
    temp->next->prev=temp;
}

void insert_at_pos()
{
    int count=0,pos,num;
    newnode=new struct node;
    cout<<"Enter the position to be inserted"<<endl;
    cin>>pos;
    cout<<"Enter the number to be inserted"<<endl;
    cin>>num;
    newnode->data=num;
    temp=head;
    while(count!=pos-1)
    {
        temp=temp->next;
        count++;
    }
    newnode->next=temp->next;
    newnode->prev=temp;
    temp->next=newnode;
}
void delete_at_beg()
{
    temp=head;
    head=temp->next;
    delete(temp);
    display();
}
```

```
void delete_at_end()
{
    temp=head;
    while(temp->next!=NULL)
    {
        temp=temp->next;
    }
    temp->prev->next=NULL;
    delete(temp);
    display();
}

void delete_at_pos()
{
    int pos,count,i;
    temp=head;
    cout<<"Enter the position to be deleted"<<endl;
    cin>>pos;
    for(i=0; i<pos && head!=NULL; i++)
    {
        temp = temp->next;
    }
    temp->prev->next = temp-
>next;   // Assign the next pointer of node to be deleted to its previous node
's prev pointer
    temp->next->prev = temp-
>prev;   // Assign the prev pointer of the node to be deleted to its next node
's next pointer
    free(temp);
    display();
}

void delete_at_val()
{
    int val;
    struct node *ptr;
    cout<<"Enter the value to be delted"<<endl;
    cin>>val;
    temp=head;
    while(temp->data!=val)
    {
        temp=temp->next;
    }
    ptr = temp -> next;
    temp -> next = ptr -> next;
    ptr -> next -> prev = temp;
    delete(ptr);
```

```
    display();
}

void display()
{
    struct node* ptr;
    ptr = head;
    while(ptr != NULL) {
    cout<< ptr->data <<" ";
    ptr = ptr->next;
   }
   cout<<endl;
}


int main()
{
    cout<<"*****Doubly Linked List*****"<<endl;
    int choice;
    int head=0;
    while(choice!=9)
    {
        cout<<"The operations that can be done"<<endl;
        cout<<"1.Insert At Begining\n2.Insert At End\n3.Insert At any Position
\n4.Deletion at Begining\n5.Deletion at End\n6.Deletion at a Position\n7.Delet
ion based on Value\n8.Display\n9.Exit"<<endl;
        cout<<"Please enter your choice"<<endl;
        cin>>choice;
        switch (choice)
        {
        case 1:
            insert_at_beg();
            break;
        case 2:
            insert_at_end();
            break;
        case 3:
            insert_at_pos();
            break;
        case 4:
            delete_at_beg();
            break;
        case 5:
            delete_at_end();
            break;
        case 6:
            delete_at_pos();
            break;
        case 7:
```

```
            delete_at_val();
            break;
        case 8:
            display();
            break;
        case 9:
            cout<<"Exiting"<<endl;
            break;
        default:
            cout<<"Invalid Input"<<endl;
            break;
        }
    }
    return 1;
}
```

OUTPUT

```
PS E:\VIT Semester\Winter Semester 2020\DSA\Lab\Module 2\Assig
 ; if ($?) { g++ doublyLinkedList.cpp -o doublyLinkedList } ;
*****Doubly Linked List*****
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
1
Enter the number to be inserted
7
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
2
Enter the number to be inserted
9
```

```
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
8
7 9
```

```
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
2
Enter the number to be inserted
11
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
2
Enter the number to be inserted
13
```

```
 The operations that can be done
 1.Insert At Begining
 2.Insert At End
 3.Insert At any Position
 4.Deletion at Begining
 5.Deletion at End
 6.Deletion at a Position
 7.Deletion based on Value
 8.Display
 9.Exit
 Please enter your choice
 8
 7 9 11 13
```

```
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
3
Enter the position to be inserted
2
Enter the number to be inserted
78
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
8
7 78 9 11 13
```

```
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
4
78 9 11 13
The operations that can be done
1.Insert At Begining
2.Insert At End
3.Insert At any Position
4.Deletion at Begining
5.Deletion at End
6.Deletion at a Position
7.Deletion based on Value
8.Display
9.Exit
Please enter your choice
5
78 9 11
```

2. Write a menu driven program to perform following functions in a circularly singly linked list.

i) Insertion in the beginning of the list

ii) Insertion at the end of the list

iii) Deletion from the beginning of the list

iv) Deletion from the end of the list.

CODE

```
#include <stdio.h>
#include <iostream>
#include <string.h>

using namespace std;

void display();

struct node{
    int data;
    struct node *next;
}*temp,*head,*newnode;

void insert_at_beg()
{
    int num;
    newnode=new struct node;
    cout<<"Enter the number to be inserted"<<endl;
    cin>>num;
    newnode->data=num;
    if(head==NULL)
    {
        head=temp=newnode;
        temp->next=head;
    }
    else
    {
        temp=head;
        newnode->next=temp;
        head=newnode;
    }
}

void insert_at_end()
```

```
{
    int num;
    newnode=new struct node;
    cout<<"Enter the number to be inserted"<<endl;
    cin>>num;
    newnode->data=num;
    temp=head;
    while(temp->next!=head)
    {
        temp=temp->next;
    }
    newnode->next=head;
    temp->next=newnode;
}


void del_at_begin()
{
     struct node *ptr;
    if(head == NULL)
    {
        printf("\nUNDERFLOW");
    }
    else if(head->next == head)
    {
        head = NULL;
        free(head);
        printf("\nnode deleted\n");
    }
    else
    {   ptr = head;
        while(ptr -> next != head)
            ptr = ptr -> next;
        ptr->next = head->next;
        free(head);
        head = ptr->next;
        printf("\nnode deleted\n");

    }
    display();
}

void del_at_end()
{
    struct node *ptr, *preptr;
    if(head==NULL)
    {
        printf("\nUNDERFLOW");
```

```
    }
    else if (head ->next == head)
    {
        head = NULL;
        free(head);
        printf("\nnode deleted\n");

    }
    else
    {
        ptr = head;
        while(ptr ->next != head)
        {
            preptr=ptr;
            ptr = ptr->next;
        }
        preptr->next = ptr -> next;
        free(ptr);
        printf("\nnode deleted\n");

    }
    display();
}


void display()
{
      struct node *ptr;
    ptr=head;
    if(head == NULL)
    {
        printf("\nnothing to print");
    }
    else
    {
        printf("Printing values ... \n");

        while(ptr -> next != head)
        {

            printf("%d\n", ptr -> data);
            ptr = ptr -> next;
        }
        printf("%d ", ptr -> data);
    }
}


int main()
```

```
{
    int choice;
    head=NULL;
    cout<<"***Circularly Singly Linked List***"<<endl;
    while(choice!=6)
    {
        cout<<"Please choose one of the following options"<<endl;
        cout<<"1.Insert at beginning\n2.Insert at end\n3.Delete at beginning\n
4.Delete at End\n5.Display\n6.Exit"<<endl;
        cin>>choice;
        switch (choice)
        {
        case 1:
            insert_at_beg();
            break;
        case 2:
            insert_at_end();
            break;
        case 5:
            display();
            break;
        case 6:
            cout<<"Exiting..."<<endl;
        default:
            cout<<"Invalid Input"<<endl;
            break;
        }
    }
    return 1;
}
```

OUTPUT

```
PS E:\VIT Semester\Winter Semester 2020\DSA\Lab\Module 2\
 ; if ($?) { g++ circularlySinglyLinkedList.cpp -o circul
***Circularly Singly Linked List***
Please choose one of the following options
1.Insert at beginning
2.Insert at end
3.Delete at beginning
4.Delete at End
5.Display
6.Exit
1
Enter the number to be inserted
4
Please choose one of the following options
1.Insert at beginning
2.Insert at end
3.Delete at beginning
4.Delete at End
5.Display
6.Exit
2
Enter the number to be inserted
6
Please choose one of the following options
1.Insert at beginning
2.Insert at end
3.Delete at beginning
4.Delete at End
5.Display
6.Exit
2
Enter the number to be inserted
7
```

```
Please choose one of the following options
1.Insert at beginning
2.Insert at end
3.Delete at beginning
4.Delete at End
5.Display
6.Exit
5
Printing values ...
4
6
7
```

```
Please choose one of the following options
1.Insert at beginning
2.Insert at end
3.Delete at beginning
4.Delete at End
5.Display
6.Exit
3

node deleted
Printing values ...
6
7
Please choose one of the following options
1.Insert at beginning
2.Insert at end
3.Delete at beginning
4.Delete at End
5.Display
6.Exit
4

node deleted
Printing values ...
6
```

3. Create linked list to enroll the students who wish to participate for a gaming event by taking details like Name, Register No., Age, Phone number. Ensure that no more than five members are there in the list with same age. Perform insertion(), deletion() and display() operations on the Linked List.

CODE

```
#include <stdio.h>
#include <iostream>
#include <string.h>

using namespace std;

struct node{
    char name[50];
    int reg_no;
    int age;
    int phone;
    struct node *next;
}*head,*temp,*newnode;

int counter(int );

void insert()
{
    newnode= new struct node;
    cout<<"Enter the name of participant : ";
    cin>>newnode->name;
    cout<<"\n";
    cout<<"Enter the reg no of participant : ";
    cin>>newnode->reg_no;
    cout<<"\n";
    cout<<"Enter ur age : ";
    cin>>newnode->age;
    int c=counter(newnode->age);
    cout<<"\n";
    cout<<"Enter ur phone number : ";
    cin>>newnode->phone;
    if(head==NULL)
    {
        newnode->next=NULL;
        temp=head=newnode;
    }
    else
    {
        if(c<=4)
        {
            temp=head;
```

```
            while(temp->next!=NULL)
            {
                temp=temp->next;
            }
            newnode->next=NULL;
            temp->next=newnode;
        }
        else
        {
            cout<<"More than 5 members of same age.Sorry!"<<endl;
        }
    }
}

void del()
{
    if (head == NULL)
    {
        printf("Underflow");
    }
    else
    {
        temp=head;
        head = head->next;
        delete(temp);
    }
}
void display()
{
    struct node *r;
    int c = 0;
    r = head;
    while (r != NULL)
    {
        c++;
        cout<<r->name<<" "<<r->age<<" "<<r->reg_no<<" "<<r->phone;
        r = r->next;
    }
    printf("\n");
}

int counter(int a)
{
    struct node *s;
    s=head;
    int count=0;
    while(s!=NULL)
    {
```

```
        if(s->age==a)
        {
            count++;
        }
        else
        {
            continue;
        }
        s=s->next;
    }
    return count;
}


int main()
{
    int choice;
    cout<<"**Game Event**"<<endl;
    head=0;
    while(choice!=4)
    {
        cout<<"Pls enter your choice"<<endl;
        cout<<"1.Register for the event\n2.Delete\n3.Display all participants\
n4.Exit"<<endl;
        cin>>choice;
        switch (choice)
        {
        case 1:
            insert();
            break;
        case 2:
            del();
            break;
        case 3:
            display();
            break;
        case 4:
            cout<<"Exiting......"<<endl;
            break;
        default:
            break;
        }
    }
    return 1;
}
```

OUTPUT

```
PS E:\VIT Semester\Winter Semester 2020\DSA\Lab
 ; if ($?) { g++ Q3.cpp -o Q3 } ; if ($?) { .\Q
**Game Event**
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
1
Enter the name of participant : a

Enter the reg no of participant : 69

Enter ur age : 18

Enter ur phone number : 879
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
1
Enter the name of participant : b

Enter the reg no of participant : 70

Enter ur age : 18
```

```
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
1
Enter the name of participant : c

Enter the reg no of participant : 71

Enter ur age : 18

Enter ur phone number : 7
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
1
Enter the name of participant : d

Enter the reg no of participant : 72

Enter ur age : 18

Enter ur phone number : 7888
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
1
Enter the name of participant : e

Enter the reg no of participant : 73

Enter ur age : 18

Enter ur phone number : 98
```

```
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
1
Enter the name of participant : f

Enter the reg no of participant : 74

Enter ur age : 18

Enter ur phone number : 8777
More than 5 members of same age.Sorry!
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
3
a 18 69 879b 18 70 45454c 18 71 7d 18 72 7888e 18 73 98
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
2
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
3
b 18 70 45454c 18 71 7d 18 72 7888e 18 73 98
```

```
Pls enter your choice
1.Register for the event
2.Delete
3.Display all participants
4.Exit
4
Exiting......
```

4. Write a Program to create Queue of Patients waiting to see the Physician in a clinic. Insert Patient details one by one into the Patient Queue in its appropriate position based on the Age, irrespective of their arrival time. Patients should be allowed in the order from the oldest to the youngest.

CODE

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <iostream>

using namespace std;

struct node
{
    int age;
    char name[20];
    char disease[30];
    char doctor_assigned[30];
    struct node *next;
} *head = NULL;

int choice;
void enqueue();
void dequeue();
void display();


void enqueue()
{
    struct node *temp;
    temp = (struct node *)malloc(sizeof(struct node));
    cout<<"Enter patient's name: ";
    cin>>temp->name;
    cout<<"Enter patient's age: ";
    cin>>temp->age;
    cout<<"Enter disease of patient: ";
    cin>>temp->disease;
    cout<<"Enter doctor assigned to patient: ";
    cin>>temp->doctor_assigned;
    if (head == NULL)
    {
        head = temp;
        head->next = NULL;
    }
    else if (head->next == NULL)
    {
```

```
        if (head->age > temp->age)
        {
            head->next = temp;
            temp->next = NULL;
        }
        else
        {
            temp->next = head;
            head = temp;
        }
    }
    else
    {
        struct node *r;
        r = head;
        while (r->next != NULL)
        {
            if (r->next->age > temp->age)
            {
                r = r->next;
            }
            else
            {
                break;
            }
        }
        if (r == head)
        {
            temp->next = head;
            head = temp;
        }
        else
        {
            temp->next = r->next;
            r->next = temp;
        }
    }
}
void dequeue ()
{
    struct node *ptr;
    if(head == NULL)
    {
        printf("\nUNDERFLOW\n");
        return;
    }
    else
    {
```

```
        ptr = head;
        head = head -> next;
        free(ptr);
    }
}
void display()
{
    int c = 0;
    struct node *r;
    r = head;
    while (r != NULL)
    {
        c++;
        printf("%d.%s(%d) , Disease: %s , Doctor Assigned: %s  \n", c, r-
>name, r->age,r->disease,r->doctor_assigned);
        r = r->next;
    }
}



int main()
{
    while (choice != 4)
    {
        printf("\n1.Insert a patient\n");
        printf("2.Discharge Patient \n");
        printf("3.Display\n");
        printf("4.Exit\n");
        printf("Enter choice: ");
        scanf("%d", &choice);
        switch (choice)
        {
        case 1:
            enqueue();
            break;
        case 2:
            dequeue();
            break;
        case 3:
            display();
            break;
        case 4:
            printf("Exiting..\n");
            break;
        default:
            printf("Invalid input\n");
        };
    }
```

```
    return 1;
}
```

OUTPUT

```
PS E:\VIT Semester\Winter Semester 2020\DSA\Lab\Mo
 ; if ($?) { g++ Q4.cpp -o Q4 } ; if ($?) { .\Q4 }

1.Insert a patient
2.Discharge Patient
3.Display
4.Exit
Enter choice: 1
Enter patient's name: Alok
Enter patient's age: 19
Enter disease of patient: Fever
Enter doctor assigned to patient: A

1.Insert a patient
2.Discharge Patient
3.Display
4.Exit
Enter choice: 1
Enter patient's name: Ruchi
Enter patient's age: 50
Enter disease of patient: Headache
Enter doctor assigned to patient: B

1.Insert a patient
2.Discharge Patient
3.Display
4.Exit
Enter choice: 1
Enter patient's name: Brijesh
Enter patient's age: 52
Enter disease of patient: Fracture
Enter doctor assigned to patient: C
```

```
1.Insert a patient
2.Discharge Patient
3.Display
4.Exit
Enter choice: 1
Enter patient's name: Akshay
Enter patient's age: 24
Enter disease of patient: Fever
Enter doctor assigned to patient: D

1.Insert a patient
2.Discharge Patient
3.Display
4.Exit
Enter choice: 3
1.Brijesh(52) , Disease: Fracture , Doctor Assigned: C
2.Ruchi(50) , Disease: Headache , Doctor Assigned: B
3.Akshay(24) , Disease: Fever , Doctor Assigned: D
4.Alok(19) , Disease: Fever , Doctor Assigned: A
```

```
1.Insert a patient
2.Discharge Patient
3.Display
4.Exit
Enter choice: 2

1.Insert a patient
2.Discharge Patient
3.Display
4.Exit
Enter choice: 3
1.Ruchi(50) , Disease: Headache , Doctor Assigned: B
2.Akshay(24) , Disease: Fever , Doctor Assigned: D
3.Alok(19) , Disease: Fever , Doctor Assigned: A
```

5. Write the recursive code for the following

i)Linear Search

CODE

```
#include <stdio.h>
#include <iostream>
#include <string.h>

using namespace std;

int linear_search(int s,int arr[],int index)
{
    if(s<=-1)
    {
        return -1;
    }
    else if(arr[index]==s)
    {
        return 1;
    }
    else
    {
        return linear_search(s,arr,index+1);
    }
}

int main()
{
    int i,n;
    cout<<"The number of elements in arrray"<<endl;
    cin>>n;
    int arr[10];
    for(i=0;i<n;i++)
    {
        cin>>arr[i];
    }
    int search;
    cout<<"Enter the number to be searched"<<endl;
    cin>>search;
    int a=linear_search(search,arr,0);
    if(a==1)
    {
        printf("Element is found");
    }
    else
    {
```

```
        printf("Element is not found");
    }
    return 1;
}
```

OUTPUT

```
PS E:\VIT Semester\Winter Semester 2020\DSA\Lab\Module 2\Assignment\Assigr
 ; if ($?) { g++ recursiveLinearSearch.cpp -o recursiveLinearSearch } ; if
The number of elements in arrray
4
1
7
8
9
Enter the number to be searched
7
Element is found
```

ii) Binary Search

CODE

```
#include <stdio.h>
#include <iostream>
#include <string.h>

using namespace std;
void BinarySearch(int arr[],int num,int first,int last){

   int mid;

   if(first > last){

        printf("Number is not found");

   } else {

      /* Calculate mid element */
      mid = (first + last)/2;

      /* If mid is equal to number we are searching */

      if(arr[mid]==num){

            printf("Element is found at index %d ",mid);
            exit(0);

        }else if(arr[mid] > num){

            BinarySearch(arr, num, first, mid-1);

        }else{

            BinarySearch(arr, num, mid+1, last);
        }
    }
}


main(){

   int arr[100],beg,mid,end,i,n,num;

   printf("Enter the size of an array ");
   scanf("%d",&n);
```

```
    printf("Enter the values in sorted sequence \n");

    for(i=0;i<n;i++)
    {
        scanf("%d",&arr[i]);
    }


    beg=0;
    end=n-1;

    printf("Enter a value to be search: ");
    scanf("%d",&num);

    BinarySearch(arr,num,beg,end);

}
```

OUTPUT

```
PS E:\VIT Semester\Winter Semester 2020\DSA\Lab\Module 2\As
 ; if ($?) { g++ recursiveBinarysearch.cpp -o recursiveBina
Enter the size of an array 6
Enter the values in sorted sequence
1
2
3
4
5
7
Enter a value to be search: 2
Element is found at index 1
```