EXPERIMENT: 1

A) Declare a calendar as an array of 7 elements (A dynamically Created array) to represent 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String).

PROGRAM CODE:

```
#include <stdio.h>
#include <string.h>
// Define a structure to represent a day
struct Day {
    char name[20];
    int date;
    char activity[100];
};
int main() {
    // Declare an array of 7 elements to represent the calendar
    struct Day calendar[7];
   // Initialize the calendar with sample data
    strcpy(calendar[0].name, "Monday");
    calendar[0].date = 1;
    strcpy(calendar[0].activity, "Work from 9 AM to 5 PM");

    strcpy(calendar[1].name, "Tuesday");
    calendar[1].date = 2;
   strcpy(calendar[1].activity, "Meeting at 10 AM");

    strcpy(calendar[2].name, "Wednesday");
    calendar[2].date = 3;
```

```
    strcpy(calendar[2].activity, "Gym at 6 PM");
    strcpy(calendar[3].name, "Thursday");
    calendar[3].date = 4;
    strcpy(calendar[3].activity, "Dinner with friends at 7 PM");

    strcpy(calendar[4].name, "Friday");
    calendar[4].date = 5;
    strcpy(calendar[4].activity, "Movie night at 8 PM");

    strcpy(calendar[5].name, "Saturday");
    calendar[5].date = 6;
    strcpy(calendar[5].activity, "Weekend getaway");

    strcpy(calendar[6].name, "Sunday");
    calendar[6].date = 7;
    strcpy(calendar[6].activity, "Relax and recharge");

    // Print the calendar
    printf("Calendar for the week:\n");
    for (int i = 0; i < 7; i++) {
        printf("%s (Date: %d): %s\n", calendar[i].name, calendar[i].date, calendar[i].activity);
    }

    return 0;
}
```

SAMPLE OUTPUT 1:

Calendar for the week:

Monday (Date: 1): Work from 9 AM to 5 PM
Tuesday (Date: 2): Meeting at 10 AM

Wednesday (Date: 3): Gym at 6 PM

Thursday (Date: 4): Dinner with friends at 7 PM

Friday (Date: 5): Movie night at 8 PM

Saturday (Date: 6): Weekend getaway

Sunday (Date: 7): Relax and recharge

B) Write functions create(), read() and display(); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.

PROGRAM CODE

```
#include <stdio.h>
#include <string.h>
// Define a structure to represent a day
struct Day {
    char name[20];
    int date;
    char activity[100];
};

// Function to create the calendar
void create(struct Day calendar[7]) {
    for (int i = 0; i < 7; i++) {
        printf("Enter details for %s:\n", calendar[i].name);
        printf("Date: ");
        scanf("%d", &calendar[i].date);
        printf("Activity: ");
        scanf(" %[^\n]", calendar[i].activity);
    }
}
```

```
// Function to read data from the keyboard
void read(struct Day calendar[7]) {
    FILE *file = fopen("calendar.txt", "r");
    if (file == NULL) {
        printf("Error opening the file.\n");
        return;
    }

    for (int i = 0; i < 7; i++) {
        fscanf(file, "%d", &calendar[i].date);
        fscanf(file, " %[^\n]", calendar[i].activity);
    }

    fclose(file);
}

// Function to display the calendar
void display(struct Day calendar[7]) {
    printf("Calendar for the week:\n");
    for (int i = 0; i < 7; i++) {
        printf("%s (Date: %d): %s\n", calendar[i].name, calendar[i].date, calendar[i].activity);
    }
}

int main()
{
    struct Day calendar[7];
```

```
// Initialize the names of the days
strcpy(calendar[0].name, "Monday");
strcpy(calendar[1].name, "Tuesday");
strcpy(calendar[2].name, "Wednesday");
strcpy(calendar[3].name, "Thursday");
strcpy(calendar[4].name, "Friday");
strcpy(calendar[5].name, "Saturday");
strcpy(calendar[6].name, "Sunday");
int choice;
printf("1. Create Calendar\n");
printf("2. Read Calendar from File\n");
printf("Enter your choice: ");
scanf("%d", &choice);
switch (choice) {
    case 1:
        create(calendar);
        break;
    case 2:
        read(calendar);
        break;
    default:
        printf("Invalid choice.\n");
        return 1;
}
```

```
    display(calendar);


    return 0;
}
```

SAMPLE OUTPUT 1:

1. Create Calendar

2. Read Calendar from File

Enter your choice: 1

Enter details for Monday:

Date: 07/01/2001

Activity: Enter details for Tuesday:

Date: JAVA

Activity: Enter details for Wednesday:

Date: PYTHON

Activity: Enter details for Thursday:

Date: C/C++

Activity: Enter details for Friday:

Date: GAMING

Activity: Enter details for Saturday:

Date: APTITUDE

Activity: Enter details for Sunday:

Date: GENERAL KNOWLEDGE

Activity: Calendar for the week:

Monday (Date: 7): /01/2001

Tuesday (Date: 1417934205): JAVA

Wednesday (Date: 32543): PYTHON

Thursday (Date: 0): C/C++

Friday (Date: 0): GAMING

Saturday (Date: 832): APTITUDE

Sunday (Date: 0): GENERAL KNOWLEDGE

EXPIREMENT:2

2. Design, Develop and Implement a Program in C for the following operations on Strings a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR. Support the program with functions for each of the above operations. Don't use Built-in functions.

ABOUT THE EXPERIMENT:

Strings are actually one-dimensional array of characters terminated by a null character '\0'. Thus a null-terminated string contains the characters that comprise the string followed by a null.

The following declaration and initialization create a string consisting of the word "Hello". To hold the null character at the end of the array, the size of the character array containing the string is one more than the number of characters in the word "Hello." char greeting[6] = {'H', 'e', 'l', 'l', 'o', '\0'}; If you follow the rule of array initialization then you can write the above statement as follows: char greeting[] = "Hello"; C language supports a wide range of built-in functions that manipulate null-terminated.strings as follows:

strcpy(s1, s2); Copies string s2 into string s1.

strcat(s1, s2); Concatenates string s2 onto the end of string s1.

strlen(s1); Returns the length of string s1.

strcmp(s1, s2); Returns 0 if s1 and s2 are the same; less than 0 if s1s2.

strchr(s1, ch); Returns a pointer to the first occurrence of character ch in string s1.

strstr(s1, s2); Returns a pointer to the first occurrence of string s2 in string s1.

ALGORITHM:

Step 1: Start.

ALGORITHM:

Step 1: Start.
Step 2: Read main string STR, pattern string PAT and replace string REP.

Step 3: Search / find the pattern string PAT in the main string STR.

Step 4: if PAT is found then replace all occurrences of PAT in main string STR with REP string.

Step 5: if PAT is not found give a suitable error message.

Step 6: Stop.

PROGRAM CODE:

```
#include<stdio.h>

void main()

{

char STR[100],PAT[100],REP[100],ans[100];

int i,j,c,m,k,flag=0;

printf("\nEnter the MAIN string: \n"); gets(STR);

printf("\nEnter a PATTERN string: \n"); gets(PAT);

printf("\nEnter a REPLACE string: \n"); gets(REP);

i = m = c = j = 0; while ( STR[c] != '\0') {

// Checking for Match

if ( STR[m]==PAT[i])

 {
 i++; m++;

flag=1;

if ( PAT[i] == '\0')

{

//copy replace string in ans string

for(k=0; REP[k] != '\0';k++,j++)

ans[j] = REP[k];

i=0;

c=m;

}
```

```
}
else //mismatch
{
ans[j] = STR[c];
j++; c++;
m = c; i=0;
}
}
if(flag==0)
{
printf("Pattern doesn't found!!!");
}
else
{
ans[j] = '\0';
printf("\nThe RESULTANT string is:%s\n" ,ans);
}
}
```

SAMPLE OUTPUT 1:

Enter the MAIN string: good morning

Enter a PATTERN string: morning

Enter a REPLACE string: evening

+The RESULTANT string is: good evening

SAMPLE OUTPUT 2:

Enter the MAIN string: hi vcet

Enter a PATTERN string: bye

Enter a REPLACE string: hello

Pattern doesn’t found!!

EXPIREMENT :3

3) Develop a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)

a. Push an Element on to Stack

b. Pop an Element from Stack

c. Demonstrate how Stack can be used to check Palindrome

d. Demonstrate Overflow and Underflow situations on Stack

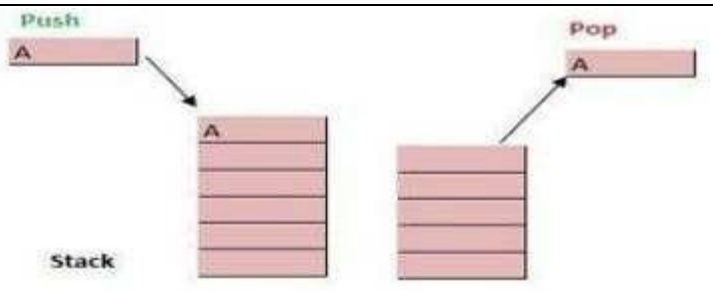
e. Display the status of Stack

f. Exit

Support the program with appropriate functions for each of the above operations.

ABOUT THE EXPERIMENT:

A stack is an abstract data type (ADT), commonly used in most programming languages. It is named stack as it behaves like a real-world stack. A real-world stack allows operations at one end only. For example, we can place or remove a card or plate from top of the stack only. Likewise, Stack ADT allows all data operations at one end only. At any given time, we can only access the top element of a stack. This feature makes it LIFO data structure. LIFO stands for Last-in-first-out. Here, the element which is placed (inserted or added) last is accessed first. In stack terminology, insertion operation is called PUSH operation and removal operation is called POP operation. A stack can be implemented by means of Array, Structure, Pointer and Linked-List. Stack can either be a fixed size one or it may have a sense of dynamic resizing. Here, we are going to implement stack using arrays which makes it a fixed size stack implementation.



Basic Operations:

• push() - pushing (storing) an element on the stack.

• pop() -removing (accessing) an element from the stack. To use a stack efficiently we need to check status of stack as well. For the same purpose, the following functionality is added to stacks;

• peek() − get the top data element of the stack, without removing it.

• isFull() − check if stack is full.

• isEmpty() − check if stack is empty.

ALGORITHM:

Step 1: Start.

Step 2: Initialize stack size MAX and top of stack -1.

Step 3: Push integer element on to stack and display the contents of the stack. if stack is full give a message as „Stack is Overflow".

Step 4: Pop element from stack along with display the stack contents. if stack is empty give a message as „Stack is Underflow".

Step 5: Check whether the stack contents are Palindrome or not.

Step 6: Stop

PROGRAM CODE

```
#include<stdlib.h>

#include<stdio.h>

#include<string.h>

#define max_size 5

int stack[max_size],top=-1,flag=1;
```

```
int i,temp,item,rev[max_size],num[max_size];
void push();
void pop();
void display();
void pali();
int main()
{
int choice;
printf("\n\n--------STACK OPERATIONS ------ \n");
printf("1.Push\n");
printf("2.Pop\n"); printf("3.Palindrome\n"); printf("4.Display\n"); printf("5.Exit\n");
printf(" ");
while(1)
{
printf("\nEnter your choice:\t");
scanf("%d",&choice);
switch(choice)
{
case 1: push();break;
case 2: pop();
if(flag)
printf("\nThe poped element: %d\t",item);
temp=top; break;
case 3: pali();
top=temp; break;
case 4: display(); break;
case 5: exit(0); break;
default: printf("\nInvalid choice:\n"); break;
}
```

```
}
//return 0;
}
void push() //Inserting element into the stack
{
if(top==(max_size-1))
{
printf("\nStack Overflow:");
}
else
{
printf("Enter the element to be inserted:\t");
scanf("%d",&item);
top=top+1;
stack[top]=item;
}
temp=top;
}
void pop() //deleting an element from the stack
{
if(top==-1)
{
printf("Stack Underflow:");
flag=0;
}
else
{
item=stack[top];
top=top-1;
```

```
}
}
void pali()
{ i=0;
if(top==-1)
{
printf("Push some elements into the stack first\n");
}
else
{
while(top!=-1)
{
rev[top]=stack[top]; pop();
}
top=temp; for(i=0;i<=temp;i++)
{
if(stack[top--]==rev[i])
{
if(i==temp)
{
printf("Palindrome\n"); return;
}
}
}
printf("Not Palindrome\n");
}
}
void display()
{
```

```
int i; top=temp;
if(top==-1)
{
printf("\nStack is Empty:");
}
else
{
printf("\nThe stack elements are:\n" );
for(i=top;i>=0;i--)
{
printf("%d\n",stack[i]);
}
}
}
```

SAMPLE OUTPUT 1:

```
linux:~/dslab # gedit stack.c linux:~/dslab # cc stack.c
 --------STACK OPERATIONS-----------
1.Push
2.Pop
3.Palindrome
4.Display
5.Exit
 -------------------------
 Enter your choice: 1
Enter the element to be inserted: 1
Enter your choice: 1
Enter the element to be inserted: 2
Enter your choice: 1
Enter the element to be inserted: 1
```

Enter your choice: 1

Enter the element to be inserted: 5

Enter your choice: 2

The poped element: 5

Enter your choice: 4

The stack elements are: 1 2 1

Enter your choice: 3

Numbers= 1 Numbers= 2 Numbers= 1 reverse operation : reverse array : 1 2 1 check for palindrome : It is palindrome number

Enter your choice: 5

Exit

SAMPLE OUTPUT 2:

--------STACK OPERATIONS----------

1. Push

2.Pop

3.Palindrome

4.Display

5.Exit

Enter your choice: 1

Enter the element to be inserted: 10

Enter your choice: 1

Enter the element to be inserted: 20

Enter your choice: 1

Enter the element to be inserted: 10

Enter your choice: 1

Enter the element to be inserted: 50

Enter your choice: 2

The poped element: 50

Enter your choice: 4

The stack elements are: 10 20 10 Enter your choice: 3 Numbers= 1 Numbers= 2 Numbers= 1 reverse operation : reverse array : 1 2 1 check for palindrome : It is palindrome number

Enter your choice: 5

Exit

EXPIREMENT: 4

4) Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.

ABOUT THE EXPERIMENT:

Infix: Operators are written in-between their operands. Ex: X + Y Prefix: Operators are written before their operands. Ex: +X Y Postfix: Operators are written after their operands. Ex: XY+

Examples of Infix, Prefix, and Postfix

Infix Expression	Prefix Expression	Postfix Expression
A + B	+ A B	A B +
A + B * C	+ A * B C	ABC*+

Expression	Stack	Output	Comment
5^E+D*(C^B+A)	Empty	-	Initial
^E+D*(C^B+A)	Empty	5	Print
E+D*(C^B+A)	^	5	Push
+D*(C^B+A)	^	5E	Push
D*(C^B+A)	+	5E^	Pop And Push
*(C^B+A)	+	5E^D	Print
(C^B+A)	+*	5E^D	Push
C^B+A)	+*(	5E^D	Push
^B+A)	+*(	5E^DC	Print
B+A)	+*(^	5E^DC	Push
+A)	+*(^	5E^DCB	Print
A)	+*(+	5E^DCB^	Pop And Push
)	+*(+	5E^DCB^A	Print
End	+*	5E^DCB^A+	Pop Until '('
End	Empty	5E^DCB^A+*+	Pop Every element

Infix to prefix conversion Expression = (A+B^C)*D+E^5

Step 1. Reverse the infix expression.

5^E+D*)C^B+A(

Step 2. Make Every '(' as ')' and every ')' as '('

5^E+D*(C^B+A)

Step 3. Convert expression to postfix form.

Step 4. Reverse the expression.

+*+A^BCD^E

Step 5. Result

+*+A^BCD^E5

ALGORITHM:

Step 1: Start.

Step 2: Read an infix expression with parenthesis and without parenthesis.

Step 3: convert the infix expression to postfix expression.

Step 4: Stop

PROGRAM CODE:

```
#define SIZE 50 /* Size of Stack */
#include <ctype.h>
#include <stdio.h>
char s[SIZE];
int top = -1; /* Global declarations */
push(char elem) /* Function for PUSH operation */
{
s[++top] = elem;
}
char pop() /* Function for POP operation */
{
return (s[top--]);
}
int pr(char elem) /* Function for precedence */
{
switch (elem)
{
case '#': return 0;
case '(': return 1;
case '+':
case '-': return 2;
case '*': case '/':
case '%': return 3;
case '^': return 4;
}
}
void main() /* Main Program */
{
char infx[50], pofx[50], ch, elem;
int i = 0, k = 0;
```

```
printf("\n\nRead the Infix Expression ? ");
scanf("%s", infx);
push('#');
while ((ch = infx[i++]) != '\0')
{
if (ch == '(') push(ch);
else if (isalnum(ch))
pofx[k++] = ch;
else if (ch == ')')
{
while (s[top] != '(')
pofx[k++] = pop();
elem = pop(); /* Remove ( */
}
else /* Operator */
{
while (pr(s[top]) >= pr(ch))
pofx[k++] = pop();
push(ch);
}
}
while (s[top] != '#') /* Pop from stack till empty */
pofx[k++] = pop();
pofx[k] = '\0'; /* Make pofx as valid string */
printf("\n\nGiven Infix Expn: %s Postfix Expn: %s\n", infx, pofx);
}
```

SAMPLE OUTPUT 1:

Read the Infix Expression (a+b)*c/d^5%1

Given Infix Expn: (a+b)*c/d^5%1

Postfix Expn: ab+c*d5^/1%

SAMPLE OUTPUT 2:

Read the Infix Expression (a+(b-c)*d)

Given Infix Expn: (a+(b-c)*d)

Postfix Expn: abc-d*+

EXPIREMENT:5

A) Develop a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^

B) Solving Tower of Hanoi problem with n disks.

ABOUT THE EXPERIMENT:

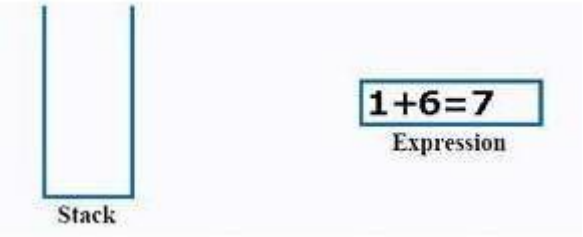
a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ Postfix/Suffix Expression: Operators are written after their operands. Ex: XY+ In normal algebra we use the infix notation like a+b*c. The corresponding postfix notation is abc*+

Example: Postfix String: 123*+4- Initially the Stack is empty. Now, the first three characters scanned are 1,2 and 3, which are operands. Thus they will be pushed into the stack in that order.

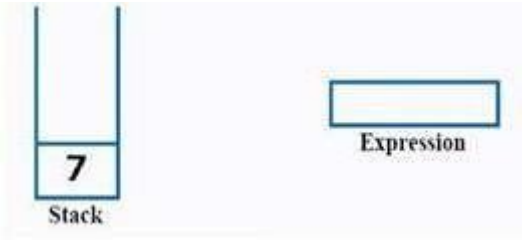
Next character scanned is "*", which is an operator. Thus, we pop the top two elements from the stack and perform the "*" operation with the two operands. The second operand will be the first element that is popped.

The value of the expression(2*3) that has been evaluated(6) is pushed into the stack.

Next character scanned is "+", which is an operator. Thus, we pop the top two elements from the stack and perform the "+" operation with the two operands. The second operand will be the first element that is popped.



The value of the expression(1+6) that has been evaluated(7) is pushed into the stack.



Next character scanned is "4", which is added to the stack.

Next character scanned is "-", which is an operator. Thus, we pop the top two elements from the stack and perform the "-" operation with the two operands. The second operand will be the first element that is popped.

The value of the expression (7-4) that has been evaluated(3) is pushed into the stack.

Now, since all the characters are scanned, the remaining element in the stack (there will be only one element in the stack) will be returned. End result: Postfix String:123*+4- Result: 3

ALGORITHM:

Step 1: Start.

Step 2: Read the postfix/suffix expression.

Step 3: Evaluate the postfix expression based on the precedence of the operator.

Step 4: Stop.

PROGRAM CODE:

```
#include <stdio.h>
#include <conio.h>
#include <math.h>
#define MAX 20
struct stack
{
int top;
float str[MAX];
}s;//stack
char postfix[MAX];//postfix
void push(float);
float pop();
int isoperand(char);
float operate(float,float,char);
int main()
{
int i=0;
printf("Enter Expression:");
scanf("%s",postfix);
float ans,op1,op2;
while(postfix[i]!='\0')
{
if(isoperand(postfix[i]))
push(postfix[i]-48);
else
{
op1=pop();
op2=pop();
ans=operate(op1,op2,postfix[i]);
push(ans);
```

```
printf("%f %c %f = %f\n",op2,postfix[i],op1,ans);
}
i++;
}
printf("%f",s.str[s.top]);
getch();
}
int isoperand(char x)
{
if(x>='0' && x<='9')
return 1;
else return 0;
}
void push(float x)
{
if(s.top==MAX-1)
printf("Stack is full\nStack overflow\n");
else
{
s.top++;
s.str[s.top]=x;
}
}
float pop()
{
if(s.top==-1)
{
printf("Stack is emplty\nSTACK UNDERFLOW\n");
getch();
}
else
```

```
{
s.top--;
return s.str[s.top+1];
}
}
float operate(float op1,float op2,char a)
{
switch(a)
{
case '+' : return op2+op1;
case '-' : return op2-op1;
case '*' : return op2*op1;
case '/' : return op2/op1;
case '^' : return pow(op2,op1);
}
}
```

SAMPLE OUTPUT 1:

```
Enter Expression:123*+4-
2.000000 * 3.000000 = 6.000000
1.000000 + 6.000000 = 7.000000
7.000000 - 4.000000 = 3.000000
3.000000
End Result: 3
```

SAMPLE OUTPUT 2:

Insert a postfix notation :: 22^32*+ Result :: 10

SAMPLE OUTPUT 3:

Insert a postfix notation :: 23+ Result :: 5

B) Towers of Hanoi

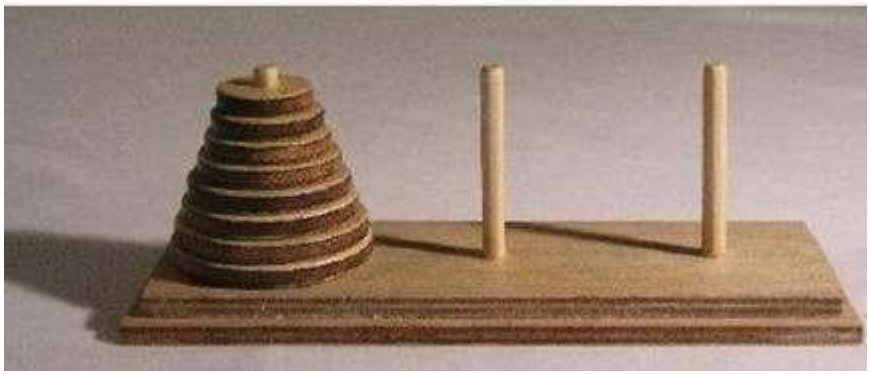
Solving Tower of Hanoi problem with n disks. The Tower of Hanoi is a mathematical game or puzzle. It consists of three rods, and a number of disks of different sizes which can slide onto any rod. The puzzle starts with the disks in a neat stack in ascending order of size on one rod, the smallest at the top, thus making a conical shape.

The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules:

• Only one disk can be moved at a time.

• Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack.

• No disk may be placed on top of a smaller disk. With three disks, the puzzle can be solved in seven moves. The minimum number of moves required to solve a Tower of Hanoi puzzle is 2 n - 1, where n is the number of disks.



ALGORITHM:

Step 1: Start.

Step 2: Read N number of discs.

Step 3: Move all the discs from source to destination by using temp rod.

Step 4: Stop.

PROGRAM CODE:

```
#include <stdio.h>

#include <conio.h>

void tower(int n, int source, int temp,int destination)
```

```
{
if(n == 0)
return;
tower(n-1, source, destination, temp);
printf("\nMove disc %d from %c to %c", n, source, destination);
tower(n-1, temp, source, destination);
}
void main()
{
int n;
printf("\nEnter the number of discs: \n");
scanf("%d", &n);
tower(n, 'A', 'B', 'C');
printf("\n\nTotal Number of moves are: %d", (int)pow(2,n)-1);
getch();
}
```

SAMPLE OUTPUT 1:

Enter the number of discs: 3

Move disc 1 from A to C

Move disc 2 from A to B

Move disc 1 from C to B

Move disc 3 from A to C

Move disc 1 from B to A

Move disc 2 from B to C

Move disc 1 from A to C

Total Number of moves are: 7

EXPIREMENT:6

6) Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)

a. Insert an Element on to Circular QUEUE

b. Delete an Element from Circular QUEUE

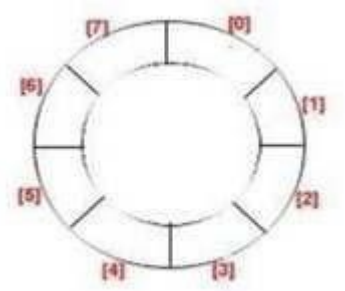
c. Demonstrate Overflow and Underflow situations on Circular QUEUE

d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations.

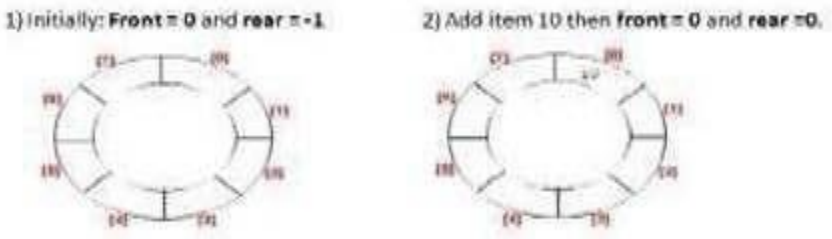
ABOUT THE EXPERIMENT:

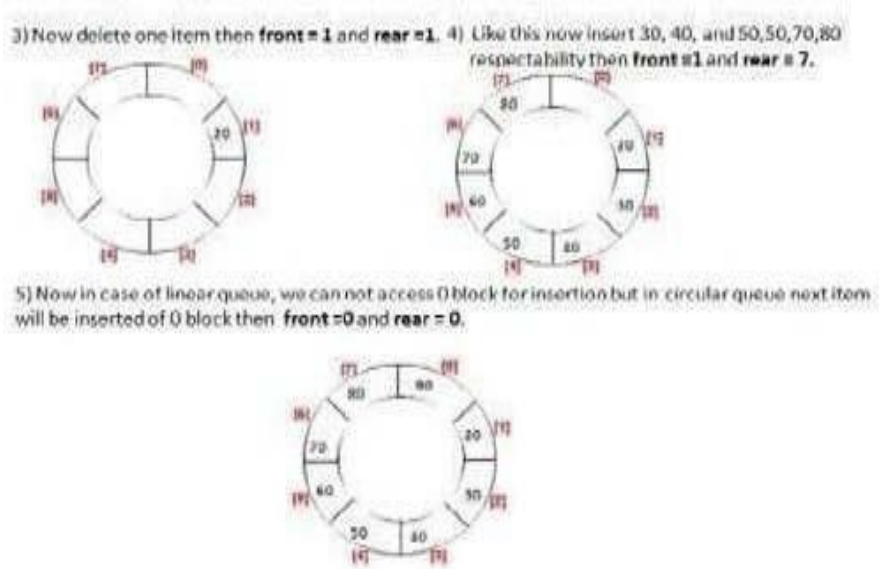
Circular queue is a linear data structure. It follows FIFO principle. In circular queue the last node is connected back to the first node to make a circle. Circular linked list fallow the First In First Out principle. Elements are added at the rear end and the elements are deleted at front end of the queue. The queue is considered as a circular queue when the positions 0 and MAX 1 are adjacent. Any position before front is also after rear.

A circular queue looks like



Consider the example with Circular Queue implementation:





ALGORITHM:

Step 1: Start.

Step 2: Initialize queue size to MAX.

Step 3: Insert the elements into circular queue. If queue is full give a message as „queue is overflow"

Step 4: Delete an element from the circular queue. If queue is empty give a message as „queue is underflow".

Step 5: Display the contents of the queue.

Step 6: Stop.

PROGRAM CODE:

```
#include  <stdio.h>
#include <conio.h>
#define SIZE 5
int CQ[SIZE];
int front=-1;
int rear=-1, ch;
int IsCQ_Full();
int IsCQ_Empty();
void CQ_Insert(int );
void CQ_Delet();
```

```
void CQ_Display();
void main()
{
printf("1.Insert\n2.Delete\n3.Display\n4.Exit\n");
while(1)
{
int ele;
printf("Enter your choice\n");
scanf("%d",&ch);
switch(ch)
{
case 1: if(IsCQ_Full())
printf("Circular Queu Overflow\n");
else
{
printf("Enter the element to be inserted\n");
scanf("%d",&ele); CQ_Insert(ele);
}
break;
case 2: if(IsCQ_Empty())
printf("Circular Queue Underflow\n");
else
CQ_Delet();
break;
case 3: if(IsCQ_Empty())
printf("Circular Queue Underflow\n");
else
CQ_Display();
break;
case 4: exit(0);
}
```

```
}
}
void CQ_Insert(int item)
{
if(front==-1)
front++;
rear = (rear+1)%SIZE;
CQ[rear] =item;
}
void CQ_Delet()
{
int item; item=CQ[front];
printf("Deleted element is: %d",item);
front = (front+1)%SIZE;
}
void CQ_Display()
{
int i;
if(front==-1)
printf("Circular Queue is Empty\n");
else
{
printf("Elements of the circular queue are..\n");
for(i=front;i!=rear;
i=(i+1)%SIZE);
{
printf("%d\t",CQ[i]);
}
printf("%d\n",CQ[i]);
}
}
```

```
int IsCQ_Full()
{
if(front ==(rear+1)%SIZE)
return 1;
return 0;
}
int IsCQ_Empty()
{
if(front == -1)
return 1;
else if(front == rear)
{
printf("Deleted element is: %d",CQ[front]);
front=-1;
return 1;
}
return 0;
}
```

SAMPLE OUTPUT 1:

Circular Queue operations

1.insert

2. delete

3.display

4.exit

Enter your choice:1

Enter element to be insert:10

Enter your choice:1

Enter element to be insert:20

Enter your choice:1

Enter element to be insert:30

Enter your choice:3 10 20 30 rear is at 30 front is at 10

Enter your choice:2 Deleted element is:10

Enter your choice:3 20 30 rear is at 30 front is at 20

Enter your choice:4

Exit

SAMPLE OUTPUT 2:

Circular Queue operations 1.insert 2.delete 3.display 4.exit

Enter your choice:1

Enter element to be insert:1000

Enter your choice:1

Enter element to be insert:2000

Enter your choice:1

Enter element to be insert:3000

Enter your choice:3 1000 2000 3000 rear is at 3000 front is at 1000

Enter your choice:2

Deleted element is:1000

Enter your choice:3 2000 3000 rear is at 3000 front is at 2000

Enter your choice:4

Exit

EXPIREMENT: 7

7. Develop a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo

a. Create a SLL of N Students Data by using front insertion.

b. Display the status of SLL and count the number of nodes in it

c. Perform Insertion / Deletion at End of SLL

d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack)

e. Exit

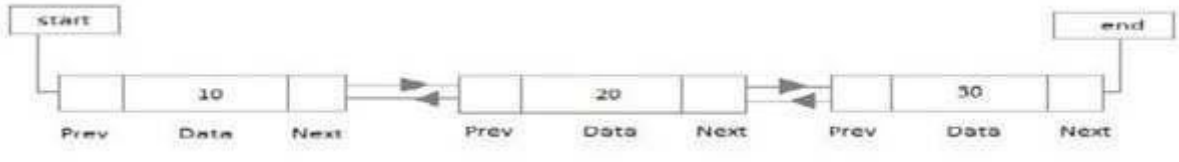
ABOUT THE EXPERIMENT:

Linked List is a linear data structure and it is very common data structure which consists of group of nodes in a sequence which is divided in two parts. Each node consists of its own data and the address of the next node and forms a chain. Linked Lists are used to create trees and graphs.

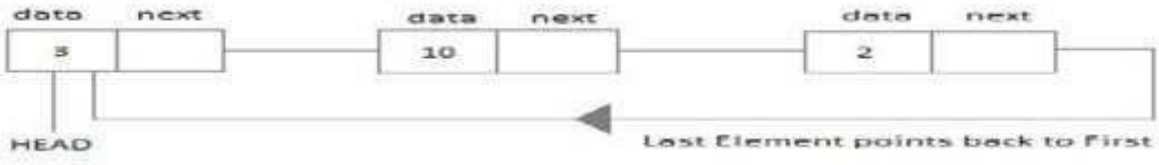
- They are a dynamic in nature which allocates the memory when required.
- Insertion and deletion operations can be easily implemented.
- Stacks and queues can be easily executed.
- Linked List reduces the access time.
- Linked lists are used to implement stacks, queues, graphs, etc.
- Linked lists let you insert elements at the beginning and end of the list.
- In Linked Lists we don‟t need to know the size in advance.

Types of Linked List: Singly Linked List: Singly linked lists contain nodes which have a data part as well as an address part i.e. next, which points to the next node in sequence of nodes. The operations we can perform on singly linked lists are insertion, deletion and traversal.

Doubly Linked List: In a doubly linked list, each node contains two links the first link points to the previous node and the next link points to the next node in the sequence.



Circular Linked List: In the circular linked list the last node of the list contains the address of the first node and forms a circular chain.



ALGORITHM:

Step 1: Start.

Step 2: Read the value of N. (N student‟s information)

Step 3: Create a singly linked list. (SLL)

Step 4: Display the status of SLL.

Step 5: Count the number of nodes.

Step 6: Perform insertion at front of list.

Step 7: Perform deletion at the front of the list.

Step 8: Perform insertion at end of the list.

Step 9: Perform deletion at the end of the list.

Step 10: Demonstrate how singly linked list can be used as stack.

Step 11: Demonstrate how singly linked list can be used as queue.

Step 12: Stop.

PROGRAM CODE:

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
typedef struct
{
int usn;
char name[20];
char branch[20];
int semester;
char phone[20];
}STUDENT;
struct node
{
int usn;
char name[20];
char branch[20];
int semester;
char phone[20];
struct node *link;
};
typedef struct node*NODE;
NODE getnode()
{
NODE x;
x=(NODE)malloc(sizeof(struct node));
if(x==NULL)
{
printf("out of memory\n");
exit(0);
}
```

```
return x;
}
NODE insert_front(STUDENT item,NODE first)
{
NODE temp;
temp=getnode();
temp->usn=item.usn;
strcpy(temp->name,item.name);
strcpy(temp->branch,item.branch);
temp->semester=item.semester;
strcpy(temp->phone,item.phone);
temp->link=NULL;
if(first==NULL)
return temp;
temp->link=first;
return temp;
}
NODE insert_rear(STUDENT item,NODE first)
{
NODE temp,cur;
temp=getnode();
temp->usn=item.usn;
strcpy(temp->name,item.name);
strcpy(temp->branch,item.branch);
temp->semester=item.semester;
strcpy(temp->phone,item.phone);
temp->link=NULL;
if(first==NULL)
return temp;
cur=first;
while(cur->link!=NULL)
```

```
{
cur=cur->link;
}
cur->link=temp;
return first;
}
NODE delete_front(NODE first)
{
NODE temp;
if(first==NULL)
{
printf("student list is empty\n");
return NULL;
}
temp=first;
temp=temp->link;
printf("delete student record:USN=%d\n",first->usn);
free(first);
return temp;
}
NODE delete_rear(NODE first)
{
NODE cur,prev;
if(first==NULL)
{
printf("student list is empty cannot delete\n");
return first;
}
if(first->link==NULL)
{
printf("delete student record:USN=%d\n",first->usn);
```

```
free(first);
return NULL;
}
prev=NULL;
cur=first;
while(cur->link!=NULL)
{
prev=cur;
cur=cur->link;
}
printf("delete student record:USN=%d\n",cur->usn);
free(cur);
prev->link=NULL;
return first;
}
void display(NODE first)
{
NODE cur;
int count=0;
if(first==NULL)
{
printf("student list is empty\n");
return;
}
cur=first;
while(cur!=NULL)
{
printf("%d\t%s\t%s\t%d\t%s\t\n",cur->usn,cur->name,cur->branch,cur->semester,cur->phone);
cur=cur->link;
count++;
}
```

```
printf("numbrt of students=%d\n",count);
}
void main()
{
NODE first;
int choice;
STUDENT item;
first=NULL;
for(;;)
{
printf("1.insert_front\n2.insert_rear\n3.delete_front\n4.delete_rear\n5.display\n6.exit\n");
printf("Enter the choice\n");
scanf("%d",&choice);
switch(choice)
{
case 1:
printf("USN :\n");
scanf("%d",&item.usn);
printf("name :\n");
scanf("%s",item.name);
printf("branch :\n");
scanf("%s",item.branch);
printf("semester:\n");
scanf("%d",&item.semester);
printf("phone :\n");
scanf("%s",item.phone);
first=insert_front(item,first);
break;
case 2:
printf("USN :\n");
scanf("%d",&item.usn);
```

```
printf("name :\n");
scanf("%s",item.name);
printf("branch :\n");
scanf("%s",item.branch);
printf("semester:\n");
scanf("%d",&item.semester);
printf("phone :\n");
scanf("%s",item.phone);
first=insert_rear(item,first);
break;
case 3:
first=delete_front(first);
break;
case 4:
first=delete_rear(first);
break;
case 5:
display(first);
break;
default:
exit(0);
}
}
}
```

SAMPLE OUTPUT 1:

```
-
–----------MENU----------
1 – create a SLL of n emp
2 - Display from beginning
3 - Insert at end
```

4 - delete at end

5 - Insert at beg

6 - delete at beg

7 – exit

Enter choice : 1

Enter no of students : 2

Enter usn,name, branch, sem, phno of student : 007 vijay CSE 3 121

Enter usn,name, branch, sem, phno of student : 100 yashas CSE 3 911

Enter choice : 2

Linked list elements from begining : 100

yashas CSE 3 911 007 vijay CSE 3 121

No of students = 2

Enter choice : 3

Enter usn,name, branch, sem, phno of student : 001 raj CSE 3 111

Enter choice : 2

Linked list elements from begining : 100 yashas CSE 3 911 007 vijay CSE 3 121 001 raj CSE 3 111

No of students = 3

Enter choice : 4 001 raj CSE 3 111

Enter choice : 2

Linked list elements from begining : 100 yashas CSE 3 911 007 vijay CSE 3 121

No of students = 2

Enter choice : 5

Enter usn,name, branch, sem, phno of student : 003 harsh cse 3 111

Enter choice : 2

Linked list elements from begining : 003 harsh cse 3 111 100 yashas CSE 3 911 007 vijay CSE 3 121

No of students = 3

Enter choice : 6

003 harsh cse 3 111 Enter choice : 2

Linked list elements from begining : 100 yashas CSE 3 911 007 vijay CSE 3 121

No of students = 2

Enter choice : 7

Exit

SAMPLE OUTPUT 2:

–----------MENU----------

1 – create a SLL of n emp

2 - Display from beginning

3 - Insert at end

4 - delete at end

5 - Insert at beg

6 - delete at beg

7 – exit

Enter choice : 1

Enter no of students : 1

Enter usn,name, branch, sem, phno of student : 009 suhas ISE 8 9854125422

Enter choice : 2 Linked list elements from begining : 009 suhas ISE 8 9854125422

No of students = 1

Enter choice : 3 Enter usn,name, branch, sem, phno of student : 001 raj CSE 3 111

Enter choice : 2

Linked list elements from begining : 009 suhas ISE 8 9854125422 001 raj CSE 3 111

No of students = 2

Enter choice : 4 001 raj CSE 3 111 Enter choice : 2

Linked list elements from begining : 009 suhas ISE 8 9854125422

No of students = 1

Enter choice : 5

Enter usn,name, branch, sem, phno of student : 009 suhas ISE 8 9854125422

003 harsh cse 3 111

Enter choice : 2

Linked list elements from begining : 009 suhas ISE 8 9854125422 003 harsh cse 3 111

No of students = 2

Enter choice : 6

003 harsh cse 3 111

Enter choice : 2

Linked list elements from begining : 003 harsh cse 3 111

No of students = 1

Enter choice : 7

EXPIREMENT: 8

8) Develop a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo

a. Create a DLL of N Employees Data by using end insertion.

b. Display the status of DLL and count the number of nodes in it

c. Perform Insertion and Deletion at End of DLL

d. Perform Insertion and Deletion at Front of DLL

e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit

ABOUT THE EXPERIMENT:

Doubly Linked List: In a doubly linked list, each node contains two links the first link points to the previous node and the next link points to the next node in the sequence. In computer science, a doubly linked list is a linked data structure that consists of a set of sequentially linked records called nodes. Each node contains two fields, called links, that are references to the previous and to the next node in the sequence of nodes.

The beginning and ending nodes' previous and next links, respectively, point to some kind of terminator, typically a sentinel node or null, to facilitate traversal of the list. If there is only one sentinel node, then the list is circularly linked via the sentinel node. It can be conceptualized as two singly linked lists formed from the same data items, but in opposite sequential orders. A doubly linked list whose nodes contain three fields: an integer value, the link to the next node, and the link to the previous node.

The two node links allow traversal of the list in either direction. While adding or removing a node in a doubly linked list requires changing more links than the same operations on a singly linked list, the operations are simpler and potentially more efficient (for nodes other than first nodes) because there is no need to keep track of the previous node during traversal or no need to traverse the list to find the previous node, so that its link can be modified.

ALGORITHM:

Step 1: Start.

Step 2: Read the value of N. (N student‟s information)

Step 3: Create a doubly linked list. (DLL)

Step 4: Display the status of DLL.

Step 5: Count the number of nodes.

Step 6: Perform insertion at front of list.

Step 7: Perform deletion at the front of the list.

Step 8: Perform insertion at end of the list.

Step 9: Perform deletion at the end of the list.

Step 10: Demonstrate how doubly linked list can be used as double ended queue.

Step 11: Stop.

PROGRAM CODE:

```
#include  <stdio.h>
#include <stdlib.h>
#include <string.h>
struct Enode
{
char ssn[15];
char name[20];
char dept[5];
char designation[10];
int salary;
long long int phno;
struct  Enode  *left;
struct Enode *right;
}*head=NULL;
struct Enode *tail,*temp1,*temp2;
```

```
void create(char [],char [],char [],char [],int ,long long int);
void ins_beg(char [],char [],char [],char [],int ,long long int);
void ins_end(char [],char [],char [],char [],int ,long long int);
void del_beg();
void del_end();
void display();
int count=0;
void main()
{
int choice;
char s[15],n[20],dpt[5],des[10];
int sal;
long long int p;
printf("1.Create\n2.Display\n3.Insert at beginning\n4.Insert at End\n5.Delete at beginning\n6.Delete at End\n7.Exit\n");
while(1)
{
printf("\nEnter your choice\n");
scanf("%d",&choice); switch(choice)
{
case 1:
printf("Enter the required data(Emp no,Name,Dept,Desig,sal,phone\n");
scanf("%s%s%s%s%d%lld",s,n,dpt,des,&sal,&p);
create(s,n,dpt,des,sal,p);
break;
case 2:
display();
break;
case 3:
printf("Enter the required data (Emp no,Name,Dept,Desig,sal,phone\n");
scanf("%s%s%s%s%d%lld",s,n,dpt,des,&sal,&p);
```

```
ins_beg(s,n,dpt,des,sal,p);
break;
case 4:
printf("Enter the required data(Emp no,Name,Dept,Desig,sal,phone\n");
scanf("%s%s%s%s%d%lld",s,n,dpt,des,&sal,&p);
ins_end(s,n,dpt,des,sal,p);
break;
case 5:
del_beg();
break;
case 6:
del_end();
break;
case 7:
exit(0);
}
}
}
void create(char s[15],char n[20],char dpt[5],char des[10],int sal,long long int p)
{
if(head==NULL)
{
head=(struct Enode *)malloc(1*sizeof(struct Enode));
strcpy(head->ssn,s);
strcpy(head->name,n);
strcpy(head->dept,dpt);
strcpy(head->designation,des);
head->salary=sal;
head->phno=p;
head->left=NULL;
head->right=NULL;
```

```
tail=head;
}
else
{
temp1=(struct Enode *)malloc(1*sizeof(struct Enode));
strcpy(temp1->ssn,s);
strcpy(temp1->name,n);
strcpy(temp1->dept,dpt);
strcpy(temp1->designation,des);
temp1->salary=sal;
temp1->phno=p;
tail->right=temp1;
temp1->right=NULL;
temp1->left=tail;
tail=temp1;
}
}
void display()
{
temp1=head;
printf("Employee Details \n");
while(temp1!=NULL)
{
printf(" \n");
printf("%s\n%s\n%s\n%s\n%d\n%lld\n",temp1->ssn,temp1->name,temp1->dept,temp1->designation,temp1->salary,temp1->phno); printf(" ");
temp1=temp1->right;
}
}
void ins_beg(char s[15],char n[20],char dpt[5],char des[10],int sal,long long int p)
{
```

```
temp1=(struct Enode *)malloc(1*sizeof(struct Enode));
strcpy(temp1->ssn,s);
strcpy(temp1->name,n);
strcpy(temp1->dept,dpt);
strcpy(temp1->designation,des);
temp1->salary=sal;
temp1->phno=p;
temp1->right=head;
head->left=temp1;
head=temp1;
temp1->left=NULL;
}
void ins_end(char s[15],char n[20],char dpt[5],char des[10],int sal,long long int p)
{
temp1=(struct Enode *)malloc(1*sizeof(struct Enode));
strcpy(temp1->ssn,s);
strcpy(temp1->name,n);
strcpy(temp1->dept,dpt);
strcpy(temp1->designation,des);
temp1->salary=sal;
temp1->phno=p;
tail->right=temp1;
temp1->left=tail;
temp1->right=NULL;
tail=temp1;
}
void del_beg()
{
temp1=head->right;
free(head);
head=temp1;
```

```
head->left=NULL;
}
void del_end()
{
temp1=tail->left;
free(tail);
tail=temp1;
tail->right=NULL;
}
```

SAMPLE OUTPUT 1:

MENU

1.Create

2. Display

3. Insert at beginning

4. Insert at End

5. Delete at beginning

6. Delete at End

7.Exit

Enter choice : 1 Enter no of employees : 2

Enter ssn,name,department, designation, salary and phno of employee : 1 RAJ SALES MANAGER 15000 911 Enter ssn,name,department, designation, salary and phno of employee : 2 RAVI HR ASST 10000 123

Enter choice : 2

Linked list elements from begining : 1 RAJ SALES MANAGER 15000.000000 911 2 RAVI HR ASST 10000.000000 123 No of employees = 2

Enter choice : 3

Enter ssn,name,department, designation, salary and phno of employee : 3 RAM MARKET MANAGER 50000 111 Enter choice : 2 Linked list elements from begining : 1 RAJ SALES MANAGER 15000.000000 911 2 RAVI HR ASST 10000.000000 123 3 RAM MARKET MANAGER 50000.000000 111 No of employees = 3

Enter choice : 4

3 RAM MARKET MANAGER 50000.000000 111 Enter choice : 2 Linked list elements from begining : 1 RAJ SALES MANAGER 15000.000000 911 2 RAVI HR ASST 10000.000000 123 No of employees = 2

Enter choice : 5

Enter ssn,name,department, designation, salary and phno of employee : 0 ALEX EXE TRAINEE 2000 133 Enter choice : 2 Linked list elements from begining : 0 ALEX EXE TRAINEE 2000.000000 133 1 RAJ SALES MANAGER 15000.000000 911 2 RAVI HR ASST 10000.000000 123 No of employees = 3

Enter choice : 6

0 ALEX EXE TRAINEE 2000.000000 133 Enter choice : 2 Linked list elements from begining : 1 RAJ SALES MANAGER 15000.000000 911 2 RAVI HR ASST 10000.000000 123 No of employees = 2

Enter choice : 7

Exit

SAMPLE OUTPUT 2:

.....MENU.....

1.Create

2.Display

3.Insert at beginning

4.Insert at End

5.Delete at beginning

6.Delete at End

7.Exit

Enter choice : 1

Enter no of employees : 1

Enter ssn,name,department, designation, salary and phno of employee : 1 RAJ SALES MANAGER 15000 911

Enter choice : 2

Linked list elements from begining :

1 RAJ SALES MANAGER 15000.000000 911

No of employees = 1

Enter choice : 3

Enter ssn,name,department, designation, salary and phno of employee : 3 RAM MARKET MANAGER 50000 111

Enter choice : 2

Linked list elements from begining : 1

RAJ SALES MANAGER 15000.000000 911 2 RAM MARKET MANAGER 50000.000000 111

No of employees = 2

Enter choice : 4

3 RAM MARKET MANAGER 50000.000000 111 Enter choice : 2 Linked list elements from begining : 1 RAJ SALES MANAGER 15000.000000 911 2 RAVI HR ASST 10000.000000 123 No of employees = 2

Enter choice : 5

Enter ssn,name,department, designation, salary and phno of employee : 0 ALEX EXE TRAINEE 2000 133

Enter choice : 2

Linked list elements from begining : 3

ALEX EXE TRAINEE 2000.000000 133 4 RAJ SALES MANAGER 15000.000000 911 5 RAVI HR ASST 10000.000000 123

No of employees = 3

Enter choice : 6

0 ALEX EXE TRAINEE 2000.000000 133

Enter choice : 2

Linked list elements from begining : 3

RAJ SALES MANAGER 15000.000000 911 4 RAVI HR ASST 10000.000000 123 No of employees = 2

Enter choice : 7

Exit

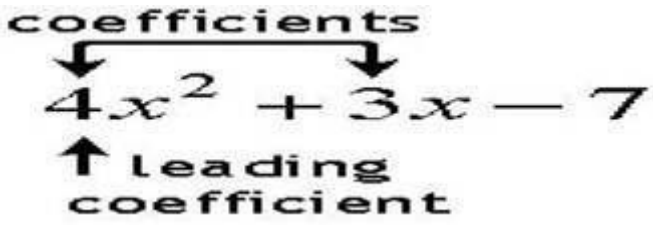
EXPIREMENT:9

9) Develop a Program in C for the following operationson Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = 6x 2 y 2 z-4yz 5 +3x 3 yz+2xy 5 z-2xyz 3 b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations.

ABOUT THE EXPERIMENT:

Circular Linked List: In the circular linked list the last node of the list contains the address of the first node and forms a circular chain. Polynomial: A polynomial equation is an equation that can be written in the form. ax n + bx n-1 + . . . + rx + s = 0, where a, b, . . . , r and s are constants.

We call the largest exponent of x appearing in a non-zero term of a polynomial the degree of that polynomial. As with polynomials with one variable, you must pay attention to the rules of exponents and the order of operations so that you correctly evaluate an expression with two or more variables. Evaluate x 2 + 3y 3 for x = 7 and y = −2. Substitute the given values for x and y. Evaluate4x 2 y – 2xy 2 + x – 7 for x = 3 and y = −1. When a term contains both a number and a variable part, the number part is called the "coefficient". The coefficient on the leading term is called the "leading" coefficient



In the above example, the coefficient of the leading term is 4; the coefficient of the second term is 3; the constant term doesn't have a coefficient. Here are the steps required for Evaluating Polynomial Functions: Step 1: Replace each x in the expression with the given value. Step 2: Use the order of operation to simplify the expression.example 1

$$\text{Given } f(x) = -2x^2 + 5x - 7, \text{find } f(3).$$

Step 1: Replace each x in the expression with the given value. In this case, we replace each x with 3.

$$f(3) = -2(3)^2 + 5(3) - 7$$

Step 2: Use the order of operation to simplify the expression.

$$f(3) = -2(9) + 5(3) - 7$$
$$f(3) = -18 + 15 - 7$$
$$f(3) = -10$$

Here are the steps required for addition of two polynomials.

Step 1

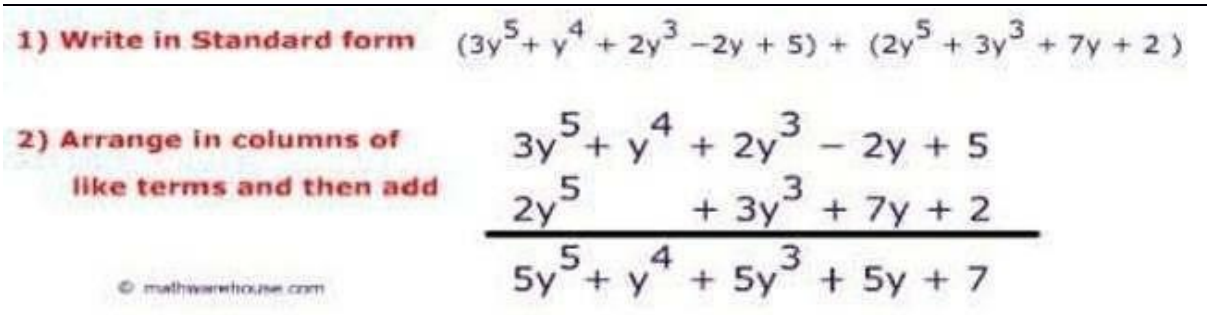
• Arrange the Polynomial in standard form

• Standard form of a polynomial and each of the following terms just means that the term with highest degree is first

Step 2

• Arrange the like terms in columns and add the like terms

Example 1: Let's find the sum of the following two polynomials (3y 5 − 2y + y 4 + 2y 3 + 5) and (2y 5 + y 3 + 2+ 7)



ALGORITHM:

Step 1: Start.

Step 2: Read a polynomial.

Step 3: Represent the polynomial using singly circular linked list.

Step 4: Evaluate the given polynomial

Step 5: Read two polynomials and find the sum of the polynomials.

Step 6: Stop

PROGRAM CODE:

```
#include  <stdio.h>
#include <conio.h>
#include <stdlib.h>
#include  <math.h>
struct node
{
int coeff;
int expo;
struct node *ptr;
};
struct node *head1,*head2,*head3, *temp,*temp1,*temp2,*temp3,*list1,*list2,*list3;
struct node *dummy1,*dummy2;
```

```
void create_poly1(int , int);
void create_poly2(int , int);
void display();
void add_poly();
void eval_poly(int );
int n,ch;
int c,e,i;
void main()
{
int x; list1=list2=NULL;
printf("1.Create first polynomial\n2.Create Second Polynomial\n3.Display both the polynomials\n");
printf("4.Add Polynomials\n5.Evaluate a Polynomial\n6.Exit\n");
while(1)
{
printf("Enter choice\n");
scanf("%d",&ch);
switch(ch)
{
case 1: printf("Enter the number of terms\n");
scanf("%d",&n);
printf("Enter coefficient & power of each term\n");
for(i=0;i<n;i++)
{
scanf("%d%d",&c,&e);
create_poly1(c,e);
}
break;
case 2: printf("Enter the number of terms\n");
scanf("%d",&n);
printf("Enter coefficient & power of each term\n");
for(i=0;i<n;i++)
```

```
{
scanf("%d%d",&c,&e);
create_poly2(c,e);
}
break;
case 3:
display();
break;
case 4:
add_poly();
break;
case 5:
printf("Enter the value for x\n");
scanf("%d",&x);
eval_poly(x);
break;
case 6:exit(0);
}
}
}
void create_poly1(int c, int e)
{
dummy1=(struct node*)malloc(1*sizeof(struct node));
dummy1->coeff=0;
dummy1->expo=0;
dummy1->ptr=list1;
if(list1==NULL)
{
list1->coeff=c;
list1->expo=e;
list1->ptr=list1; head1=list1;
```

```
head1->ptr=dummy1;
}
else
{
temp=(struct node*)malloc(1*sizeof(struct node));
temp->coeff=c;
temp->expo=e;
head1->ptr=temp;
temp->ptr=dummy1;
head1=temp;
}
}
void create_poly2(int c, int e)
{
dummy2=(struct node*)malloc(1*sizeof(struct node));
dummy2->coeff=0;
dummy2->expo=0;
dummy2->ptr=list2;
if(list2==NULL)
{
list2=(struct node*)malloc(1*sizeof(struct node));
list2->coeff=c;
list2->expo=e;
list2->ptr=list2;
head2=list2;
head2->ptr=dummy2;
}
else
{
temp=(struct node*)malloc(1*sizeof(struct node));
temp->coeff=c;
```

```
temp->expo=e;
head2->ptr=temp;
temp->ptr=dummy2;
head2=temp;
}
}
void add_poly()
{
temp1=list1;
temp2=list2;
while((temp1!=dummy1)&&(temp2!=dummy2))
{
temp=(struct node*)malloc(1*sizeof(struct node));
if(list3==NULL)
{
list3=temp;
head3=list3;
}
if(temp1->expo==temp2->expo)
{
temp->coeff=temp1->coeff+temp2->coeff;
temp->expo=temp1->expo;
temp->ptr=list3;
head3->ptr=temp;
head3=temp;
temp1=temp1->ptr;
temp2=temp2->ptr;
}
else if(temp1->expo>temp2->expo)
{
temp->coeff=temp1->coeff;
```

```
temp->expo=temp1->expo;
temp->ptr=list3;
head3->ptr=temp;
head3=temp;
temp1=temp1->ptr;
}
else
{
temp->coeff=temp2->coeff;
temp->expo=temp2->expo;
temp->ptr=list3;
head3->ptr=temp;
head3=temp;
temp2=temp2->ptr;
}
}
if(temp1==dummy1)
{
while(temp2!=dummy2)
{
temp=(struct node*)malloc(1*sizeof(struct node));
temp->coeff=temp2->coeff;
temp->expo=temp2->expo;
temp->ptr=list3;
head3->ptr=temp;
head3=temp;
temp2=temp2->ptr;
}
}
if(temp2==dummy2)
{
```

```
while(temp1!=dummy1)
{
temp=(struct node*)malloc(1*sizeof(struct node));
temp->coeff=temp1->coeff;
temp->expo=temp1->expo;
temp->ptr=list3;
head3->ptr=temp;
head3=temp;
temp1=temp1->ptr;
}
}
}
void display()
{
temp1=list1;
temp2=list2;
temp3=list3;
printf("\nPOLYNOMIAL 1:");
while(temp1!=dummy1)
{
printf("%dX^%d+",temp1->coeff,temp1->expo);
temp1=temp1->ptr;
}
printf("\b ");
printf("\nPOLYNOMIAL 2:");
while(temp2!=dummy2)
{
printf("%dX^%d+",temp2->coeff,temp2->expo);
temp2=temp2->ptr;
}
printf("\b ");
```

```
printf("\n\nSUM OF POLYNOMIALS:\n"); while(temp3->ptr!=list3)
{
printf("%dX^%d+",temp3->coeff,temp3->expo);
temp3=temp3->ptr;
}
printf("%dX^%d\n",temp3->coeff,temp3->expo);
}
void eval_poly(int x)
{
int result=0;
temp1=list1;
temp2=list2;
while(temp1!=dummy1)
{
result+=(temp1->coeff)*pow(x,temp1->expo);
temp1=temp1->ptr;
}
printf("Polynomial 1 Evaluation:%d\n",result);
result=0;
while(temp2!=dummy2)
{
result+=(temp2->coeff)*pow(x,temp2->expo);
temp2=temp2->ptr;
}
printf("Polynomial 2 Evaluation:%d\n",result);
}
```

SAMPLE OUTPUT 1:

<< MENU >>-

Polynomial Operations :

1.Add

2.Evaluate

3.Exit

Enter your choice==>1

Enter no of terms of polynomial==>3

Enter coef & expo==>

4

3

Enter coef & expo==>

2

2

Enter coef & expo==>

5

1

The polynomial is==>5x^(1) + 2x^(2) + 4x^(3)

Enter no of terms of polynomial==>3

Enter coef & expo==>

4

1

Enter coef & expo==>

3

2

Enter coef & expo==>

5

3

The polynomial is==>4x^(1) + 3x^(2) + 5x^(3)

Addition of polynomial==> The polynomial is==>9x^(1) + 5x^(2) + 9x^(3)

Enter your choice==>2

Enter no of terms of polynomial==>3

Enter coef & expo==> 1

Enter coef & expo==>

4

2

Enter coef & expo==>

5

4

The polynomial is==>3x^(1) + 4x^(2) + 5x^(4)

Enter the value of x=2

Value of polynomial=102

Enter your choice==>3

exit

EXPIREMENT: 10

10) Develop a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers.

a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2

b. Traverse the BST in Inorder, Preorder and Post Order

c. Search the BST for a given element (KEY) and report the appropriate message d. Exit

ABOUT THE EXPERIMENT:

A binary search tree (BST) is a tree in which all nodes follows the below mentioned properties • The left sub-tree of a node has key less than or equal to its parent node's key. • The right sub-tree of a node has key greater than or equal to its parent node's key. Thus, a

binary search tree (BST) divides all its sub-trees into two segments; left sub-tree and right sub-tree and can be defined as left_subtree (keys) ≤ node (key) ≤ right_subtree (keys)

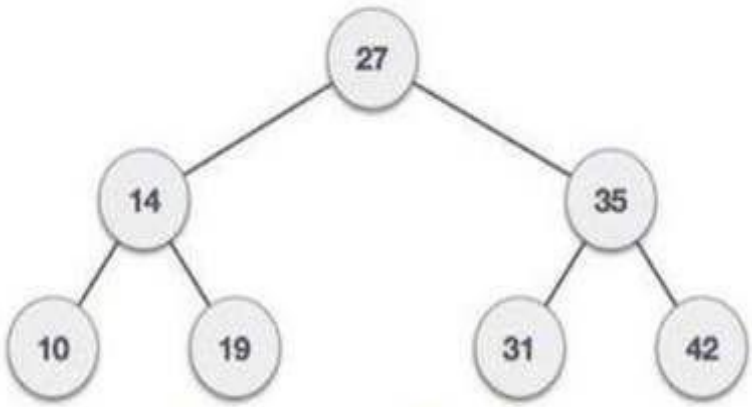


Fig: An example of BST

Following are basic primary operations of a tree which are following.

• Search − search an element in a tree.

• Insert − insert an element in a tree. • Preorder Traversal − traverse a tree in a preorder manner.

• Inorder Traversal − traverse a tree in an inorder manner.

• Postorder Traversal − traverse a tree in a postorder manner.

Node definition: Define a node having some data, references to its left and right child nodes. struct node { 5. int data; struct node *leftChild; struct node *rightChild; };

ALGORITHM:

Step 1: Start.

Step 2: Create a Binary Search Tree for N elements.

Step 3: Traverse the tree in inorder.

Step 4: Traverse the tree in preorder

Step 5: Traverse the tree in postorder.

Step 6: Search the given key element in the BST.

Step 7: Delete an element from BST.

Step 8: Stop

PROGRAM CODE

```
#include  <stdio.h>
#include <stdlib.h>
struct BST
{
int data;
struct BST *left;
struct BST *right;
};
typedef struct BST NODE;
NODE *node;
NODE* createtree(NODE *node, int data)
{
if (node == NULL)
{
NODE *temp;
temp= (NODE*)malloc(sizeof(NODE));
temp->data = data;
temp->left = temp->right = NULL;
return temp;
}
if (data < (node->data))
{
node->left = createtree(node->left, data);
}
else if (data > node->data)
{
node -> right = createtree(node->right, data);
```

```
}
return node;
}
NODE* search(NODE *node, int data)
{
if(node == NULL)
printf("\nElement not found");
else if(data < node->data)
{
node->left=search(node->left, data);
}
else if(data > node->data)
{
node->right=search(node->right, data);
}
else
printf("\nElement found is: %d", node->data);
return node;
}
void inorder(NODE *node)
{
if(node != NULL)
{
inorder(node->left);
printf("%d\t", node->data);
inorder(node->right);
}
}
void preorder(NODE *node)
```

```
{
if(node != NULL)
{
printf("%d\t", node->data);
preorder(node->left);
preorder(node->right);
}
}
void postorder(NODE *node)
{
if(node != NULL)
{
postorder(node->left);
postorder(node->right);
printf("%d\t", node->data);
}
}
NODE* findMin(NODE *node)
{
if(node==NULL)
{
return NULL;
}
if(node->left)
return findMin(node->left);
else
return node;
}
NODE* del(NODE *node, int data)
```

```
{
NODE *temp;
if(node == NULL)
{
printf("\nElement not found");
}
else if(data < node->data)
{
node->left = del(node->left, data);
}
else if(data > node->data)
{
node->right = del(node->right, data);
}
else
{
/* Now We can delete this node and replace with either minimum element in the right sub tree or maximum element in the left subtree */
if(node->right && node->left)
{
/* Here we will replace with minimum element in the right sub tree */
temp = findMin(node->right);
node -> data = temp->data;
/* As we replaced it with some other node, we have to delete that node */
node -> right = del(node->right, temp->data);
}
else
{
/* If there is only one or zero children then we can directly remove it from the tree and connect its
```

```
parent to its child */
temp = node;
if(node->left == NULL)
node = node->right;
else if(node->right == NULL)
node = node->left;
free(temp); /* temp is longer required */
}
}
return node;
}
void main()
{
int data, ch, i, n;
NODE *root=NULL;
while (1)
{
printf("\n1.Insertion in Binary Search Tree");
printf("\n2.Search Element in Binary Search Tree");
printf("\n3.Delete Element in Binary Search Tree");
printf("\n4.Inorder\n5.Preorder\n6.Postorder\n7.Exit");
printf("\nEnter your choice: "); scanf("%d", &ch);
switch (ch)
{
case 1:
printf("\nEnter N value: " );
scanf("%d", &n);
printf("\nEnter the values to create BST like(6,9,5,2,8,15,24,14,7,8,5,2)\n");
for(i=0; i<n; i++)
```

```
{
scanf("%d", &data);
root=createtree(root, data);
}
break;
case 2:
printf("\nEnter the element to search: ");
scanf("%d", &data);
break;
case 3:
printf("\nEnter the element to delete: ");
scanf("%d", &data);
root=del(root, data);
break;
case 4:
printf("\nInorder Traversal: \n");
inorder(root);
break;
case 5:
printf("\nPreorder Traversal: \n");
preorder(root);
break;
case 6:
printf("\nPostorder Traversal: \n");
postorder(root);
break;
case 7:
exit(0);
default : printf("\nWrong option");
```

```
break;
}
}
}
```

SAMPLE OUTPUT 1:

```
Program For Binary Search Tree
1. Create
2. Search
3. Recursive Traversals
4. Exit
Enter your choice :1
Enter The Element 15
Want To enter More Elements?(1/0)1
Enter The Element 25
Want To enter More Elements?(1/0)1
Enter The Element 35
Want To enter More Elements?(1/0)1
Enter The Element 45
Want To enter More Elements?(1/0)1
Enter The Element 5
Want To enter More Elements?(1/0)1
Enter The Element 7
Want To enter More Elements?(1/0)0
Enter your choice :2
Enter Element to be searched :7
The 7 Element is Present Parent of node 7 is 5
1. Create
2. Search
```

3. Recursive Traversals

4.Exit

Enter your choice :2

Enter Element to be searched :88

The 88 Element is not Present

Enter your choice :3

The Inorder display : 5 7 15 25 35 45

The Preorder display : 15 5 7 25 35 45

The Postorder display : 7 5 45 35 25 15

Enter your choice :4

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EXPIREMENT: 11

8) Develop a Program in C for the following operations on Graph(G) of Cities

a. Create a Graph of N cities using Adjacency Matrix.

b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method

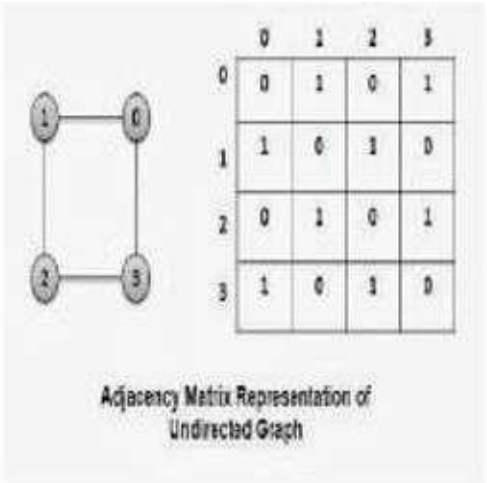
ABOUT THE EXPERIMENT:

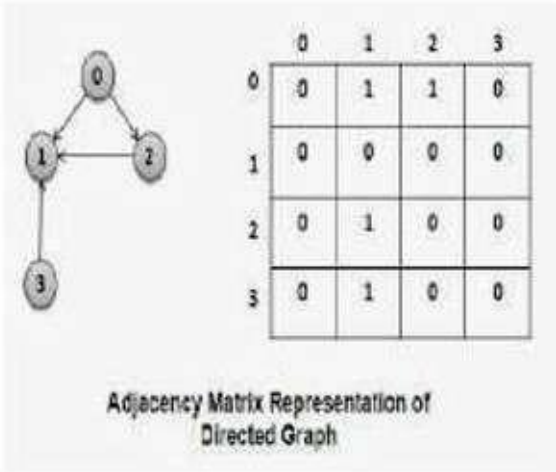
Adjacency Matrix In graph theory, computer science, an adjacency matrix is a square matrix used to represent a finite graph. The elements of the matrix indicate whether pairs of vertices are adjacent or not in the graph. In the special case of a finite simple graph, the adjacency matrix is a (0, 1)-matrix with zeros on its diagonal. A graph G = (V, E) where v= {0, 1, 2, . . .n-1} can be represented using two dimensional integer array of size n x n. a[20][20] can be used to store a graph with 20 vertices. a[i][j] = 1, indicates presence of edge between two vertices i and j. a[i][j] = 0, indicates absence of edge between two vertices i and j.

• A graph is represented using square matrix.

• Adjacency matrix of an undirected graph is always a symmetric matrix, i.e. an edge (i, j) implies the edge (j, i).

• Adjacency matrix of a directed graph is never symmetric, adj[i][j] = 1 indicates a directed edge from vertex i to vertex j. An example of adjacency matrix representation of an undirected and directed graph is given below:





BFS graph Breadth-first search (BFS) is an algorithm data structures. It starts at the tree root for traversing or searching tree or and explores the neighbor nodes first, before moving to the next level neighbors.

Breadth First Search algorithm(BFS) traverses a graph in a breadth wards motion and uses a queue to remember to get the next vertex to start a search when a dead end occurs in any iteration.

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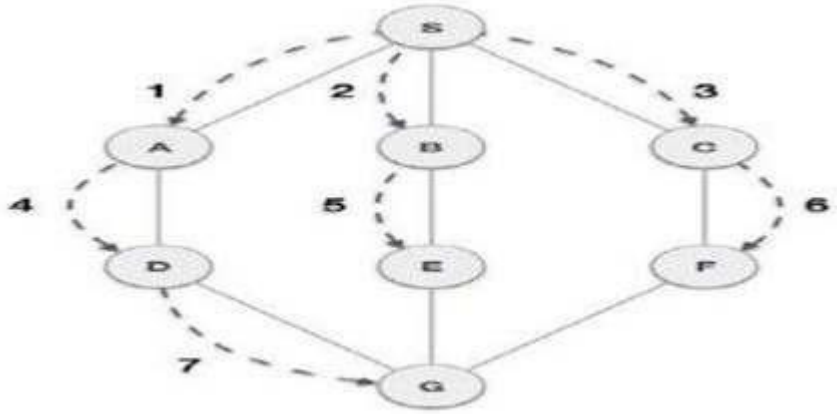
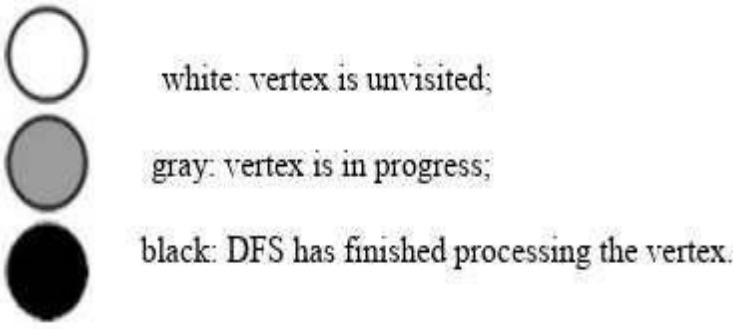


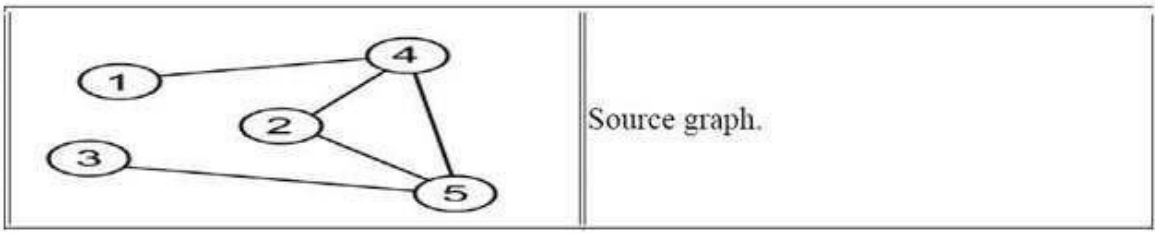
As in example given above, BFS algorithm traverses from A to B to E to F first then to C and G lastly to D. It employs following rules. 1.

Rule 1 − Visit adjacent unvisited vertex. Mark it visited. Display it. Insert it in a queue. 2. Rule 2 − If no adjacent vertex found, remove the first vertex from queue. 3. Rule 3 − Repeat Rule 1 and Rule 2 until queue is empty. DFS Depth-first search (DFS) is an algorithm for traversing or searching tree or graph data structures. One starts at the root (selecting some arbitrary node as the root in the case of a graph) and explores as far as possible along each branch before backtracking.

Depth-first search, or DFS, is a way to traverse the graph. Initially it allows visiting vertices of the graph only, but there are hundreds of algorithms for graphs, which are based on DFS. Therefore, understanding the principles of depth-first search is quite important to move ahead into the graph theory. The principle of the algorithm is quite simple: to go forward (in depth) while there is such possibility, otherwise to backtrack. Algorithm In DFS, each vertex has three possible colors representing its state:



NB. For most algorithms Boolean classification unvisited / visited is quite enough, but we show general case here. Initially all vertices are white (unvisited). DFS starts in arbitrary vertex and runs as follows: 5.Mark vertex u as gray (visited). 6.For each edge (u, v), where u is white, run depth-first search for u recursively. 7.Mark vertex u as black and backtrack to the parent. Example. Traverse a graph shown below, using DFS. Start from a vertex with number 1 .



ALGORITHM:

Step 1: Start.

Step 2: Input the value of N nodes of the graph

Step 3: Create a graph of N nodes using adjacency matrix representation.

Step 4: Print the nodes reachable from the starting node using BFS.

Step 5: Check whether graph is connected or not using DFS.

Step 6: Stop.

PROGRAM CODE:

```
#include <stdio.h>
#include <stdlib.h>
int a[20][20],q[20],visited[20],reach[10],n,i,j,f=0,r=-1,count=0;
void bfs(int v)
{
for(i=1;i<=n;i++)
if(a[v][i] && !visited[i])
q[++r]=i;
if(f<=r)
{
visited[q[f]]=1;
bfs(q[f++]);
}
}
```

```
void dfs(int v)
{
int i; reach[v]=1;
for(i=1;i<=n;i++)
{
if(a[v][i] && !reach[i])
{
printf("\n %d->%d",v,i);
count++;
dfs(i);
}
}
}
void main()
{
int v, choice;
printf("\n Enter the number of vertices:");
scanf("%d",&n);
for(i=1;i<=n;i++)
{
q[i]=0;
visited[i]=0;
}
for(i=1;i<=n-1;i++)
reach[i]=0;
printf("\n Enter graph data in matrix form:\n");
for(i=1;i<=n;i++)
for(j=1;j<=n;j++)
scanf("%d",&a[i][j]);
```

```
printf("1.BFS\n 2.DFS\n 3.Exit\n");
scanf("%d",&choice);
switch(choice)
{
case 1:
printf("\n Enter the starting vertex:");
scanf("%d",&v);
bfs(v);
if((v<1)||(v>n))
{
printf("\n Bfs is not possible");
}
else
{
printf("\n The nodes which are reachable from %d:\n",v);
for(i=1;i<=n;i++)
if(visited[i])
printf("%d\t",i);
}
break;
case 2:
dfs(1);
if(count==n-1)
printf("\n Graph is connected");
else
printf("\n Graph is not connected");
break;
case 3: exit(0);
}
```

}

SAMPLE OUTPUT 1:

Enter the number of vertices:5

Enter graph data in matrix form: 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 0 1 0 0 0

1. BFS

2. DFS

3. Exit 2

1->2 2->3 3->4 2->5

Graph is connected

Enter the number of vertices:5

Enter graph data in matrix form: 0 1 0 1 0 1 0 1 0 0 0 1 0 1 0 1 0 1 0 0 0 0 0 0 0

1. BFS

2. DFS

3. Exit 2

1->2

2->3

3->4

Graph is not connected

Enter the number of vertices:5

Enter graph data in matrix form: 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0

1. BFS

2. DFS

3. Exit 1

Enter the starting vertex:1

The nodes which are reachable from 1: 2 3 4

Enter graph data in matrix form: 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0

1. BFS

2. DFS

3. Exit 1

Enter the starting vertex:0

BFS is not possible

EXPIREMENT :12

9) Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers.

Develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

ALGORITHM:

Step 1: Start.

Step 2: Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F.

Step 3: Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT.

Step 4: Let the keys in K and addresses in L are Integers

Step 5: Hash function H: K ®L as H(K)=K mod m (remainder method)

Step 6: Hashing as to map a given key K to the address space L, Resolve the collision (if any) is using linear probing.

Step 7: Stop.

PROGRAM CODE:

```
#include <stdio.h>

#include <stdlib.h>

#define MAX 100

int create(int);

void display (int[]);

void main()

{

int a[MAX],num,key,i;
```

```
int ans=1;
printf(" collision handling by linear probing : \n");
for (i=0;i<MAX;i++)
{
a[i] = -1;
}
do
{
printf("\n Enter the data");
scanf("%4d", &num);
key=create(num);
linear_prob(a,key,num);
printf("\n Do you wish to continue ? (1/0) ");
scanf("%d",&ans);
}while(ans);
display(a);
}
int create(int num)
{
int key;
key=num%100;
return key;
}
void linear_prob(int a[MAX], int key, int num)
{
int flag, i, count=0;
flag=0;
if(a[key]== -1)
{
```

```
a[key] = num;
}
else
{
printf("\nCollision Detected...!!!\n");
i=0;
while(i<MAX)
{
if (a[i]!=-1)
count++;
i++;
}
printf("Collision avoided successfully using LINEAR PROBING\n");
if(count == MAX)
{
printf("\n Hash table is full");
display(a);
exit(1);
}
for(i=key+1; i<MAX; i++)
if(a[i] == -1)
{
a[i] = num;
flag =1;
break;
}
//for(i=0;i<key;i++)
i=0;
while((i<key) && (flag==0))
```

```
{
if(a[i] == -1)
{
a[i] = num;
flag=1;
break;
}
i++;
}
}
}
void display(int a[MAX])
{
int i,choice;
printf("1.Display ALL\n 2.Filtered Display\n");
scanf("%d",&choice);
if(choice==1)
{
printf("\n the hash table is\n");
for(i=0; i<MAX; i++)
printf("\n %d %d ", i, a[i]);
}
else
{
printf("\n the hash table is\n");
for(i=0; i<MAX; i++)
if(a[i]!=-1)
{
printf("\n %d %d ", i, a[i]);
```

```
continue;
}
}
}
```

SAMPLE OUTPUT 1:

collision handling by linear probing :

Enter the data1234

Do you wish to continue ? (1/0) 1 Enter the data2548

Do you wish to continue ? (1/0) 1 Enter the data3256

Do you wish to continue ? (1/0) 1 Enter the data1299

Do you wish to continue ? (1/0) 1 Enter the data1298

Do you wish to continue ? (1/0) 1 Enter the data1398

Collision Detected...!!! Collision avoided successfully using LINEAR PROBING

Do you wish to continue ? (1/0) 0

1. Display ALL
2. Filtered Display 2 the hash table is 0 1398 34 1234 48 2548 56 3256 98 1298 99 1299