

1. Develop a Program in C for the following:

- 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).**
- 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.**

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

#define NUM_DAYS_IN_WEEK 7
// Structure to represent a day
typedef struct
{
    char *acDayName;
    int iDate;
    char *acActivity;
} DAYTYPE;
void fnFreeCal (DAYTYPE *);
void fnDispCal (DAYTYPE *);
void fnReadCal (DAYTYPE *);
DAYTYPE *fnCreateCal();

int main()
{
    // Create the calendar
    DAYTYPE *weeklyCalendar = fnCreateCal();
    // Read data from the keyboard
    fnReadCal (weeklyCalendar);
    //display the week activity details
    fnDispCal(weeklyCalendar);
    // Free allocated memory
    fnFreeCal (weeklyCalendar);
    return 0;
}
DAYTYPE *fnCreateCal ()
{
    DAYTYPE *calendar = (DAYTYPE *)malloc( NUM_DAYS_IN_WEEK *sizeof(DAYTYPE));
    for (int i = 0; i < NUM_DAYS_IN_WEEK; i++)
    {
        calendar[i].acDayName = NULL;
        calendar[i].iDate = 0;
        calendar[i].acActivity = NULL;
    }
    return calendar;
}
```

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```
}
void fnReadCal (DAYTYPE *calendar)
{
char cChoice;
for (int i = 0; i < NUM_DAYS_IN_WEEK; i++)
{
    printf("Do you want to enter details for day %d [Y/N]: ", i + 1);
    scanf("%c", &cChoice);
    getchar();
    if (tolower(cChoice) == 'n')
        continue;
    printf("Day Name: ");
    char nameBuffer[50];
    scanf("%s", &nameBuffer);
    calendar[i].acDayName = strdup (nameBuffer); // Dynamically allocate and copy the string
    printf("Date: ");
    scanf("%d", &calendar[i].iDate);
    printf("Activity: ");
    char activityBuffer[100];
    scanf("%S", &activityBuffer); // Read the entire line including spaces
    calendar[i].acActivity = strdup (activityBuffer);
    printf("\n");
    getchar(); //remove trailing enter character in input buffer
}
}

void fnDispCal (DAYTYPE *calendar)
{
printf("\nWeek's Activity Details:\n");
for (int i = 0; i < NUM_DAYS_IN_WEEK; i++)
{
printf("Day %d:\n", i + 1);
if (calendar[i].iDate == 0)
{
    printf("No Activity\n\n");
    continue;
}
printf(" Day Name: %s\n", calendar[i].acDayName);
printf(" Date: %d\n", calendar [i].iDate);
printf(" Activity: %s\n\n", calendar[i].acActivity);
}
}

void fnFreeCal (DAYTYPE *calendar)
{
for(int i = 0; i < NUM_DAYS_IN_WEEK; i++)
{
    free (calendar[i].acDayName);
    free (calendar[i].acActivity);
}
}
```

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BCSL305

```
free(calendar);  
}
```

OUT PUT:

Do you want to enter details for day 1 [Y/N]: y Day Name: Monday Date: 1 Activity: Meeting with clients Do you want to enter details for day 2 [Y/N]: y Day Name: Tuesday Date: 2 Activity: Gym workout Do you want to enter details for day 3 [Y/N]: y Day Name : Wednesday Date: 3 Activity: Movie night wit Do you want to enter details for day 4 [Y/N]: n Do you want to enter details for day 5 [Y/N]: n Do you want to enter details for day 6 [Y/N]: n Do you want to enter details for day 7 [Y/N]: n Week's Activity Details:	Day 1: Day Name: Monday Date: 1 Activity: Meeting with clients Day 2: Day Name: Tuesday Date: 2 Activity: Gym workout Day 3: Dat Name: Wednesday Date: 3 Activity: Movie night with friends Day 4: No Activity Day 5: No Activity Day 6: No Activity Day 7: No Activity
--	--

2. Develop 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.

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
int main()
{
    char acMainStr[200], acSrchStr[30], acRepStr[30], acResStr[200], acCopyStr[200];
    int i=0, j=0, k=0, l, iMtchCnt, iStop, len, iNumOfMatch=0;

    printf("\nEnter the main string :\n");
    scanf(" %[^\\n]", acMainStr);

    printf("\nEnter the Pattern string :\n");
    scanf(" %[^\\n]", acSrchStr);
    printf("\nEnter the Replace string :\n");
    scanf(" %[^\\n]", acRepStr);
    strcpy(acCopyStr, acMainStr);
    for(i=0; i<(strlen(acMainStr)-strlen(acSrchStr)+1); i++)
    {
        iMtchCnt = 0;
        for(j=0; j<strlen(acSrchStr); j++)
        {
            if(acMainStr[i+j] == acSrchStr[j])
            {
                iMtchCnt++;
            }
            else
            {
                break;
            }
        }
    }
}
```

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BCSL305

```
        if(iMtchCnt == strlen(acSrchStr))    //Check if number of character matches equals
length of pattern string
        {
            iNumOfMatch++;                //update number of total matches by 1
            for(k=0;k<i;k++)
            {
                acResStr[k] = acMainStr[k];    //copy till the ith character where the match
occured
            }
            iStop = k + strlen(acSrchStr); //point from where rest of the original string has to be
copied
            acResStr[k] = '\0';
            strcat(acResStr, acRepStr); // append the replacement string
            len = strlen(acResStr);
            for(k=iStop, l=0; acMainStr[k] != '\0';k++, l++) //copy rest of original string
            {
                acResStr[len+l] = acMainStr[k];
            }
            acResStr[len+l] = '\0';
            strcpy(acMainStr,acResStr);
        }
    }
    printf("\nInput Text :\n");
    printf("%s\n",acCopyStr);
    if(iNumOfMatch > 0)
    {
        printf("\n%d matches occurred\n\nText after replacing matched patterns is shown below\n",
iNumOfMatch);
        printf("\n%s\n",acResStr);
    }
    else
    {
        printf("\nPattern String not found in Text\n");
    }
    return 0;
}
```

OUT PUT:

```
Enter the main string :
Hello , this is a test string
Enter the Pattern string :
is
Enter the Replace string :
was
Input Text :
Hello , this is a test string
```

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2 matches occurred

Text after replacing matched patterns is shown below

Hello , thwas a test string

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**

```
#include <stdio.h>
#include <stdlib.h>
#include <stdbool.h>
```

```
#define MAX 4
```

```
bool fnStkFull(int);
bool fnStkEmpty(int);
void fnPush(int [], int, int*);
int fnPop(int [], int*);
void fnDisplay(int[], int);
int fnPeek(int [], int);
bool fnChkPalindrome(int);
```

```
int main(void)
{
    int stkArray[MAX];
    int top = -1;
    int iElem, iChoice;
    for(;;)
```


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```
{
    printf("\nSTACK OPERATIONS\n");
    printf("=====");
    printf("\n 1.Push\n 2.Pop\n 3.Display\n 4.Peek\n 5.CheckPalindrome\n
6.DemonstrateOverflow\n 7.Demonstrate Underflow\n 8.EXIT\n");
    printf("Enter your choice\n");
    scanf("%d",&iChoice);
    switch(iChoice)
    {
        case 1: if(!fnStkFull(top))
            {
                printf("\nEnter element to be pushed onto the stack\n");
                scanf("%d", &iElem);
                fnPush(stkArray, iElem, &top);
            }
            else
            {
                printf("\nStack Overflow\n");
            }
        break;
        case 2: if(!fnStkEmpty(top))
            {
                iElem = fnPop(stkArray, &top);
                printf("\nPopped Element is %d\n", iElem);
            }
            else
            {
                printf("\nStack Underflow\n");
            }
        break;

        case 3: if(fnStkEmpty(top))
            {
                printf("\nStack Empty\n");
            }
            else
            {
                fnDisplay(stkArray, top);
            }
            break;

        case 4: if(!fnStkEmpty(top))
            {
                iElem = fnPeek(stkArray, top);
                printf("\nElement at the top of the stack is %d\n", iElem);
            }
            else
                printf("\nEmpty Stack\n");
    }
}
```

```
        break;

    case 5: printf("\nEnter number to be checked for a palindrome : ");
            scanf("%d", &iElem);
            if(fnChkPalindrome(iElem))
            {
                printf("\n%d is a palindrome\n", iElem);
            }
            else
            {
                printf("\n%d is not a palindrome\n", iElem);
            }
            break;

    case 6: if(!fnStkFull(top))
            printf("\nThere are currently %d elements in Stack\nPush %d elemnts for Stack to
overflow", top+1, MAX - (top+1));
            while(!fnStkFull(top))
            {
                printf("\nEnter an element : ");
                scanf("%d", &iElem);
                fnPush(stkArray, iElem, &top);
            }
            printf("\nStack Overflow cannot push elements onto the stack\n");
            break;

    case 7: if(!fnStkEmpty(top))
            printf("\nThere are currently %d elements in Stack\nPop out %d elemnts for Stack
to Underflow", top+1, MAX - (top+1));
            while(!fnStkEmpty(top))
            {
                iElem = fnPop(stkArray, &top);
                printf("\nPopped Element is %d\n", iElem);
            }
            printf("\nStack Underflow cannot pop elements from the stack\n");
            break;

    case 8: exit(1);

            default: printf("\nWrong choice\n");
        }
    }
    return 0;
}

bool fnStkFull(int t)
{
    return ((t == MAX-1) ? true : false);
}
```

```
}

bool fnStkEmpty(int t)
{
    return ((t == -1) ? true : false);
}

void fnPush(int stk[], int iElem, int *t)
{
    *t = *t + 1;
    stk[*t] = iElem;
}

int fnPop(int stk[], int *t)
{
    int iElem;
    iElem = stk[*t];
    *t = *t - 1;

    return iElem;
}

void fnDisplay(int stk[], int t)
{
    int i;

    printf("\nStack Contents are: \n");
    for(i = t ; i > -1; --i)
    {
        printf("\t%d\n", stk[i]);
    }
    printf("Stack has %d elements\n", t+1);
}

int fnPeek(int stk[], int t)
{
    return stk[t];
}

bool fnChkPalindrome(int iVal)
{
    int palStk[10];
    int t = -1, iDig, iRev = 0;

    int iCopy = iVal;

    while(iCopy != 0)
    {
```

DATA STRUCTURES LAB
BCSL305

```
        iDig = iCopy % 10;
        fnPush(palStk, iDig, &t);
        iCopy /= 10;
    }
    int p = 0;
    while(p <= t)
    {
        iDig = palStk[p];
        iRev = iRev *10 + iDig;
        p++;
    }
    if(iRev == iVal)
        return true;
    else
        return false;
}
```

OUT PUT:

<p>STACK OPERATIONS</p> <p>=====</p> <p>1.Push</p> <p>2.Pop</p> <p>3.Display</p> <p>4.Peek</p> <p>5.CheckPalindrome</p> <p>6.DemonstarteOverflow</p> <p>7.Demonstarte Underflow</p> <p>8.EXIT</p> <p>Enter your choice</p> <p>1</p> <p>Enter element to be pushed onto the stack</p> <p>8</p> <p>STACK OPERATIONS</p> <p>=====</p> <p>1.Push</p> <p>2.Pop</p> <p>3.Display</p> <p>4.Peek</p> <p>5.CheckPalindrome</p> <p>6.DemonstarteOverflow</p>	<p>3</p> <p>Stack Contents are:</p> <p>8</p> <p>Stack has 1 elements</p> <p>STACK OPERATIONS</p> <p>=====</p> <p>1.Push</p> <p>2.Pop</p> <p>3.Display</p> <p>4.Peek</p> <p>5.CheckPalindrome</p> <p>6.DemonstarteOverflow</p> <p>7.Demonstarte Underflow</p> <p>8.EXIT</p> <p>Enter your choice</p> <p>1</p> <p>Enter element to be pushed onto the stack</p> <p>6</p> <p>STACK OPERATIONS</p> <p>=====</p> <p>1.Push</p> <p>2.Pop</p>
--	--

DATA STRUCTURES LAB
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7.Demonstarte Underflow 8.EXIT Enter your choice	3.Display 4.Peek 5.CheckPalindrome
6.DemonstarteOverflow 7.Demonstarte Underflow 8.EXIT Enter your choice 5 Enter number to be checked for a palindrome : 1331 1331 is a palindrome STACK OPERATIONS =====	Enter your choice 2 Popped Element is 6 STACK OPERATIONS =====
1.Push 2.Pop 3.Display 4.Peek 5.CheckPalindrome 6.DemonstarteOverflow 7.Demonstarte Underflow 8.EXIT	1.Push 2.Pop 3.Display 4.Peek 5.CheckPalindrome 6.DemonstarteOverflow 7.Demonstarte Underflow 8.EXIT Enter your choice

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.

```
#include <stdio.h>
#include <ctype.h>
#include <stdlib.h>
#include <string.h>
#define STK_SIZE 10
void fnPush(char [], int*, char);
char fnPop(char [], int*);
int fnPreced(char);
```

```
int main()
{
int i, j=0;
char acExpr[50], acStack[50], acPost[50], cSymb;
int top = -1;
printf("\nEnter a valid infix expression : \n");
scanf("%s", acExpr);
fnPush(acStack, &top, '#');
for(i=0;acExpr[i]!='\0'; ++i)
{
cSymb = acExpr[i];
if(isalnum(cSymb))
{
acPost[j++] = cSymb;
}
else if(cSymb == '(')
{
fnPush(acStack, &top, cSymb);
}
else if(cSymb == ')')
{
while(acStack[top] != '(')
{
acPost[j++] = fnPop(acStack, &top);
}
fnPop(acStack, &top);
}
else
{
while(fnPreced(acStack[top]) >= fnPreced(cSymb))
{
if((cSymb == '^') && (acStack[top] == '^'))
break;
acPost[j++] = fnPop(acStack, &top);
}
fnPush(acStack, &top, cSymb);
}
}
while(acStack[top] != '#')
{
acPost[j++] = fnPop(acStack, &top);
}
acPost[j] = '\0';
printf("\nInfix Expression is :%s\n", acExpr);
printf("\nPostfix Expression is :%s\n", acPost);
return 0;
}
```

```
void fnPush(char Stack[], int *t, char elem)
```

```
{  
    *t = *t + 1;  
    Stack[*t] = elem;  
}
```

```
char fnPop(char Stack[], int *t)
```

```
{  
    char elem;  
    elem = Stack[*t];  
    *t = *t - 1;
```

```
    return elem;  
}
```

```
int fnPrecd(char ch)
```

```
{  
    int iPrecdVal;  
    switch(ch)  
    {  
        case '#': iPrecdVal = -1; break;  
        case '(': iPrecdVal = 0; break;  
        case '+':  
        case '-': iPrecdVal = 1; break;  
        case '%':  
        case '*':  
        case '/': iPrecdVal = 2; break;  
        case '^': iPrecdVal = 3; break;  
    }
```

```
    return iPrecdVal;  
}
```

OUT PUT:

Enter a valid infix expression :

A*(B+D)/E-F*(G+H/K)

Infix Expression is : A*(B+D)/E-F*(G+H/K)

Postfix Expression is : ABD+*E/FGHK/+*-

5. Develop a Program in C for the following Stack Applications

- a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^

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

```
void push(int [], int*, int);
```

```
int pop(int [], int*);
```

```
int main()
```

```
{  
    int iastack[50], i, op1, op2, res;  
    char expr[50], symb;
```



```
int top = -1;
printf("\nEnter a valid postfix expression : \n");
scanf("%s", expr);
for(i=0; i<strlen(expr); i++)
{ symb = expr[i];
if(isdigit(symb))
{
push(iastack, &top, symb-'0');
}
else
{
op2 = pop(iastack, &top);
op1 = pop(iastack, &top);
switch(symb)
{ case '+': res = op1 + op2;
break;
case '-': res = op1 - op2;
break;
case '*': res = op1 * op2;
break;
case '/': res = op1 / op2;
break;
case '%': res = op1 % op2;
break;
case '^': res = (int)pow(op1 , op2);
break;
}
push(iastack, &top, res);
}
}
res = pop(iastack, &top);
printf("\nValue of %s expression is : %d\n", expr, res);
return 0;
}

void push(int Stack[], int *t , int elem)
{
*t = *t + 1;
Stack[*t] = elem;
}

int pop(int Stack[], int *t)
{
int elem;
elem = Stack[*t];
*t = *t -1;
return elem;
}
```

OUT PUT:

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Enter a valid postfix expression :

456565+-/*()

Value of 456565+-/*() expression is : -5

5. Develop a Program in C for the following Stack Applications

b. Solving Tower of Hanoi problem with n disks

```
#include <stdio.h>
void towers(int, char, char, char);
int main()
{
    int num;
    printf("Enter the number of disks : ");
    scanf("%d", &num);
    printf("The sequence of moves involved in the Tower of Hanoi are :\n");
    towers(num, 'A', 'C', 'B');
    printf("\n");
    return 0;
}
void towers(int num, char frompeg, char topeg, char auxpeg)
{
    if (num == 1)
    {
        printf("\n Move disk 1 from peg %c to peg %c", frompeg, topeg);
        return;
    }
    towers(num - 1, frompeg, auxpeg, topeg);
    printf("\n Move disk %d from peg %c to peg %c", num, frompeg, topeg);
    towers(num - 1, auxpeg, topeg, frompeg);
}
```

OUT PUT:

```
Enter the number of disks : 3
The sequence of moves involved in the Tower of Hanoi are :Move disk 1 from peg A to peg C
Move disk 2 from peg A to peg B
Move disk 1 from peg C to peg B
Move disk 3 from peg A to peg C
Move disk 1 from peg B to peg A
Move disk 2 from peg B to peg C
Move disk 1 from peg A to peg C
```

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.**

```
#include <stdio.h>
#include <stdlib.h>
#include <stdbool.h>
#define SIZE 5
void insert(char [], int*, int*, char);
char del(char[], int*, int*);
void display(char [], int, int);
bool qfull(int, int);
bool qempty(int, int);
int main()
{
    char q[SIZE];
    int f = -1, r = -1;
    int ch;
    char elem;
    for(;;)
    {
        printf("\nQueue Operations\n");
        printf("=====");
        printf("\n1.Qinsert\n2.Qdelete\n3.Qdisplay\n4.Exit\n");
        printf("Enter your choice\n");
        scanf("%d",&ch);
        getchar();
        switch(ch)
        {
            case 1: if(!qfull(f,r))
            {
                printf("\nEnter an element : ");
                scanf("%c", &elem);
                insert(q, &f, &r, elem);
            }
            else
            {
                printf("\nQueue is Full\n");
            }
            break;

            case 2: if(!qempty(f, r))
            {
                elem = del(q, &f, &r);
                printf("\nDeleted element is %c\n", elem);
            }
            else
            {
                printf("\nQueue is Empty\n");
            }
            break;

            case 3: display(q, f, r);
            break;

            case 4: exit(0);
            break;

            default: printf("\nInvalid choice\n");
        }
    }
}
```

```
{
printf("\nQueue is Empty\n");
}
break;
case 3: if(!qempty(f, r))
{
printf("\nContents of the Queue is \n");
display(q, f, r);
}
else
{
printf("\nQueue is Empty\n");
}
break;
case 4: exit(0);
default: printf("\nInvalid choice\n");
break;
}
}
return 0;
}
bool qfull(int fr, int rr)
{
if((rr+1) % SIZE == fr)
return true;
else
return false;
}
bool qempty(int fr, int rr)
{
if(fr == -1)
return true;
else
return false;
}
void insert(char queue[], int *f, int *r, char val)
{
if(*r == -1)
{
*f = *f + 1;

*r = *r + 1;
}
else
*r = (*r + 1)%SIZE;
queue[*r] = val;
}
char del(char queue[], int *f, int *r)
```

```
{
char el;
el = queue[*f];
if(*f == *r)
{
*f = -1;
*r = -1;
}
else
{
*f = (*f + 1)%SIZE;
}
return el;
}
void display(char queue[], int fr, int rr)
{
int i;
if(fr<=rr)
{
for(i=fr; i<=rr; i++)
{
printf("%c\t", queue[i]);
}
printf("\n");
}
else
{
for(i=fr; i<=SIZE-1; i++)
{
printf("%c\t", queue[i]);
}
for(i=0; i<=rr; i++)
{
printf("%c\t", queue[i]);
}
printf("\n");
}
}
```

OUT PUT:

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<p>Queue Operations =====</p> <p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice 1 Enter an element : 23 Queue Operations =====</p> <p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice 1 Enter an element : 19 Queue Operations =====</p> <p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice Invalid choice Queue Operations =====</p>	<p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice 1 Enter an element : 34 Queue Operations =====</p> <p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice Invalid choice Queue Operations =====</p> <p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice 3 Contents of the Queue is 2 1 3 Queue Operations =====</p> <p>1.Qinsert</p>
<p>2.Qdelete 3.Qdisplay 4.Exit Enter your choice 2 Deleted element is 5 Queue Operations =====</p> <p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice 3 Contents of the Queue is 1 3 Queue Operations =====</p>	<p>Queue Operations =====</p> <p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice 2 Deleted element is 8 Queue Operations =====</p> <p>1.Qinsert 2.Qdelete 3.Qdisplay 4.Exit Enter your choice 3 Queue is Empty</p>

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**

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
struct node
{
char usn[11], name[40], prog[4];
int sem;
char ph[11];
struct node *link;
};
typedef struct node* PTR;
PTR get(void);
void freeN(PTR);
PTR insrear(PTR);
PTR delfront(PTR);
PTR insfront(PTR);
PTR delrear(PTR);
void disp(PTR);
int main()
{
PTR first = NULL;
int ch, num, i;
printf("\nEnter the number of Students N : ");
scanf("%d", &num);
for(i=0;i<num;i++)
{
printf("\nEnter Data for Node %d :\n", i+1);
first = insfront(first);
}
for(;;)
{
printf("\nQUEUE OPERATIONS\n");
printf("=====");
```

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```
printf("\n1.Insert Front\n2.Insert Rear\n3.Delete Front\n4.Delete Rear\n5.Display\n6.Exit\n");
printf("\nEnter your choice\n");
scanf("%d",&ch);
```

```
switch(ch)
{
case 1: first = insfront(first);
break;
case 2: first = insrear(first);
break;
case 3: first = delfront(first);
break;
case 4: first = delrear(first);
break;
case 5: disp(first);
break;
case 6: exit(0);
}
}
return 0;
}
PTR get()
{
PTR newborn;
newborn = (PTR)malloc(sizeof(struct node));
if(newborn == NULL)
{
printf("\nMemory Overflow");
exit(0);
}
printf("\nEnter USN : ");
scanf("%s",newborn->usn);
printf("\nEnter name : ");
scanf("%s",newborn->name);
printf("\nEnter Program name : ");
scanf("%s", newborn->prog);
printf("\nEnter semester : ");
scanf("%d",&newborn->sem);
printf("\nEnter Phone no : ");
scanf("%s",newborn->ph);
return newborn;
}
void freeN(PTR x)
{
free(x);
}
```

```
PTR insrear(PTR first)
```

```
{
PTR temp,cur;
temp = get();
temp->link = NULL;
if(first == NULL)
return temp;
cur = first;
while(cur->link != NULL)
{
cur = cur->link;
}
cur->link = temp;
return first;
}
PTR delfront(PTR first)
{
PTR temp;
if(first == NULL)
{
printf("\nSLL is empty cannot delete\n");
return first;
}
temp = first;
first = first->link;
printf("\nNode deleted is %s\n",temp->name);
freeN(temp);
return first;
}
void disp(PTR first)
{
PTR curr;
int count = 0;
if(first == NULL)
{
printf("\nSLL is empty\n");
return;
}
printf("\nThe contents of SLL are :\n");
curr = first;
printf("\nUSN\tName\tProgram\tSem\tPhone num");
while(curr != NULL)
{
printf("\n%10s\t%s\t%s\t%d\t%s",curr->usn, curr->name, curr->prog, curr->sem, curr->ph);

curr = curr->link;
count++;
}
printf("\n\nSLL has %d nodes\n", count);
```

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BCSL305

```

}
PTR insfront(PTR first)
{
PTR temp;
temp = get();
temp->link = NULL;
temp->link = first;
first = temp;
return first;
}
PTR delrear(PTR first)
{
PTR cur, prev;
if(first == NULL)
{
printf("\nSLL is empty cannot delete\n");
return first;
}
prev = NULL;
cur = first;
if(cur->link == NULL)
{
printf("\nNode deleted for %s\n",cur->name);
freeN(cur);
return NULL;
}
while(cur->link != NULL)
{
prev = cur;
cur = cur->link;
}
prev->link = cur->link;
printf("\nNode deleted for %s\n",cur->name);
freeN(cur);
return first;
}

```

OUT PUT:

Enter the number of Students N : 2 Enter Data for Node 1 : Enter USN : 2VX22CB048 Enter name : Shilpa Enter Program name : CSBS Enter semester : 3 Enter Phone no : 9854672290 Enter Data for Node 2 : Enter USN : 2VX22CB029 Enter name : Shreya Enter Program name : CSBS	5.Display 6.Exit Enter your choice 5 The contents of SLL are : <table><tr><th>USN</th><th>Name</th><th>Program Sem</th><th>phone num</th></tr><tr><td>2VX22CB048</td><td>Shilpa.</td><td>CSBS.</td><td></td></tr><tr><td>9854672290</td><td></td><td></td><td></td></tr><tr><td>2VX22CB029</td><td>Shreya</td><td>CSBS.</td><td></td></tr><tr><td>8615475682</td><td></td><td></td><td></td></tr></table>	USN	Name	Program Sem	phone num	2VX22CB048	Shilpa.	CSBS.		9854672290				2VX22CB029	Shreya	CSBS.		8615475682			
USN	Name	Program Sem	phone num																		
2VX22CB048	Shilpa.	CSBS.																			
9854672290																					
2VX22CB029	Shreya	CSBS.																			
8615475682																					

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Enter semester : 3
Enter Phone no : 8615475672

QUEUE OPERATIONS

=====

- 1.Insert Front
- 2.Insert Rear
- 3.Delete Front
- 4.Delete Rear

SLL has 2 nodes

QUEUE OPERATIONS

=====

- 1.Insert Front
- 2.Insert Rear
- 3.Delete Front
- 4.Delete Rear
- 5.Display
- 6.Exit

Enter your choice

3

Node deleted is keerti

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Node deleted for Shilpa
QUEUE OPERATIONS

=====

- 1.Insert Front
- 2.Insert Rear
- 3.Delete Front
- 4.Delete Rear
- 5.Display
- 6.Exit

Enter your choice

5

The contents of SLL are :

USN	Name	Program	Sem
Phone num			

SLL has 0 nodes

QUEUE OPERATIONS

=====

- 1.Insert Front
- 2.Insert Rear
- 3.Delete Front
- 4.Delete Rear
- 5.Display

6.Exit

QUEUE OPERATIONS

=====

- 1.Insert Front
- 2.Insert Rear
- 3.Delete Front
- 4.Delete Rear
- 5.Display
- 6.Exit

Enter your choice

2

Enter USN : 2VX22CB040

Enter name : Shivu

Enter Program name : CSBS

Enter semester : 3

Enter Phone no : 123456

Enter your choice

Enter your choice

1

Enter USN : 2VX22CB030

Enter name : shilz

Enter Program name : CSBS

Enter semester : 3

Enter Phone no : 921437

QUEUE OPERATIONS

=====

- 1.Insert Front
- 2.Insert Rear
- 3.Delete Front
- 4.Delete Rear
- 5.Display
- 6.Exit

Enter your choice

5

The contents of SLL are :

USN	Name	Program	Sem
Phone num			

2VX22CB030	shilz	CSBS	3
921438			

2VX22CB040	shivu	CSBS	3
123456			

SLL has 2 nodes

QUEUE OPERATIONS

=====

- 1.Insert Front
- 2.Insert Rear
- 3.Delete Front
- 4.Delete Rear
- 5.Display
- 6.Exit

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**

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
struct node
{
int usn;
char name[30], dept[4], desig[30], ph[11];
int sal;
struct node *plink;
struct node *nlink;
};
typedef struct node* NODE;
NODE getn(void);
void freen(NODE);
NODE insrear(NODE);
NODE delfront(NODE);
NODE insfront(NODE);
NODE delrear(NODE);
void disp(NODE);
int main()
{
NODE first = NULL;
int ch, num, i;
printf("\nEnter the number of Employees N : "); scanf("%d", &num);
for(i=0;i<num;i++)
{
printf("\nEnter Data for Node %d :\n", i+1);
first = insrear(first);
}
for(;;)
{
printf("\nDLL OPERATIONS\n");
printf("=====");
```



```
printf("\n1.Insert Rear\n2.Delete Front\n3.Insert Front\n4.Delete Rear\n5.Display\n6.Exit\n");
printf("\nEnter your choice\n");
scanf("%d",&ch);
switch(ch)
{
case 1: first = insrear(first);
break;
case 2: first = delfront(first);
break;
case 3: first = insfront(first);
break;
case 4: first = delrear(first);
break;
case 5: disp(first);
break;
case 6: exit(0);
}
}
return 0;
}
NODE getn()
{
NODE newborn;
newborn = (NODE)malloc(sizeof(struct node));
if(newborn == NULL)
{
printf("\nMemory Overflow");
exit(0);
}
printf("\nEnter SSN : ");
scanf("%d",&newborn->usn);
printf("\nEnter name : ");
scanf("%s",newborn->name);
printf("\nEnter Department : ");
scanf("%s", newborn->dept);
printf("\nEnter Designation : ");
scanf("%s", newborn->desig);
printf("\nEnter Salary : ");
scanf("%d",&newborn->sal);
printf("\nEnter Phone no : ");
scanf("%s",newborn->ph);
return newborn;
}

void freen(NODE x)
{
free(x);
}
```

```
}
NODE insrear(NODE first)
{
    NODE temp,cur;
    temp = getn();
    temp->plink = temp->nlink = NULL;
    if(first == NULL)
        return temp;
    cur = first;
    while(cur->nlink != NULL)
    {
        cur = cur->nlink;
    }
    cur->nlink = temp;
    temp->plink = cur;
    return first;
}
NODE insfront(NODE first)
{
    NODE temp;
    temp = getn();
    temp->plink = temp->nlink = NULL;
    temp->nlink = first;
    first = temp;
    return first;
}
NODE delrear(NODE first)
{
    NODE cur, prev;
    if(first == NULL)
    {
        printf("\nDLL is empty\n");
        return first;
    }

    cur = first;
    if(cur->nlink == NULL)
    {
        printf("\nNode deleted for %s\n",cur->name);
        free(cur);
        return NULL;
    }
    while(cur->nlink != NULL)
    {
        cur = cur->nlink;
    }
    prev = cur->plink;
    prev->nlink = NULL;
```

```
printf("\nNode deleted for %s\n",cur->name);
freen(cur);
return first;
}
NODE delfront(NODE first)
{
    NODE temp;
    if(first == NULL)
    {
        printf("\nDLL is empty\n");
        return first;
    }
    if(first->nlink == NULL)
    {
        printf("\nNode deleted for %s\n",first->name);
        freen(first);
        return NULL;
    }
    temp = first;
    first = first->nlink;
    first->plink = NULL;
    printf("\nNode deleted for %s\n",temp->name);
    freen(temp);
    return first;
}

void disp(NODE first)
{
    NODE curr;
    int count = 0;
    if(first == NULL)
    {
        printf("\nDLL is empty\n");
        return;
    }
    printf("\nThe contents of DLL are :\n");
    curr = first;
    printf("\nSSN\tName\tDept\tDesignation\tSalary\tPhone No");
    while(curr != NULL)
    {
        printf("\n%-5d\t%s\t%s\t%s\t%-7d\t%-11s",curr->usn, curr->name, curr->dept, curr->desig,
            curr->sal, curr->ph);
        curr = curr->nlink;
        count++;
    }
    printf("\n\nDLL has %d nodes\n", count);
}
```

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OUT PUT:

Enter the number of Employees N : 1 Enter Data for Node 1 : Enter SSN : 123 Enter name : Shilpa Enter Department : CSBS Enter Designation : aim Enter Salary : 40000 Enter Phone no : 98765 DLL OPERATIONS =====	DLL OPERATIONS =====				
1.Insert Rear 2.Delete Front 3.Insert Front 4.Delete Rear 5.Display 6.Exit Enter your choice 5	1.Insert Rear 2.Delete Front 3.Insert Front 4.Delete Rear 5.Display 6.Exit Enter your choice 5				
	The contents of DLL are :				
	SSN	Name	Dept	Designation	Salary
		Phone No			
	123	Shilpa	CSBS	aim	40000
		98765			
	126	Shilzz	CSBS	aim	90000
		123456			
Enter your choice 1	DLL has 2 nodes				
Enter SSN : 234 Enter name : Shilzz Enter Department : CSBS Enter Designation : aim Enter Salary : 90000 Enter Phone no : 123456	DLL OPERATIONS =====				
	1.Insert Rear 2.Delete Front 3.Insert Front 4.Delete Rear 5.Display 6.Exit Enter your choice 1				

Enter your choice 5 The contents of DLL are :	Enter SSN : 678 Enter name : chandan Enter Department : CDBS Enter Designation : aim Enter Salary : 54000 Enter Phone no : 01233 DLL OPERATIONS
SSN Name Dept Designation Salary Phone No 126 shreya CSBS aim 70000 12344	

DATA STRUCTURES LAB
BCSL305

678 chandan CSBS aim 54000 01233 DLL has 2 nodes DLL OPERATIONS =====	=====
1.Insert Rear 2.Delete Front 3.Insert Front 4.Delete Rear 5.Display 6.Exit Enter your choice 4 Node deleted for asd DLL OPERATIONS =====	1.Insert Rear 2.Delete Front 3.Insert Front 4.Delete Rear 5.Display 6.Exit Enter your choice 2 Node deleted for sky DLL OPERATIONS =====
1.Insert Rear 2.Delete Front 3.Insert Front 4.Delete Rear 5.Display 6.Exit	1.Insert Rear 2.Delete Front 3.Insert Front 4.Delete Rear 5.Display 6.Exit

DATA STRUCTURES LAB
BCSL305

Enter your choice

5

The contents of DLL are :

SSN	Name	Dept	Designation	Salary	Phone No
126	shreya	CSBS	aim	70000	12344

DLL has 1 nodes

DLL OPERATIONS

=====

1.Insert Rear

2.Delete Front

3.Insert Front

4.Delete Rear

5.Display

6.Exit

Enter your choice

3

Enter SSN : 485

Enter name : chadan

Enter Department : CSBS

Enter Designation : aim

Enter Salary : 54000

Enter Phone no : 01233

DLL OPERATIONS

=====

1.Insert Rear

2.Delete Front

3.Insert Front

4.Delete Rear

5.Display

6.Exit

Enter your choice

5

The contents of DLL are :

SSN	Name	Dept	Designation	Salary	Phone No
485	chandan	CSBS	aim	54000	01233
126	shilz	CSBS	aim	12344	5689652

DLL has 2 nodes

9. Develop a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes

a. Represent and Evaluate a Polynomial

$$P(x,y,z) = 6x^2y^2z - 4yz^5 + 3x^3yz + 2xy^5z - 2xyz^3$$

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

```
#include <stdio.h>
#include <stdlib.h>
#include <stdbool.h>
#include <math.h>
struct polyt
{
int cf,px, py,pz;
struct polyt* next;
};
typedef struct polyt* PTR;
PTR insert(PTR poly, int cf, int px, int py, int pz)
{
PTR cur;
PTR nn = (PTR)malloc(sizeof(struct polyt));
nn->cf = cf;
nn->px = px;
nn->py = py;
nn->pz = pz;
nn->next = NULL;
cur = poly;
while(cur->next != poly)
{
cur = cur->next;
}
cur->next = nn;
nn->next = poly;
return poly;
}

void disp(PTR poly)
{
if (poly->next == poly)
{
printf("Polynomial is empty.\n");
return;
}
PTR cur = poly->next;
do
{
printf("%dx^%dy^%dz^%d ", cur->cf, cur->px, cur->py, cur->pz);
cur = cur->next;
if (cur != poly)
```



```
{
printf("+ ");
}
} while (cur != poly);
printf("\n");
}
int evaluate(PTR poly, int x, int y, int z)
{
int result = 0;
if (poly->next == poly)
{
return result;
}
PTR cur = poly->next;
do
{
int termValue = cur->cf;
termValue *= pow(x, cur->px);
termValue *= pow(y, cur->py);
termValue *= pow(z, cur->pz);
result += termValue;
cur = cur->next;
} while (cur != poly);
return result;
}

bool fmatch(PTR p1, PTR p2)
{
bool match = true;
if(p1->px != p2->px)
match = false;
if(p1->py != p2->py)
match = false;
if(p1->pz != p2->pz)
match = false;
return match;
}

PTR add(PTR poly1, PTR poly2, PTR polySum)
{
PTR cur1 = poly1->next;
PTR cur2 = poly2->next;
do
{
polySum = insert(polySum, cur1->cf, cur1->px, cur1->py, cur1->pz);
cur1 = cur1->next;
} while(cur1 != poly1);
do
{

```

```
cur1 = polySum->next;
bool matchfound = false;
do
{
if(fmatch(cur1, cur2))
{
cur1->cf += cur2->cf;
matchfound = true;
break;
}
cur1 = cur1->next;
} while(cur1 != polySum);
if(!matchfound)
{
polySum = insert(polySum, cur2->cf, cur2->px, cur2->py, cur2->pz);
}
cur2 = cur2->next;
} while(cur2 != poly2);
return polySum;
}
```

```
int main()
{
PTR poly1 = (PTR)malloc(sizeof(struct polyt));
poly1->next = poly1;
PTR poly2 = (PTR)malloc(sizeof(struct polyt));
poly2->next = poly2;
PTR polySum = (PTR)malloc(sizeof(struct polyt));
polySum->next = polySum;
poly1 = insert(poly1, 6, 2, 2, 1);
poly1 = insert(poly1, 4, 0, 1, 5);
poly1 = insert(poly1, 3, 3, 1, 1);
poly1 = insert(poly1, 2, 1, 5, 1);
poly1 = insert(poly1, 2, 1, 1, 3);
// Display the polynomial P(x, y, z)
printf("POLY1(x, y, z) = ");
disp(poly1);
// Read and evaluate the second polynomial POLY2(x, y, z)
// Represent the polynomial P(x, y, z) = xyz + 4x^3yz
poly2 = insert(poly2, 1, 1, 1, 1); // Example term
poly2 = insert(poly2, 4, 3, 1, 1);
// Display the second polynomial POLY2(x, y, z)
printf("POLY2(x, y, z) = ");
disp(poly2);
// Add POLY1(x, y, z) and POLY2(x, y, z) and store the result in POLYSUM(x, y, z)
polySum = add(poly1, poly2, polySum);
// Display the sum POLYSUM(x, y, z)
printf("\nPOLYSUM(x, y, z) = ");
```

```
disp(polySum);  
// Evaluate POLYSUM(x, y, z) for specific values  
int x = 1, y = 2, z = 3;  
int res = evaluate(polySum, x, y, z);  
printf("\nResult of POLYSUM(%d, %d, %d): %d\n", x, y, z, res);  
return 0;  
}
```

OUT PUT :

POLY1(x, y, z) = $6x^2y^2z^1 + 4x^0y^1z^5 + 3x^3y^1z^1 + 2x^1y^5z^1 + 2x^1y^1z^3$
POLY2(x, y, z) = $1x^1y^1z^1 + 4x^3y^1z^1$
POLYSUM(x, y, z) = $6x^2y^2z^1 + 4x^0y^1z^5 + 7x^3y^1z^1 + 2x^1y^5z^1 + 2x^1y^1z^3 + 1x^1y^1z^1$
Result of POLYSUM(1, 2, 3): 2364

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

```
#include <stdio.h>

#include <stdlib.h>

Struct node {
    Int data;
    Struct node* left;
    Struct node* right;
};

Struct node* createNode(int value) {
    Struct node* newNode = (struct node*)malloc(sizeof(struct node));
    newNode->data = value;
    newNode->left = NULL;
    newNode->right = NULL;
    return newNode;
}

Struct node* insert(struct node* root, int value) {
    If (root == NULL) {
```

```
    Return createNode(value);
}

If (value < root->data) {
    Root->left = insert(root->left, value);
} else if (value > root->data) {
    Root->right = insert(root->right, value);
}

Return root;
}

Void inorderTraversal(struct node* root) {
    If (root != NULL) {
        inorderTraversal(root->left);
        printf("%d ", root->data);
        inorderTraversal(root->right);
    }
}

Void preorderTraversal(struct node* root) {
    If (root != NULL) {
        Printf("%d ", root->data);
        preorderTraversal(root->left);
        preorderTraversal(root->right);
    }
}

Void postorderTraversal(struct node* root) {
    If (root != NULL) {
        postorderTraversal(root->left);
```

```
        postorderTraversal(root->right);

        printf("%d ", root->data);

    }

}

Struct node* search(struct node* root, int key) {

    If (root == NULL || root->data == key) {

        Return root;

    }

    If (key < root->data) {

        Return search(root->left, key);

    }

    Return search(root->right, key);

}

Int main() {

    Struct node* root = NULL;

    Int choice, key;

    Root = insert(root, 6);

    Root = insert(root, 9);

    Root = insert(root, 5);

    Root = insert(root, 2);

    Root = insert(root, 8);

    Root = insert(root, 15);

    Root = insert(root, 24);

    Root = insert(root, 14);

    Root = insert(root, 7);

    Root = insert(root, 8);
```

Root = insert(root, 5);

Root = insert(root, 2);

Output :

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

BST created successfully!

- b. Traverse the BST in Inorder, Preorder, and Postorder:

Inorder traversal: 2 2 5 5 6 7 8 8 9 14 15 24

Preorder traversal: 6 5 2 2 5 9 8 7 8 15 14 24

Postorder traversal: 2 5 2 5 7 8 14 24 15 8 9 6

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

Enter the element you want to search: 8

Element 8 found in the BST!

- d. Exit

