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**LAB-MANUAL**

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**Department of Computer Science and Engineering**

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**Certificate**

**This certify that Mr./Ms. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with USN \_\_\_\_\_\_\_\_\_\_\_\_\_\_ has satisfactorily completed all the Laboratory Assignment of Subject Data Structures having Subject Code BCSL305 during the academic year 2023-24.**

**Faculty in-charge Course Coordinator**

**Signature of the Examiners**

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**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 calender, 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;

}

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);

}

free(calendar);

}

**OUTPUT:**

Do you want to enter details for day 1 [Y/N]: y

Day Name: monday

Date: 22

Activity: dance

Do you want to enter details for day 2 [Y/N]: y

Day Name: tuesday

Date: 23

Activity: sports

Do you want to enter details for day 3 [Y/N]: y

Day Name: wednesday

Date: 24

Activity: drawing

Do you want to enter details for day 4 [Y/N]: y

Day Name: thursday

Date: 25

Activity: reading

Do you want to enter details for day 5 [Y/N]: n

Do you want to enter details for day 6 [Y/N]: y

Day Name: saturday

Date: 27

Activity: conference

Do you want to enter details for day 7 [Y/N]: n

**2. Develop a Program in C for the following operations on Strings.**

1. **Read a main String (STR), a Pattern String (PAT) and a Replace String (REP)**
2. **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;

}

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 occured\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;

}

**OUTPUT:**

Enter the main string :

bbccca

Enter the Pattern string :

bb

Enter the Replace string :

bc

Input Text :

bbccca

1 matches occured

Text after replacing matched patterns is shown below

Bcccca

**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(;;)

{

printf("\nSTACK OPERATIONS\n");

printf("====================");

printf("\n 1.Push\n 2.Pop\n 3.Display\n 4.Peek\n 5.CheckPalindrome\n 6.DemonstarteOverflow\n 7.Demonstarte 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)

{

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;

}

**OUTPUT:**

STACK OPERATIONS

====================

1.Push

2.Pop

3.Display

4.Peek

5.CheckPalindrome

6.DemonstarteOverflow

7.Demonstarte Underflow

8.EXIT

Enter your choice

1

Enter element to be pushed onto the stack

9

STACK OPERATIONS

====================

1.Push

2.Pop

3.Display

4.Peek

5.CheckPalindrome

6.DemonstarteOverflow

7.Demonstarte Underflow

8.EXIT

Enter your choice

Stack Contents are:

9

Stack has 1 elements

STACK OPERATIONS

====================

1.Push

2.Pop

3.Display

4.Peek

5.CheckPalindrome

6.DemonstarteOverflow

7.Demonstarte Underflow

8.EXIT

Enter your choice

1

Enter element to be pushed onto the stack

5

STACK OPERATIONS

====================

1.Push

2.Pop

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 : 1332

1332 is not a palindrome

STACK OPERATIONS

====================

1.Push

2.Pop

3.Display

4.Peek

5.CheckPalindrome

6.DemonstarteOverflow

7.Demonstarte Underflow

8.EXIT

Enter your choice

2

Popped Element is 5

STACK OPERATIONS

====================

1.Push

2.Pop

3.Display

4.Peek

5.CheckPalindrome

6.DemonstarteOverflow

7.Demonstarte Underflow

8.EXIT

Enter your choice 8

**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 fnPrecd(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(fnPrecd(acStack[top]) >= fnPrecd(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;

}

**OUTPUT:**

Enter a valid infix expression :

P\*(Q+R)/S-T\*(W+Y/Z)

Infix Expression is :P\*(Q+R)/S-T\*(W+Y/Z)

Postfix Expression is :PQR+\*S/TWYZ/+\*-

**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;

}

**OUTPUT:**

Enter a valid postfix expression :

234567+-\*/()

Value of 234567+-\*/() expression is : 0

**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);

}

**OUTPUT:**

Enter the number of disks : 5

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

Move disk 4 from peg A to peg B

Move disk 1 from peg C to peg B

Move disk 2 from peg C to peg A

Move disk 1 from peg B to peg A

Move disk 3 from peg C to peg B

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 5 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

Move disk 3 from peg B to peg A

Move disk 1 from peg C to peg B

Move disk 2 from peg C to peg A

Move disk 1 from peg B to peg A

Move disk 4 from peg B to peg C

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: 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");

}

}

**OUTPUT:**

Queue Operations

=====================

1.Qinsert

2.Qdelete

3.Qdisplay

4.Exit

Enter your choice

1

Enter an element : s

Queue Operations

=====================

1.Qinsert

2.Qdelete

3.Qdisplay

4.Exit

Enter your choice

1

Enter an element : o

Queue Operations

=====================

1.Qinsert

2.Qdelete

3.Qdisplay

4.Exit

Enter your choice

1

Enter an element : n

Queue Operations

=====================

1.Qinsert

2.Qdelete

3.Qdisplay

4.Exit

Enter your choice

1

Enter an element : u

Queue Operations

=====================

1.Qinsert

2.Qdelete

3.Qdisplay

4.Exit

Enter your choice

2

Deleted element is s

Queue Operations

=====================

1.Qinsert

2.Qdelete

3.Qdisplay

4.Exit

Enter your choice

3

Contents of the Queue is

o n u

Queue Operations

=====================

1.Qinsert

2.Qdelete

3.Qdisplay

4.Exit

Enter your choice

4

**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("====================");

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\t\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);

}

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;

}

**OUTPUT:**

Enter the number of Students N : 3

Enter Data for Node 1 :

Enter USN : 2VX22CB76

Enter name : AABB

Enter Program name : CSBS

Enter semester : 3

Enter Phone no : 20201457

Enter Data for Node 2 :

Enter USN : 2VX22CB77

Enter name : WXYZ

Enter Program name : CSBS

Enter semester : 3

Enter Phone no : 00998877

Enter Data for Node 3 :

Enter USN : 2VX22CB77

Enter name : EFGH

Enter Program name : CSBS

Enter semester : 3

Enter Phone no : 43650000

QUEUE OPERATIONS

====================

1.Insert Front

2.Insert Rear

3.Delete Front

4.Delete Rear

5.Display

6.Exit

Enter your choice

1

Enter USN : 2VX22CB78

Enter name : DDDD

Enter Program name : CSBS

Enter semester : 3

Enter Phone no : 00000000

QUEUE OPERATIONS

====================

1.Insert Front

2.Insert Rear

3.Delete Front

4.Delete Rear

5.Display

6.Exit

Enter your choice

2

Enter USN : 2VX22CB79

Enter name : UUUU

Enter Program name : CSBS

Enter semester : 3

Enter Phone no : 99999999

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 DDDD

QUEUE OPERATIONS

====================

1.Insert Front

2.Insert Rear

3.Delete Front

4.Delete Rear

5.Display

6.Exit

Enter your choice

4

Node deleted for UUUU

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

2VX22CB77 EFGH CSBS 3 43650000

2VX22CB77 WXYZ CSBS 3 00998877

2VX22CB76 AABB CSBS 3 20201457

SLL has 3 nodes

QUEUE OPERATIONS

====================

1.Insert Front

2.Insert Rear

3.Delete Front

4.Delete Rear

5.Display

6.Exit

Enter your choice

6

**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);

freen(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\t\tPhone No");

while(curr != NULL)

{

printf("\n%-5d\t%s\t%s\t%s\t\t%-7d\t\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);

}

**OUTPUT:**

Enter the number of Employees N : 1

Enter Data for Node 1 :

Enter SSN : 678

Enter name : SUN

Enter Department : CSE

Enter Designation : OOPS

Enter Salary : 75000

Enter Phone no : 12345

DLL OPERATIONS

====================

1.Insert Rear

2.Delete Front

3.Insert Front

4.Delete Rear

5.Display

6.Exit

Enter your choice

1

Enter SSN : 123

Enter name : MOON

Enter Department : CSE

Enter Designation : OOPS

Enter Salary : 65000

Enter Phone no : 56789

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 SUN

DLL OPERATIONS

====================

1.Insert Rear

2.Delete Front

3.Insert Front

4.Delete Rear

5.Display

6.Exit

Enter your choice

3

Enter SSN : 431

Enter name : DRY

Enter Department : CSE

Enter Designation : OOPS

Enter Salary : 45000

Enter Phone no : 09875

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

431 DRY CSE OOPS 45000 09875

123 MOON CSE OOPS 65000 56789

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

6

**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) = 6x2y2z-4yz5+3x3yz+2xy5z-2xyz3**

**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;

}

**OUTPUT:**

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, Postorder**

**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 info;

struct node \*lbranch;

struct node \*rbranch;

};

typedef struct node\* NODEPTR;

NODEPTR fnGetNode(void);

void fnFreeNode(NODEPTR x);

NODEPTR fnInsertNode(int, NODEPTR);

void fnInOrder(NODEPTR);

void fnPreOrder(NODEPTR);

void fnPostOrder(NODEPTR);

void fnSearchBST(NODEPTR, int);

int main()

{

NODEPTR root = NULL;

int iChoice, iItem, i, iNum;

printf("Create a BST of N Integers \n");

printf("\nEnter the number N : ");

scanf("%d", &iNum);

printf("\nEnter %d numbers\n", iNum);

for(i=0;i<iNum;i++)

{

scanf("%d", &iItem);

root = fnInsertNode(iItem,root);

}

for(;;)

{

printf("\n1.Inorder traversal\n2.Preorder traversal");

printf("\n3.Postorder traversal\n4.Search\n5.Exit\n");

printf("\nEnter your choice : ");

scanf("%d",&iChoice);

switch(iChoice)

{

case 1: if(root ==NULL)

{

printf("\nTree is Empty\n");

}

else

{

printf("\nInorder Traversal is :\n");

fnInOrder(root);

printf("\n");

}

break;

case 2: if(root ==NULL)

{

printf("\nTree is Empty\n");

}

else

{

printf("\nPreorder Traversal is :\n");

fnPreOrder(root);

printf("\n");

}

break;

case 3: if(root ==NULL)

{

printf("\nTree is Empty\n");

}

else

{

printf("\nPostorder Traversal is :\n");

fnPostOrder(root);

printf("\n");

}

break;

case 4: printf("\nEnter the element to be searched : ");

scanf("%d", &iItem);

fnSearchBST(root, iItem);

break;

case 5: exit(0);

default: printf("Wrong choice\n");

break;

}

}

return 0;

}

NODEPTR fnGetNode(void)

{

NODEPTR x;

x = ( NODEPTR ) malloc (sizeof(struct node));

if(x == NULL)

{

printf("\nOut of Memory");

exit(0);

}

return x;

}

void fnFreeNode(NODEPTR x)

{

free(x);

}

NODEPTR fnInsertNode(int iItem,NODEPTR root)

{

NODEPTR temp,prev,cur;

temp = fnGetNode();

temp->info = iItem;

temp->lbranch = NULL;

temp->rbranch = NULL;

if(root == NULL)

return temp;

prev = NULL;

cur = root;

while(cur != NULL)

{

prev = cur;

if(iItem == cur->info)

{

printf("\nDuplicate items not allowed\n");

fnFreeNode(temp);

return root;

}

cur = (iItem < cur->info)? cur->lbranch: cur->rbranch;

}

if(iItem < prev->info)

prev->lbranch = temp;

else

prev->rbranch = temp;

return root;

}

void fnPreOrder(NODEPTR root)

{

if(root != NULL)

{

printf("%d\t",root->info);

fnPreOrder(root->lbranch);

fnPreOrder(root->rbranch);

}

}

void fnInOrder(NODEPTR root)

{

if(root != NULL)

{

fnInOrder(root->lbranch);

printf("%d\t",root->info);

fnInOrder(root->rbranch);

}

}

void fnPostOrder(NODEPTR root)

{

if(root != NULL)

{

fnPostOrder(root->lbranch);

fnPostOrder(root->rbranch);

printf("%d\t",root->info);

}

}

void fnSearchBST(NODEPTR root, int iElem)

{

if(root != NULL)

{

if(iElem < root->info)

fnSearchBST(root->lbranch, iElem);

else if(iElem > root->info)

fnSearchBST(root->rbranch, iElem);

else

printf("\n%d is found in the BST\n",iElem);

}

else

{

printf("\n%d is not found in the BST\n",iElem);

}

}

**OUTPUT:**

Create a BST of N Integers

Enter the number N : 7

Enter 7 numbers

9 5 6 7 8 2 4

1.Inorder traversal

2.Preorder traversal

3.Postorder traversal

4.Search

5.Exit

Enter your choice : 1

Inorder Traversal is :

2 4 5 6 7 8 9

1.Inorder traversal

2.Preorder traversal

3.Postorder traversal

4.Search

5.Exit

Enter your choice : 2

Preorder Traversal is :

9 5 2 4 6 7 8

1.Inorder traversal

2.Preorder traversal

3.Postorder traversal

4.Search

5.Exit

Enter your choice : 3

Postorder Traversal is :

4 2 8 7 6 5 9

1.Inorder traversal

2.Preorder traversal

3.Postorder traversal

4.Search

5.Exit

Enter your choice : 4

Enter the element to be searched : 7

7 is found in the BST

1.Inorder traversal

2.Preorder traversal

3.Postorder traversal

4.Search

5.Exit

Enter your choice : 4

Enter the element to be searched : 3

3 is not found in the BST

1.Inorder traversal

2.Preorder traversal

3.Postorder traversal

4.Search

5.Exit

Enter your choice : 5