Dharmsinh Desai University

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Department: Faculty of Management & Information Science

Subject: Data Structure TermWork

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Question – 1 :

Write a program to compare two strings stored in singly linked list.
[Given two strings, represented as linked lists (every character is a node in a linked list). Write
a function compare () that works similar to strcmp(), i.e., it returns 0 if both strings are the
same, 1 if the first linked list is lexicographically greater, and -1 if the second string is
lexicographically greater.]

Source Code :

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

typedef struct node {
   char data;
   struct node* next;
} Node;

Node* newNode(char data) {
   Node* node = (Node*)malloc(sizeof(Node));
   node->data = data;
   node->next = NULL;
   return node;
}

Node* createLinkedList(char* str) {
   Node* head = NULL, * prev = NULL;
   for (int i = 0; i < strlen(str); i++) {
      Node* node = newNode(str[i]);
      if (prev) {
         prev->next = node;
      }
```

```
        else {
            head = node;
        }
        prev = node;
    }
    return head;
}

int compare(Node* list1, Node* list2) {
    while (list1 && list2 && list1->data == list2->data) {
        list1 = list1->next;
        list2 = list2->next;
    }
    if (list1 && list2) {
        return (list1->data > list2->data) ? 1 : -1;
    }
    else if (list1) {
        return 1;
    }
    else if (list2) {
        return -1;
    }
    else {
        return 0;
    }
}
int main() {
    char str1[100], str2[100];
    printf("Enter the first string: ");
    scanf("%s", str1);
    printf("Enter the second string: ");
    scanf("%s", str2);

    Node* list1 = createLinkedList(str1);
    Node* list2 = createLinkedList(str2);

    int result = compare(list1, list2);
```

```
    printf("\n");
    printf("========================================\n");
    printf("          String Comparison          \n");
    printf("========================================\n\n");
    printf("String 1: %s\n", str1);
    printf("String 2: %s\n", str2);
    printf("\n");
    if (result == 0) {
        printf("The two strings are the same.\n");
    }
    else if (result == 1) {
        printf("The first string is lexicographically greater.\n");
    }
    else {
        printf("The second string is lexicographically greater.\n");
    }
    printf("\n");
    printf("========================================\n");
    printf("\n");
    return 0;
}
```

Output :

```
PS D:\TW_sem-2\ds> gcc -o tw_q1 tw_q1.c
PS D:\TW_sem-2\ds> ./tw_q1
Enter the first string: Alyani
Enter the second string: Mamad

========================================
          String Comparison
========================================

String 1: Alyani
String 2: Mamad

The second string is lexicographically greater.

========================================
```

Question – 2 :

Write a program to implement stack using linked list which converts infix to prefix.

Source Code :

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
struct node
{
   char data;
   struct node *next;
}
   *top = NULL,
   *pstart = NULL;
void insert(char ch)
{
   struct node *t, *ba;
   ba = (struct node *)malloc(sizeof(struct node));
   ba->next = NULL;
   ba->data = ch;
   t = pstart;

   if (pstart == NULL)
   {
      pstart = ba;
   }
   else
   {
      while (t->next != NULL)
      t = t->next;
      t->next = ba;
```

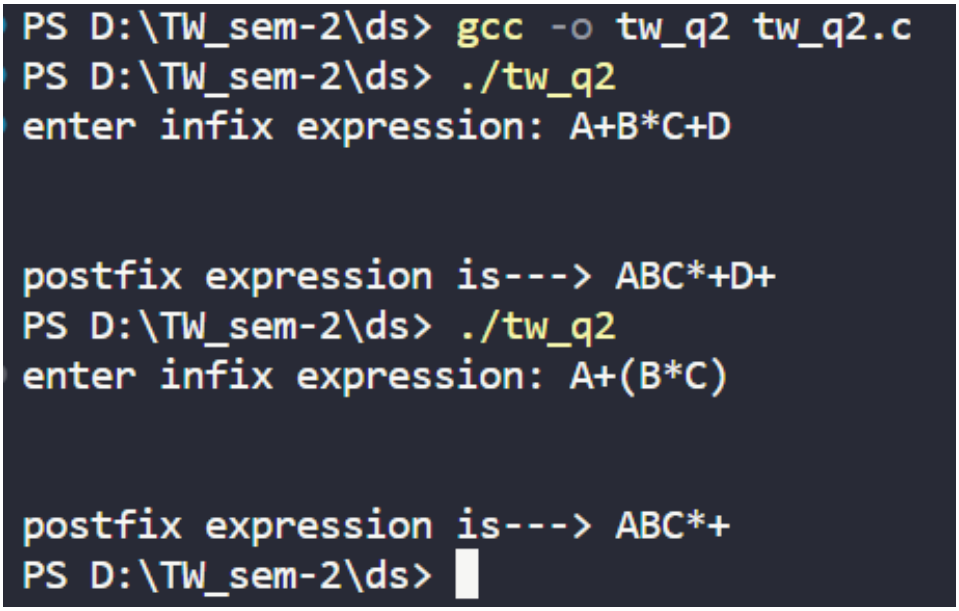
```
    }
}

void push(char symbol)
{

    struct node *p;
    p = (struct node *)malloc(sizeof(struct node));
    p->data = symbol;
    if (top == NULL)
    {
        top = p;
        p->next = NULL;
    }
    else
    {
        p->next = top;
        top = p;
    }
}

char pop()
{
    struct node *x, *y;
    char k;

    if (top == NULL)
    {
        printf("stack underflow\n");
        return 0;
    }
    else
    {
        x = top;
        top = top->next;
        k = x->data;
        free(x);
```

```
        x = NULL;
        return k;
    }
}

void displaypost()
{
    struct node *to;
    if (pstart == NULL)
        printf(" ");
    else
    {
        to = pstart;
        while (to != NULL)
        {
            printf("%c", to->data);
            to = to->next;
        }
    }
}

int precedence(char ch)
{

    if (ch == '^')
        return (5);
    else if (ch == '*' || ch == '/')
        return (4);
    else if (ch == '+' || ch == '-')
        return (3);
    else
        return (2);
}

void intopost(char infix[])
{
```

```
int len;
int index = 0;
char symbol, temp;
len = strlen(infix);
while (len > index)
{
   symbol = infix[index];

   switch (symbol)
   {

   case '(':
      push(symbol);
      break;

   case ')':
      temp = pop();
      while (temp != '(')
      {
         break;
      }

      insert(temp);
      temp = pop();

   case '^':
   case '+':
   case '-':
   case '*':
   case '/':
      if (top == NULL)
      {
         push(symbol);
      }
      else
      {
         while (top != NULL && (precedence(top -> data) >= precedence(symbol)))
```

```
                {
                    temp = pop();
                    insert(temp);
                }
                push(symbol);
            }

            break;
        default:
            insert(symbol);
        }
        index = index + 1;
    }
    while (top != NULL)
    {
        temp = pop();
        insert(temp);
    }
    displaypost();
    return;
}
int main()
{
    char infix[50];
    printf("enter infix expression: ");
    gets(infix);

    printf("\n\npostfix expression is---> ");
    intopost(infix);
    getchar();
    return 0;
}
```

Output :



Question – 3 :

Write a Program to Reverse a Linked List in groups of given size
Given a linked list, write a function to reverse every k node (where k is an input to the function).
Example:
Input: 1->2->3->4->5->6->7->8->NULL, K = 3
Output: 3->2->1->6->5->4->8->7->NULL
Input: 1->2->3->4->5->6->7->8->NULL, K = 5
Output: 5->4->3->2->1->8->7->6->NULL]

Source Code :

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

struct Node {
```

```
    int data;
    struct Node* next;
};

struct Node* reverseGroup(struct Node* head, int k) {
    struct Node* current = head;
    struct Node* next = NULL;
    struct Node* prev = NULL;
    int count = 0;

    while (current != NULL && count < k) {
        next = current->next;
        current->next = prev;
        prev = current;
        current = next;
        count++;
    }

    if (next != NULL) {
        head->next = reverseGroup(next, k);
    }

    return prev;
}

void printList(struct Node* head) {
    struct Node* temp = head;
    while (temp != NULL) {
        printf("%d->", temp->data);
```

```
        temp = temp->next;
    }
    printf("NULL\n");
}

void insert(struct Node** head, int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = *head;
    *head = newNode;
}

int main() {
    int k = 0;
    printf("\nEnter Value Of K : ");
    scanf("%d",&k);

    struct Node* head = NULL;
    insert(&head, 8);
    insert(&head, 7);
    insert(&head, 6);
    insert(&head, 5);
    insert(&head, 4);
    insert(&head, 3);
    insert(&head, 2);
    insert(&head, 1);

    printf("\nOriginal Linked List: ");
    printList(head);
```

```
    head = reverseGroup(head, k);
    printf("K = %d\n",k);

    printf("Reversed Linked List: ");
    printList(head);
    printf("\n");

    return 0;
}
```

Output :

```
PS D:\TW_sem-2\ds> gcc -o tw_q3 tw_q3.c
PS D:\TW_sem-2\ds> ./tw_q3

Enter Value Of K : 3

Original Linked List: 1->2->3->4->5->6->7->8->NULL
K = 3
Reversed Linked List: 3->2->1->6->5->4->8->7->NULL

PS D:\TW_sem-2\ds> ./tw_q3

Enter Value Of K : 5

Original Linked List: 1->2->3->4->5->6->7->8->NULL
K = 5
Reversed Linked List: 5->4->3->2->1->8->7->6->NULL
```

Question – 4 :

Write a program to implement a phone directory using a singly circular linked list with following operations. Node has info like cust_id, name, phone_number.

- Insert from first
- Insert from last
- Insert at specific position
- Delete from specific position
- Delete from first
- Delete from last
- Display in sorted order
- Search by name
- Search by cust_id
- Search by phone_number
- Delete by name
- Delete by cust_id
- Delete by phone_number

Source Code :

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
#define MAX_NAME 100
#define MAX_PHONE_NUMBER 100

typedef struct node {
   int cust_id;
   char name[MAX_NAME];
   char phone_number[MAX_PHONE_NUMBER];
   struct node* next;
}Node;

Node* head = NULL;
Node* tail = NULL;
```

```
void insertFromFirst(int cust_id, char name[], char phone_number[]) {
    Node* newNode = ( Node*) malloc(sizeof( Node));
    newNode->cust_id = cust_id;
    strcpy(newNode->name, name);
    strcpy(newNode->phone_number, phone_number);

    if (head == NULL) {
        head = newNode;
        tail = newNode;
        newNode->next = head;
    } else {
        newNode->next = head;
        head = newNode;
        tail->next = head;
    }

    printf("\nNode with customer ID %d inserted at the beginning.", cust_id);
}

void insertFromLast(int cust_id, char name[], char phone_number[]) {
     Node* newNode = ( Node*) malloc(sizeof( Node));
    newNode->cust_id = cust_id;
    strcpy(newNode->name, name);
    strcpy(newNode->phone_number, phone_number);

    if (head == NULL) {
        head = newNode;
        tail = newNode;
```

```
        newNode->next = head;
    } else {
        tail->next = newNode;
        tail = newNode;
        tail->next = head;
    }

    printf("\nNode with customer ID %d inserted at the end.", cust_id);
}

void insertAtPosition(int position, int cust_id, char name[], char phone_number[]) {
    if (head == NULL) {
        printf("\nList is empty. Cannot insert at position %d.", position);
        return;
    }

    int i;
     Node* temp = head;
     Node* prev = NULL;

    for (i = 0; i < position-1; i++) {
        prev = temp;
        temp = temp->next;

        if (temp == head && i != position-2) {
            printf("\nInvalid position. Cannot insert at position %d.", position);
            return;
        }
    }
```

```
    Node* newNode = ( Node*) malloc(sizeof( Node));
    newNode->cust_id = cust_id;
    strcpy(newNode->name, name);
    strcpy(newNode->phone_number, phone_number);

    if (prev == NULL) {
        newNode->next = head;
        head = newNode;
        tail->next = head;
    } else if (temp == head && i == position-1) {
        tail->next = newNode;
        newNode->next = head;
        tail = newNode;
    } else {
        prev->next = newNode;
        newNode->next = temp;
    }

    printf("\nNode with customer ID %d inserted at position %d.", cust_id, position);
}

void deleteFromPosition(int position) {
    if (head == NULL) {
        printf("\nList is empty. Cannot delete from position %d.", position);
        return;
    }

    int i;
```

```
    Node* temp = head;
    Node* prev = NULL;

   for (i = 0; i < position-1; i++) {
      prev = temp;
      temp = temp->next;

      if (temp == head && i!= position-2) {
         printf("\nInvalid position. Cannot delete from position %d.", position);
         return;
      }
   }

   if (prev == NULL) {
      head = temp->next;
      tail->next = head;
      free(temp);
   } else if (temp == tail) {
      prev->next = head;
      tail = prev;
      free(temp);
   } else {
      prev->next = temp->next;
      free(temp);
   }
   printf("\nNode deleted from position %d.", position);
}

void deleteFromFirst() {
```

```
    if (head == NULL) {
        printf("\nList is empty. Cannot delete from first.");
        return;
    }
     Node* temp = head;

    if (head == tail) {
        head = NULL;
        tail = NULL;
    } else {
        head = head->next;
        tail->next = head;
    }

    free(temp);
    printf("\nNode deleted from the beginning.");
}

void deleteFromLast() {
    if (head == NULL) {
        printf("\nList is empty. Cannot delete from last.");
        return;
    }
     Node* temp = head;
     Node* prev = NULL;

    while (temp->next != head) {
        prev = temp;
        temp = temp->next;
```

```
    }

    if (prev == NULL) {
        head = NULL;
        tail = NULL;
    } else {
        prev->next = head;
        tail = prev;
    }

    free(temp);
    printf("\nNode deleted from the end.");
}

void displaySorted() {
    if (head == NULL) {
    printf("\nList is empty. Cannot display sorted.");
    return;
    }

     Node* current = head;
     Node* index = NULL;
    int tempCustId;
    char tempName[50];
    char tempPhoneNumber[20];

    if (head == tail) {
        printf("\nCustomer ID: %d, Name: %s, Phone Number: %s", head->cust_id, head-
>name, head->phone_number);
```

```
    } else {
        do {
            index = current->next;

            while (index != head) {
                if (strcmp(current->name, index->name) > 0) {
                    tempCustId = current->cust_id;
                    strcpy(tempName, current->name);
                    strcpy(tempPhoneNumber, current->phone_number);

                    current->cust_id = index->cust_id;
                    strcpy(current->name, index->name);
                    strcpy(current->phone_number, index->phone_number);

                    index->cust_id = tempCustId;
                    strcpy(index->name, tempName);
                    strcpy(index->phone_number, tempPhoneNumber);
                }

                index = index->next;
            }

            printf("\nCustomer ID: %d, Name: %s, Phone Number: %s", current->cust_id,
current->name, current->phone_number);
            current = current->next;
        } while (current != head);
    }
}
```

```
void searchByName(char name[]) {
    if (head == NULL) {
        printf("\nList is empty. Cannot search by name.");
        return;
    }

     Node* current = head;
    int found = 0;

    do {
        if (strcmp(current->name, name) == 0) {
            printf("\nCustomer ID: %d, Name: %s, Phone Number: %s", current->cust_id,
current->name, current->phone_number);
            found = 1;
        }
        current = current->next;
    } while (current != head);

    if (!found) {
        printf("\nCustomer with name %s not found.", name);
    }
}

void searchByCustId(int cust_id) {
    if (head == NULL) {
        printf("\nList is empty. Cannot search by customer ID.");
        return;
    }
```

```
    Node* current = head;
    int found = 0;

    do {
        if (current->cust_id == cust_id) {
            printf("\nCustomer ID: %d, Name: %s, Phone Number: %s", current->cust_id,
current->name, current->phone_number);
            found = 1;
        }

        current = current->next;
    } while (current != head);

    if (!found) {
        printf("\nCustomer with ID %d not found.", cust_id);
    }
}

void searchByPhoneNumber(char* phone_number) {
    if (head == NULL) {
        printf("\nList is empty. Cannot search by phone number.");
        return;
    }

    Node* current = head;
    int found = 0;

    do {
        if (strcmp(current->phone_number, phone_number) == 0) {
```

```
            printf("\nCustomer ID: %d, Name: %s, Phone Number: %s", current->cust_id,
current->name, current->phone_number);
            found = 1;
        }

        current = current->next;
    } while (current != head);

    if (!found) {
        printf("\nCustomer with phone number %s not found.", phone_number);
    }
}



void deleteByName(char name[]) {
    if (head == NULL) {
        printf("\nList is empty. Cannot delete by name.");
        return;
    }
     Node* temp = head;
     Node* prev = NULL;
    int found = 0;

    do {
        if (strcmp(temp->name, name) == 0) {
            found = 1;
            break;
        }
```

```
            prev = temp;
            temp = temp->next;
        } while (temp != head);

        if (found) {
            if (prev == NULL) {
                head = temp->next;
                tail->next = head;
                free(temp);
            } else if (temp == tail) {
                prev->next = head;
                tail = prev;
                free(temp);
            } else {
                prev->next = temp->next;
                free(temp);
            }

            printf("\nNode deleted with name %s.", name);
        } else {
            printf("\nCustomer with name %s not found.", name);
        }

    }

    void deleteByCustId(int cust_id) {
        if (head == NULL) {
            printf("\nList is empty. Cannot delete by customer ID.");
            return;
```

```
}
 Node* temp = head;
 Node* prev = NULL;
int found = 0;

do {
    if (temp->cust_id == cust_id) {
        found = 1;
        break;
    }

    prev = temp;
    temp = temp->next;
} while (temp != head);

if (found) {
    if (prev == NULL) {
        head = temp->next;
        tail->next = head;
        free(temp);
    } else if(temp == tail) {
        prev->next = head;
        tail = prev;
        free(temp);
        } else {
            prev->next = temp->next;
            free(temp);
        }
        printf("\nNode deleted with customer ID %d.", cust_id);
```

```
            } else {
        printf("\nCustomer with customer ID %d not found.", cust_id);
    }
}

void deleteByPhoneNumber(char phone_number[]) {
    if (head == NULL) {
        printf("\nList is empty. Cannot delete by phone number.");
        return;
    }

     Node* temp = head;
     Node* prev = NULL;
    int found = 0;

    do {
        if (strcmp(temp->phone_number, phone_number) == 0) {
            found = 1;
            break;
        }

        prev = temp;
        temp = temp->next;
    } while (temp != head);

    if (found) {
        if (prev == NULL) {
            head = temp->next;
            tail->next = head;
```

```
            free(temp);
        } else if (temp == tail) {
            prev->next = head;
            tail = prev;
            free(temp);
        } else {
            prev->next = temp->next;
            free(temp);
        }

        printf("\nNode deleted with phone number %s.", phone_number);
    } else {
        printf("\nCustomer with phone number %s not found.", phone_number);
    }
}

int main() {
int choice, cust_id, pos;
char name[MAX_NAME];
char phone_number[MAX_PHONE_NUMBER];

while (1) {
    printf("\n-------------------------------------------------\n");
    printf("PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST\n");
    printf("-------------------------------------------------\n");
    printf("1. Insert from first\n");
    printf("2. Insert from last\n");
    printf("3. Insert at specific position\n");
    printf("4. Delete from specific position\n");
```

```
printf("5. Delete from first\n");
printf("6. Delete from last\n");
printf("7. Display in sorted order\n");
printf("8. Search by name\n");
printf("9. Search by customer ID\n");
printf("10. Search by phone number\n");
printf("11. Delete by name\n");
printf("12. Delete by customer ID\n");
printf("13. Delete by phone number\n");
printf("14. Exit\n");
printf("Enter your choice: ");
scanf("%d", &choice);

switch (choice) {
    case 1:
        printf("\nEnter customer ID: ");
        scanf("%d", &cust_id);
        printf("Enter name: ");
        scanf("%s", name);
        printf("Enter phone number: ");
        scanf("%s", phone_number);
        insertFromFirst(cust_id, name, phone_number);
        break;

    case 2:
        printf("\nEnter customer ID: ");
        scanf("%d", &cust_id);
        printf("Enter name: ");
        scanf("%s", name);
```

```
        printf("Enter phone number: ");
        scanf("%s", phone_number);
        insertFromLast(cust_id, name, phone_number);
        break;

    case 3:
        printf("\nEnter customer ID: ");
        scanf("%d", &cust_id);
        printf("Enter name: ");
        scanf("%s", name);
        printf("Enter phone number: ");
        scanf("%s", phone_number);
        printf("Enter position: ");
        scanf("%d", &pos);
        insertAtPosition(pos,cust_id, name, phone_number);
        break;

    case 4:
        printf("\nEnter position: ");
        scanf("%d", &pos);
        deleteFromPosition(pos);
        break;

    case 5:
        deleteFromFirst();
        break;

    case 6:
        deleteFromLast();
```

```
        break;

    case 7:
        displaySorted();
        break;

    case 8:
        printf("\nEnter name to search: ");
        scanf("%s", name);
        searchByName(name);
        break;

    case 9:
        printf("\nEnter customer ID to search: ");
        scanf("%d", &cust_id);
        searchByCustId(cust_id);
        break;

    case 10:
        printf("\nEnter phone number to search: ");
        scanf("%s", phone_number);
        searchByPhoneNumber(phone_number);
        break;

    case 11:
        printf("\nEnter name to delete: ");
        scanf("%s", name);
        deleteByName(name);
        break;
```

```
            case 12:
                printf("\nEnter customer ID to delete: ");
                scanf("%d", &cust_id);
                deleteByCustId(cust_id);
                break;

            case 13:
                printf("\nEnter phone number to delete: ");
                scanf("%s", phone_number);
                deleteByPhoneNumber(phone_number);
                break;

            case 14:
                printf("\nExiting program...");
                exit(0);
                break;

            default:
                printf("\nInvalid choice. Please try again.");
        }
    }

    return 0;
    }
```

Output :

```
PS D:\TW_sem-2\ds> gcc -o tw_q4 tw_q4.c
PS D:\TW_sem-2\ds> ./tw_q4
```

```
--------------------------------------------------
PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST
--------------------------------------------------
1. Insert from first
2. Insert from last
3. Insert at specific position
4. Delete from specific position
5. Delete from first
6. Delete from last
7. Display in sorted order
8. Search by name
9. Search by customer ID
10. Search by phone number
11. Delete by name
12. Delete by customer ID
13. Delete by phone number
14. Exit
Enter your choice: 1

Enter customer ID: 21
Enter name: alyani
Enter phone number: 7984657346

Node with customer ID 21 inserted at the beginning.
--------------------------------------------------
PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST
--------------------------------------------------
1. Insert from first
2. Insert from last
3. Insert at specific position
4. Delete from specific position
5. Delete from first
6. Delete from last
7. Display in sorted order
8. Search by name
9. Search by customer ID
10. Search by phone number
11. Delete by name
12. Delete by customer ID
13. Delete by phone number
14. Exit
Enter your choice: 2
```

Enter customer ID: 22
Enter name: akshay
Enter phone number: 6355948766

Node with customer ID 22 inserted at the end.

PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST
---
1. Insert from first
2. Insert from last
3. Insert at specific position
4. Delete from specific position
5. Delete from first
6. Delete from last
7. Display in sorted order
8. Search by name
9. Search by customer ID
10. Search by phone number
11. Delete by name
12. Delete by customer ID
13. Delete by phone number
14. Exit
Enter your choice: 3

Enter customer ID: 23
Enter name: pathu
Enter phone number: 99055547586
Enter position: 3

Node with customer ID 23 inserted at position 3.

PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST
---
1. Insert from first
2. Insert from last
3. Insert at specific position
4. Delete from specific position
5. Delete from first
6. Delete from last
7. Display in sorted order
8. Search by name
9. Search by customer ID
10. Search by phone number

11. Delete by name
12. Delete by customer ID
13. Delete by phone number
14. Exit
Enter your choice: 7

Customer ID: 22, Name: akshay, Phone Number: 6355948766
Customer ID: 21, Name: alyani, Phone Number: 7984657346
Customer ID: 23, Name: pathu, Phone Number: 99055547586

PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST
---
1. Insert from first
2. Insert from last
3. Insert at specific position
4. Delete from specific position
5. Delete from first
6. Delete from last
7. Display in sorted order
8. Search by name
9. Search by customer ID
10. Search by phone number
11. Delete by name
12. Delete by customer ID
13. Delete by phone number
14. Exit
Enter your choice: 5

Node deleted from the beginning.

PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST
---
1. Insert from first
2. Insert from last
3. Insert at specific position
4. Delete from specific position
5. Delete from first
6. Delete from last
7. Display in sorted order
8. Search by name
9. Search by customer ID
10. Search by phone number
11. Delete by name

12. Delete by customer ID
13. Delete by phone number
14. Exit
Enter your choice: 7

Customer ID: 21, Name: alyani, Phone Number: 7984657346
Customer ID: 23, Name: pathu, Phone Number: 99055547586

PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST
---
1. Insert from first
2. Insert from last
3. Insert at specific position
4. Delete from specific position
5. Delete from first
6. Delete from last
7. Display in sorted order
8. Search by name
9. Search by customer ID
10. Search by phone number
11. Delete by name
12. Delete by customer ID
13. Delete by phone number
14. Exit
Enter your choice: 4

Enter position: 0

Node deleted from position 0.

PHONE DIRECTORY USING SINGLY CIRCULAR LINKED LIST
---
1. Insert from first
2. Insert from last
3. Insert at specific position
4. Delete from specific position
5. Delete from first
6. Delete from last
7. Display in sorted order
8. Search by name
9. Search by customer ID
10. Search by phone number
11. Delete by name

12. Delete by customer ID
13. Delete by phone number
14. Exit
Enter your choice: 14

Exiting program...

Question – 5 :

Write a program to implement priority queue using linked list.

Source Code :

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

typedef struct Node
{
   int data;
   int priority;
   struct Node *next;
} Node;

Node *create(int data, int priority)
{
   Node *node = (Node *)malloc(sizeof(Node));
   node->data = data;
   node->priority = priority;
   node->next = NULL;
   return node;
}

void enqueue(Node **head, int data, int priority)
{
   Node *newNode = create(data, priority);

   if (*head == NULL || priority > (*head)->priority)
```

```
    {
        newNode->next = *head;
        *head = newNode;
    }
    else
    {
        Node *current = *head;
        while (current->next != NULL && current->next->priority >= priority)
        {
            current = current->next;
        }
        newNode->next = current->next;
        current->next = newNode;
    }
}

int dequeue(Node **head)
{
    if (*head == NULL)
    {
        printf("Queue is empty!\n");
        return -1;
    }
    Node *temp = *head;
    int data = temp->data;
    *head = (*head)->next;
    free(temp);
    return data;
}

void printQueue(Node *head)
{
    printf("Priority Queue: ");
    while (head != NULL)
    {
        printf("(%d, %d) ", head->data, head->priority);
        head = head->next;
```

```
    }
    printf("\n");
}

int main()
{
    Node *head = NULL;

    int data, priority, choice;
    do
    {
        printf("\n1. Enqueue\n");
        printf("2. Dequeue\n");
        printf("3. Print queue\n");
        printf("0. Exit\n");

        printf("Enter your choice: ");
        scanf("%d", &choice);
        switch (choice)
        {
        case 1:
            printf("Enter data: ");
            scanf("%d", &data);
            printf("Enter priority: ");
            scanf("%d", &priority);
            enqueue(&head, data, priority);
            break;
        case 2:
            dequeue(&head);
            break;
        case 3:
            printQueue(head);
            break;
        case 0:
            break;
        default:
            printf("Invalid choice!\n");
```

```
            break;
        }
    } while (choice != 0);

    return 0;
}
```

Output :

```
PS D:\TW_sem-2\ds> gcc -o tw_q5 tw_q5.c
PS D:\TW_sem-2\ds> ./tw_q5

1. Enqueue
2. Dequeue
3. Print queue
0. Exit
Enter your choice: 1
Enter data: 10
Enter priority: 1

1. Enqueue
2. Dequeue
3. Print queue
0. Exit
Enter your choice: 1
Enter data: 20
Enter priority: 3

1. Enqueue
2. Dequeue
3. Print queue
0. Exit
Enter your choice: 1
Enter data: 30
Enter priority: 2

1. Enqueue
2. Dequeue
3. Print queue
0. Exit
Enter your choice: 3
Priority Queue: (20, 3) (30, 2) (10, 1)

1. Enqueue
2. Dequeue
3. Print queue
0. Exit
Enter your choice: 2

1. Enqueue
2. Dequeue
3. Print queue
0. Exit
Enter your choice: 0
PS D:\TW_sem-2\ds>
```

Common-Question :

For this program, you will generate two different types of graphs and compute using them.
[Generate from provided two files]
File format

- Input will be based on file.
- Assume vertices are numbered 0..n-1.
- In this case, we will assume each file contains exactly one graph.
- Every graph has a two line "header".
  - Line 1: isDirected isWeighted
  - Line 2: n m

On line 1, if isDirected==0 the graph is undirected, else it is directed. If isWeighted==0 the graph is unweighted else it is weighted.
On line 2, n is the number of vertices (nodes) and m is the number of edges.

The next m lines contain information about the edges. If the graph isWeighted, the next m lines
each contain three integers, u, v and w, where u and v are the endpoints of the edge and w is the
weight on that edge. If the graph is not weighted, each of the m lines contains only u and v. If the
graph is undirected, there is an edge (u, v) and an edge (v, u). If the graph isDirected, the edge is
from u to v.
IF Directed (and Unweighted)
Generate Adjacency Matrix
Instantiate directed graph
Traverse the graph with DFS and BFS
Else Undirected
Generate Adjacency List
Instantiate undirected graph
Traverse the graph with DFS and BFS

Source Code :

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

#define MAX_NODES 100
```

```
int n, m, isDirected, isWeighted;
int adjMatrix[MAX_NODES][MAX_NODES] = {0};
int adjList[MAX_NODES][MAX_NODES] = {0};

void dfs(int v, int visited[]) {
    visited[v] = 1;
    printf("%d ", v);
    for (int i = 0; i < n; i++) {
        if (adjMatrix[v][i] && !visited[i]) {
            dfs(i, visited);
        }
    }
}

void bfs(int start) {
    int visited[MAX_NODES] = {0};
    int queue[MAX_NODES], front = 0, rear = 0;
    visited[start] = 1;
    printf("%d ", start);
    queue[rear++] = start;
    while (front < rear) {
        int v = queue[front++];
        for (int i = 0; i < n; i++) {
            if (adjMatrix[v][i] && !visited[i]) {
                visited[i] = 1;
                printf("%d ", i);
                queue[rear++] = i;
            }
        }
    }
}

void printAdjMatrix() {
    printf("\nAdjacency Matrix:\n");
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            printf("%d ", adjMatrix[i][j]);
        }
        printf("\n");
    }
}
```

```
void printAdjList() {
    printf("\nAdjacency List:\n");
    for (int i = 0; i < n; i++) {
        printf("%d: ", i);
        for (int j = 0; j < n; j++) {
            if (adjList[i][j]) {
                printf("%d ", j);
            }
        }
        printf("\n");
    }
}

void generateAdjMatrix(FILE *fp) {
    int u, v, w;
    for (int i = 0; i < m; i++) {
        if (isWeighted) {
            fscanf(fp, "%d %d %d", &u, &v, &w);
        } else {
            fscanf(fp, "%d %d", &u, &v);
        }
        adjMatrix[u][v] = 1;
        if (!isDirected) {
            adjMatrix[v][u] = 1;
        }
    }
    printAdjMatrix();
}

void generateAdjList(FILE *fp) {
    int u, v, w;
    for (int i = 0; i < m; i++) {
        if (isWeighted) {
            fscanf(fp, "%d %d %d", &u, &v, &w);
        } else {
            fscanf(fp, "%d %d", &u, &v);
        }
        adjList[u][v] = 1;
        if (!isDirected) {
            adjList[v][u] = 1;
        }
    }
    printAdjList();
```

```
}

int main() {
    FILE *fp;
    fp = fopen("file1.txt", "r");
    fscanf(fp, "%d %d", &isDirected, &isWeighted);
    fscanf(fp, "%d %d", &n, &m);
    if (isDirected && !isWeighted) {
        generateAdjMatrix(fp);
    }else {
        generateAdjList(fp);
    }
    fclose(fp);

    fp = fopen("file2.txt", "r");
    fscanf(fp, "%d %d", &isDirected, &isWeighted);
    fscanf(fp, "%d %d", &n, &m);

    if (isDirected && !isWeighted) {
        generateAdjMatrix(fp);
    } else {
        generateAdjList(fp);
    }

    fclose(fp);

    printf("\nDFS: ");
    int visited[MAX_NODES] = {0};

    for (int i = 0; i < n; i++) {
        if (!visited[i]) {
            dfs(i, visited);
        }
    }

    printf("\nBFS: ");
    bfs(0);
    printf("\n");

    return 0;
}
```

Output :

```
PS D:\TW_sem-2\ds> gcc -o tw_common tw_common.c
PS D:\TW_sem-2\ds> ./tw_common

Adjacency List:
0: 1 2 3 8
1: 0 2 3
2: 0 1 3
3: 0 1 2
4: 8 9
5: 10
6: 7 8
7: 6
8: 0 4 6 9 11
9: 4 8 10
10: 5 9 12
11: 8
12: 10

Adjacency Matrix:
0 1 1 0 0 0 1 1
0 0 0 1 1 1 1 0
0 0 0 1 1 1 1 1
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1
1 1 0 0 0 0 0 1
0 0 0 0 1 1 0 0

DFS: 0 1 3 4 5 7 6 2
BFS: 0 1 2 6 7 3 4 5
PS D:\TW_sem-2\ds>
```