INDEX

Serial Number	Title of the program	Date	Signature
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			

Experiment – 1

Aim –

Write a program to implement all operations on 1-D array

Expiation –

```
#include <stdio.h>
void display(int arr[],int size){
printf("Array elements: ");
for(int i=0;i<size;i++){
printf("%d \t",arr[i]);
}
printf("\n");
}
int insertion(int arr[],int size,int element,int position){
if(position<0 || position>size){
printf("INVALID POSITION FOR INSERTION \n");
return size;
}
for (int i=size-1;i>=position;i--){
arr[i+1]=arr[i];
}
arr[position]=element;
return size+1;
}
int deletion(int arr[],int size,int position){
```

```
if(position<0 || position>=size){
printf("INVALID POSITION FOR DELETION \n");
return size;
}
for(int i=position;i<size-1;i++){
arr[i]=arr[i+1];
}
return size-1;
}
int search(int arr[],int size,int element){
for(int i=0;i<size;i++){
if(arr[i]==element){
return i;
}
}
return -1;
}
void update(int arr[],int size,int position,int newValue){
if(position>=0 && position<size){
arr[position]=newValue;
}
else{
printf("INVALID POSITION FOR UPDATING \n");
}
}
```

```
int main(){
int arr[100];int size=0;
size=insertion(arr,size,100,0);
size=insertion(arr,size,200,1);
size=insertion(arr,size,300,2);
printf("After Insertion:\n");
display(arr,size);
size=deletion(arr,size,1);
printf("After Deletion: \n");
display(arr,size);
int searchIndex=search(arr,size,300);
if(searchIndex!=-1){
printf("Element 300 found at index %d\n",searchIndex);
}
else{
printf("Element 300 not found\n");
}
update(arr,size,1,400);
printf("After Updating: \n");
display(arr,size);
return 0;
}
```

Output –

```
PS D:\Programming\C\ADSA Lab> cd "d:\Programming\C\ADSA Lab\" ; if ($?) { gcc Experiment_1.c -o Experiment_1 } ; if ($?) { .\Experiment_1 }
After Insertion:
Array elements: 100     200     300
After Deletion:
Array elements: 100     300
Element 300 found at index 1
After Updating:
Array elements: 100     400
PS D:\Programming\C\ADSA Lab>
```

Experiment-2

Aim –

Write a program to implement all operations on simple linked list.

Expiation –

```
#include<stdio.h>
#include<stdlib.h>
struct Node{
int data;
struct Node* next;
};
void insertBegin(struct Node**head,int data){
struct Node* newNode=(struct Node*)malloc(sizeof(struct Node));
newNode->data=data;
newNode->next=*head;
*head=newNode;
}
void insertEnd(struct Node**head,int data){
struct Node*newNode=(struct Node*)malloc(sizeof(struct Node));
newNode->data=data;
newNode->next=NULL;
if(*head==NULL){
*head=newNode;
return;
}
```

```
struct Node*current=*head;
while(current->next!=NULL){
current=current->next;
}
current->next=newNode;
}
void deleteNode(struct Node**head,int data){
if(*head==NULL){
printf("List is empty\n");
return;
}
if((*head)->data==data){
struct Node*temp=*head;
*head=(*head)->next;
free(temp);
return;
}
struct Node*current=*head;
while(current->next!=NULL && current->next->data!=data){
current=current->next;
}
if(current->next==NULL){
printf("Value not found in list\n");
return;
}
```

```
struct Node*temp=current->next;
current->next = current->next->next;
free(temp);
}
void display(struct Node*head){
struct Node*current=head;
while(current!=NULL){
printf("%d ->",current->data);
current=current->next;
}
printf("NULL \n");
}
int main(){
struct Node*head=NULL;
insertEnd(&head,100);
insertEnd(&head,200);
insertBegin(&head,50);
insertEnd(&head,300);
printf("Linked List after insertion \n");
display(head);
deleteNode(&head,200);
printf("Linked List after deletion: \n");
display(head);
return 0;
}
```

Output-

```
PS D:\Programming\C\ADSA Lab> cd "d:\Programming\C\ADSA Lab\" ; if ($?) { gcc Experiment_2.c -o Experiment_2 } ; if ($?) { .\Experiment_2 }
Linked List after insertion
50 ->100 ->200 ->300 ->NULL
Linked List after deletion:
50 ->100 ->300 ->NULL
PS D:\Programming\C\ADSA Lab>
```

Experiment-3

Aim –

Write a program to implement all operations on a circular linked list.

Expiation –

```
#include<stdio.h>
#include<stdlib.h>
struct Node{
int data;
struct Node*next;
};
struct Node*insertBegin(struct Node*head,int data){
struct Node*newNode=(struct Node*)malloc(sizeof(struct Node));
newNode->data=data;
if(head==NULL){
newNode->next=newNode;
}
else{
struct Node*current=head;
while(current->next!=head){
current=current->next;
}
current->next=newNode;
newNode->next=head;
}
```

```
return newNode;
}
void display(struct Node*head){
if(head==NULL){
printf("List is empty \n");
return;
}
struct Node*current=head;
do{
printf("%d->",current->data);
current=current->next;
}
while(current!=head);
printf("...\n");
}
int main(){
struct Node*head=NULL;
head=insertBegin(head,100);
head=insertBegin(head,200);
head=insertBegin(head,300);
printf("Circular LinKed List: \n");
display(head);
return 0;
}
```

Output-

```
PS D:\Programming\C\ADSA Lab> cd "d:\Programming\C\ADSA Lab\" ; if ($?) { gcc Experiment_3.c -o Experiment_3 } ; if ($?) { .\Experiment_3 }
Circular LinKed List:
300->200->100->...
PS D:\Programming\C\ADSA Lab>
```

Experiment-4

Aim –

Write a program to implement all operations on a doubly linked list.

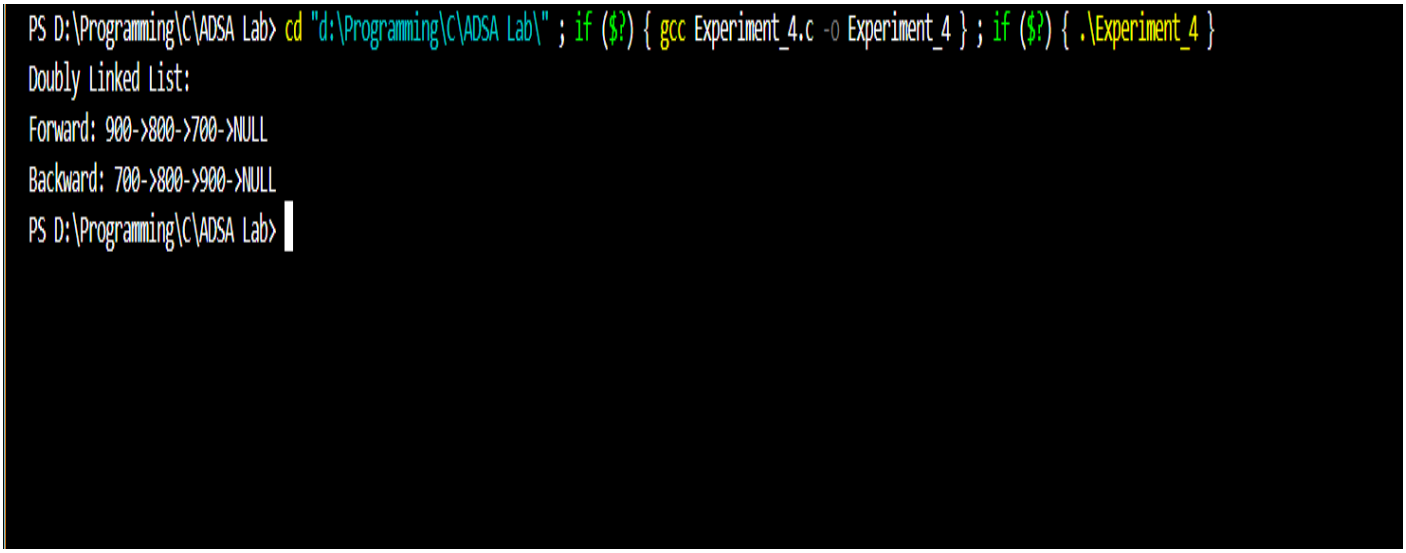
Expiation –

```
#include<stdio.h>
#include<stdlib.h>
struct Node{
int data;
struct Node*prev;
struct Node*next;
};
void insertEnd(struct Node**head,int data){
struct Node*newNode=(struct Node*)malloc(sizeof(struct Node));
newNode->data=data;
newNode->next=NULL;
if(*head==NULL){
newNode->prev=NULL;
*head=newNode;
return;
}
struct Node*current=*head;
while(current->next!=NULL){
current=current->next;
```

```
}
current->next=newNode;
newNode->prev=current;
}
void display(struct Node*head){
printf("Forward: ");
struct Node*current=head;
while(current!=NULL){
printf("%d->",current->data);
current=current->next;
}
printf("NULL \n");
printf("Backward: ");
current=head;
while(current->next!=NULL){
current=current->next;
}
while(current!=NULL){
printf("%d->",current->data);
current=current->prev;
}
printf("NULL \n");
}
```

```
int main(){
struct Node*head=NULL;
insertEnd(&head,900);
insertEnd(&head,800);
insertEnd(&head,700);
printf("Doubly Linked List: \n");
display(head);
return 0;
}
```

Output –


PS D:\Programming\C\ADSA Lab> cd "d:\Programming\C\ADSA Lab\" ; if ($?) { gcc Experiment_4.c -o Experiment_4 } ; if ($?) { .\Experiment_4 }
Doubly Linked List:
Forward: 900->800->700->NULL
Backward: 700->800->900->NULL
PS D:\Programming\C\ADSA Lab>

Experiment-5

Aim –

Write a program to implement all operations on a doubly circular linked list.

Expiation –

```
#include<stdio.h>
#include<stdlib.h>
struct Node{
int data;
struct Node*prev;
struct Node*next;
};
struct Node*insertEnd(struct Node*head,int data){
struct Node*newNode=(struct Node*)malloc(sizeof(struct Node));
newNode->data=data;
if(head==NULL){
newNode->prev=newNode;
newNode->next=newNode;
return newNode;
}
struct Node*last=head->prev;
newNode->next=head;
newNode->prev=last;
head->prev=newNode;
last->next=newNode;
```

```
return head;
}
void display(struct Node*head) {
if(head==NULL){
printf("List is empty \n");
return;
}
struct Node*current=head;
printf("Forward: ");
do{
printf("%d->",current->data);
current=current->next;
}
while(current!=head);
printf("...\n");
current=head->prev;
printf("Backward: ");
do{
printf("%d->",current->data);
current=current->prev;
}
while(current!=head->prev);
printf(".... \n");
}
int main(){
```

```
struct Node*head=NULL;
head=insertEnd(head,900);
head=insertEnd(head,800);
head=insertEnd(head,700);
printf("Doubly Circular Linked List: \n");
display(head);
return 0;
}
```

Output -

```
PS D:\Programming\C\ADSA Lab> cd "d:\Programming\C\ADSA Lab\" ; if ($?) { gcc Experiment_5.c -o Experiment_5 } ; if ($?) { .\Experiment_5 }
Doubly Circular Linked List:
Forward: 900->800->700->...
Backward: 700->800->900->....
PS D:\Programming\C\ADSA Lab>
```

Experiment-6

Aim –

Write a program to implement all operations on stack using array.

Expiation –

```
#include<stdio.h>
#include<stdbool.h>
#define MAX_SIZE 100
struct Stack{
int arr[MAX_SIZE];
int top;
};
void initializeStack(struct Stack*stack){
stack->top=-1;
}
bool isEmpty(struct Stack*stack){
return stack->top==-1;
}
bool isFull(struct Stack*stack){
return stack->top==MAX_SIZE-1;
}
void push(struct Stack*stack,int value){
if(isFull(stack)){
printf("Stack overflow,cannot push %d\n",value);
return;
```

```
}
stack->top++;
stack->arr[stack->top]=value;
}
int pop(struct Stack*stack){
if(isEmpty(stack)){
printf("Stack underflow,cannot pop\n");
return -1;
}
int value=stack->arr[stack->top];
stack->top--;
return value;
}
int peek(struct Stack*stack){
if(isEmpty(stack)){
printf("Stack is empty,no top element\n");
return -1; }
return stack->arr[stack->top]; }
int main(){
struct Stack stack;
initializeStack(&stack);
push(&stack,150);
push(&stack,250);
push(&stack,300);
printf("Top element: %d\n",peek(&stack));
```

```
printf("Popped element: %d\n",pop(&stack));
printf("Popped element: %d\n",pop(&stack));
printf("Top element: %d\n",peek(&stack));
return 0;
}
```

Output –

```
PS D:\Programming> cd "d:\Programming\C\ADSA Lab\" ; if ($?) { gcc Experiment_6.c -o Experiment_6 } ; if ($?) { .\Experiment_6 }
Top element: 300
Popped element: 300
Popped element: 250
Top element: 150
PS D:\Programming\C\ADSA Lab>
```

Experiment – 7

Aim –

Write a program to implement all operations on stack using linked list.

Expiation –

```
#include<stdio.h>
#include<stdlib.h>
#include<stdbool.h>
struct Node{
int data;
struct Node*next;
};
struct Stack{
struct Node*top;
};
void initializeStack(struct Stack*stack){
stack->top=NULL;
}
bool isEmpty(struct Stack*stack){
return stack->top==NULL;
}
void push(struct Stack*stack,int value){
struct Node*newNode=(struct Node*)malloc(sizeof(struct Node));
newNode->data=value;
newNode->next=stack->top;
```

```
stack->top=newNode;
}
int pop(struct Stack*stack){
if(isEmpty(stack)){
printf("Stack underflow,cannot pop\n");
return -1;
}
struct Node* temp=stack->top;
int value=temp->data;
stack->top=temp->next;
free(temp);
return value;
}
int peek(struct Stack*stack){
if(isEmpty(stack)){
printf("Stack is empty,no top element\n");
return -1;
}
return stack->top->data;
}
void display(struct Stack*stack){
struct Node*current=stack->top;
printf("Stack elements: ");
while(current!=NULL){
printf("%d \t",current->data);
```

```
current=current->next;
}
printf("\n");
}
int main(){
struct Stack stack;
initializeStack(&stack);
push(&stack,100);
push(&stack,250);
push(&stack,300);
display(&stack);
printf("Top element: %d\n",peek(&stack));
printf("Popped element: %d\n",pop(&stack));
printf("Popped element: %d\n",pop(&stack));
display(&stack);
return 0;
}
```

Output –

```
PS D:\Programming\C\ADSA Lab> cd "d:\Programming\C\" ; if ($?) { gcc Experiment_7.c -o Experiment_7 } ; if ($?) { .\Experiment_7 }
Stack elements: 300     250     100
Top element: 300
Popped element: 300
Popped element: 250
Stack elements: 100
PS D:\Programming\C>
```

Experiment – 8

Aim –

Write a program to implement all operations on queue using array.

Expiation –

```
#include <stdio.h>
#include <stdbool.h>
#define MAX 100
struct Queue {
int items[MAX];
int front;
int rear;
};
void initializeQueue(struct Queue*queue) {
queue->front=-1;
queue->rear=-1;
}
bool isEmpty(struct Queue*queue) {
return queue->front == -1;
}
bool isFull(struct Queue*queue) {
return queue->rear==MAX-1;
}
void enqueue(struct Queue*queue, int value) {
if (isFull(queue)) {
```

```
printf("Queue is full!\n");
return;
}
if (isEmpty(queue)) {
    queue->front = 0;
}
queue->rear++;
queue->items[queue->rear] = value;
printf("%d enqueued to queue\n", value);
}
int dequeue(struct Queue*queue) {
if (isEmpty(queue)) {
printf("Queue is empty!\n");
return -1;
}
int item = queue->items[queue->front];
if (queue->front >= queue->rear) {
queue->front = -1;
queue->rear = -1;
}
else {
queue->front++;
}
return item;
}
```

```
void display(struct Queue*queue) {
if (isEmpty(queue)) {
printf("Queue is empty!\n");
return;
}
printf("Queue elements: ");
for (int i = queue->front; i <= queue->rear; i++) {
printf("%d ", queue->items[i]);
}
printf("\n");
}
int main() {
struct Queue queue;
initializeQueue(&queue);
enqueue(&queue, 100);
enqueue(&queue, 200);
enqueue(&queue, 300);
display(&queue);
printf("%d dequeued from queue\n", dequeue(&queue));
display(&queue);
enqueue(&queue, 400);
enqueue(&queue, 500);
display(&queue);
printf("%d dequeued from queue\n", dequeue(&queue));
display(&queue);
```

```
return 0;
}
```

Output –

```
PS D:\Programming\C\ADSA Lab> cd "d:\Programming\C\ADSA Lab\" ; if ($?) { gcc Experiment_8.c -o Experiment_8 } ; if ($?) { .\Experiment_8 }
100 enqueued to queue
200 enqueued to queue
300 enqueued to queue
Queue elements: 100 200 300
100 dequeued from queue
Queue elements: 200 300
400 enqueued to queue
500 enqueued to queue
Queue elements: 200 300 400 500
200 dequeued from queue
Queue elements: 300 400 500
PS D:\Programming\C\ADSA Lab>
```

Experiment – 9

Aim –

Write a program to implement all operations on queue using Linked List.

Expiation –

```
#include <stdio.h>
#include <stdlib.h>
#include <stdbool.h>
struct Node {
int data;
struct Node* next;
};
struct Queue {
struct Node* front;
struct Node* rear; };
struct Queue* createQueue() {
struct Queue* queue = (struct Queue*)malloc(sizeof(struct Queue));
queue->front = NULL;
queue->rear = NULL;
return queue;
}
bool isEmpty(struct Queue* queue) {
return queue->front == NULL; }
void enqueue(struct Queue* queue, int value) {
struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
```

```
newNode->data = value;
newNode->next = NULL;
if (isEmpty(queue)) {
queue->front = newNode;
}
else {
queue->rear->next = newNode;
}
queue->rear = newNode;
printf("%d enqueued to queue\n", value);
}
int dequeue(struct Queue* queue) {
if (isEmpty(queue)) {
printf("Queue is empty!\n");
return -1;
}
struct Node* temp = queue->front;
int item = temp->data;
queue->front = queue->front->next;
if (queue->front == NULL) {
queue->rear = NULL;
}
free(temp);
return item;
}
```

```
void display(struct Queue* queue) {
if (isEmpty(queue)) {
printf("Queue is empty!\n");
return;
}
struct Node* current = queue->front;
printf("Queue elements: ");
while (current != NULL) {
printf("%d ", current->data);
current = current->next;
}
printf("\n");
}
int main() {
struct Queue* queue = createQueue();
enqueue(queue, 100);
enqueue(queue, 200);
enqueue(queue, 300);
display(queue);
printf("%d dequeued from queue\n", dequeue(queue));
display(queue);
enqueue(queue, 400);
enqueue(queue, 500);
display(queue);
printf("%d dequeued from queue\n", dequeue(queue));
```

```
display(queue);
while (!isEmpty(queue)) {
dequeue(queue);
}
free(queue);
return 0; }
```

Output –

```
PS D:\Programming\C\ADSA Lab> cd "d:\Programming\C\ADSA Lab\" ; if ($?) { gcc Experiment_9.c -o Experiment_9 } ; if ($?) { .\Experiment_9 }
100 enqueued to queue
200 enqueued to queue
300 enqueued to queue
Queue elements: 100 200 300
100 dequeued from queue
Queue elements: 200 300
400 enqueued to queue
500 enqueued to queue
Queue elements: 200 300 400 500
200 dequeued from queue
Queue elements: 300 400 500
PS D:\Programming\C\ADSA Lab>
```

Experiment – 10

Aim –

Write a program to implement hashing techniques.

Expiation –

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#define TABLE_SIZE 100
struct KeyValue {
char key[50];
char value[50];
struct KeyValue* next;
};
struct HashTable {
struct KeyValue* table[TABLE_SIZE];
} HashTable;
unsigned int hash(const char* key) {
unsigned long int hashval = 0;
for (int i = 0; key[i] != '\0'; i++) {
hashval = (hashval << 5) + key[i];
}
return hashval % TABLE_SIZE;
}
struct HashTable* createHashTable() {
```

```
struct HashTable* ht = (struct HashTable*)malloc(sizeof(struct HashTable));
for (int i = 0; i < TABLE_SIZE; i++) {
ht->table[i] = NULL;
}
return ht;
}
void insert(struct HashTable* ht, const char* key, const char* value) {
unsigned int index = hash(key);
struct KeyValue* newEntry = (struct KeyValue*)malloc(sizeof(struct
KeyValue));
strcpy(newEntry->key, key);
strcpy(newEntry->value, value);
newEntry->next = NULL;
if (ht->table[index] == NULL) {
ht->table[index] = newEntry;
}
else {
struct KeyValue* current = ht->table[index];
while (current->next != NULL) {
if (strcmp(current->key, key) == 0) {
strcpy(current->value, value);
free(newEntry);
return;
}
current = current->next;
```

```
}
current->next = newEntry;
}
}
const char* search(struct HashTable* ht, const char* key) {
unsigned int index = hash(key);
struct KeyValue* current = ht->table[index];
while (current != NULL) {
if (strcmp(current->key, key) == 0) {
return current->value;
}
current = current->next;
}
return NULL;
}
void delete(struct HashTable* ht, const char* key) {
unsigned int index = hash(key);
struct KeyValue* current = ht->table[index];
struct KeyValue* prev = NULL;
while (current != NULL) {
if (strcmp(current->key, key) == 0) {
if (prev == NULL) {
// Removing the first entry in the chain
ht->table[index] = current->next;
} else {
```

```
// Bypass the current entry
prev->next = current->next;
}
free(current);
return;
}
prev = current;
current = current->next;
}
printf("Key not found: %s\n", key);
}
void freeHashTable(struct HashTable* ht) {
for (int i = 0; i < TABLE_SIZE; i++) {
struct KeyValue* current = ht->table[i];
while (current != NULL) {
struct KeyValue* toDelete = current;
current = current->next;
free(toDelete);
}
}
free(ht);
}
int main() {
struct HashTable* ht = createHashTable();
insert(ht, "name", "John Doe");
```

```
insert(ht, "age", "30");
insert(ht, "city", "New York");
printf("Searching for 'name': %s\n", search(ht, "name"));
printf("Searching for 'age': %s\n", search(ht, "age"));
printf("Searching for 'city': %s\n", search(ht, "city"));
insert(ht, "age", "31");
printf("Updated age: %s\n", search(ht, "age"));
delete(ht, "city");
printf("Searching for 'city' after deletion: %s\n", search(ht, "city"));
freeHashTable(ht);
return 0;
}
```

Output –

```
Searching for 'name': John Doe
Searching for 'age': 30
Searching for 'city': New York
Updated age: 30
Searching for 'city' after deletion: (null)


=== Code Execution Successful ===
```