VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

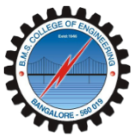
LAB REPORT
on

OPERATING SYSTEMS

Submitted by

R Shreya(1BM21CS152)

in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING



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B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "**OPERATING SYSTEMS LAB**" carried out by **R Shreya(1BM21CS152),** who is bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of a **Operating Systems Lab - (22CS4PCOPS)** work prescribed for the said degree.

Sonika Sharma D
Assistant Professor
Department of CSE
BMSCE, Bengaluru

Dr. Jyothi S Nayak
Professor and Head
Department of CSE
BMSCE, Bengaluru

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EXPERIMENT 1

Aim of the program: Write a C program to simulate the following non-pre-emptive CPU scheduling algorithm to find turnaround time and waiting time.

- FCFS
- SJF (preemptive & Non-pre-emptive)

Program:

FCFS

```
#include<stdio.h>

typedef struct process{
   int bt;
   int arr;
   int wt;
   int tat;
   int proc;
}process;

void main(){
   int n, i, tot_tat = 0, tot_wt = 0;
   process p[100];

   printf("Enter the number of processes: ");
   scanf("%d", &n);
```

```
    printf("Enter arrival time of processes: ");
    for(i=0; i<n; i++)
        scanf("%d", &p[i].arr);
    printf("Enter burst time of processes: ");
    for(i=0; i<n; i++){
        scanf("%d", &p[i].bt);
        p[i].proc = i+1;
    }

    sort(p, n);

    tot_tat = p[0].arr;
    for(i=0; i<n; i++){
        tot_tat += p[i].bt;
        p[i].tat = tot_tat - p[i].arr;
        p[i].wt = p[i].tat - p[i].bt;
        tot_wt += p[i].wt;
    }

    printSchedule(p, n, tot_tat, tot_wt);
}

void sort(process p[], int n){
    int i, j, min_idx;
    for (i=0; i<n-1; i++)
    {
```

```
        min_idx = i;
        for (j=i+1; j<n; j++)
            if (p[j].arr < p[min_idx].arr)
                min_idx = j;
        swap(&p[min_idx], &p[i]);
    }
}

void swap(process *p1, process *p2){
    process t;
    t = *p1;
    *p1 = *p2;
    *p2 = t;
}

void printSchedule(process p[], int n, int tot_tat, int tot_wt){
    int i;

    printf("Process Number\tArrival Time\tBurst Time\tWaiting
Time\tTurnAroundTime\n");
    for(i=0; i<n; i++){
        printf("\t%d      \t%d      \t%d\t      %d\t      %d\n", p[i].proc, p[i].arr, p[i].bt, p[i].wt,
p[i].tat);
    }

    printf("Avg turnaround time = %.3f\n", (float)tot_tat/(float)n);
    printf("Avg waiting time = %.3f\n", (float)tot_wt/(float)n);
}
```

OUTPUT:

```
Enter the number of processes: 3
Enter arrival time of processes: 0 3 2
Enter burst time of processes: 5 4 3
Process Number  Arrival Time    Burst Time      Waiting Time    TurnAroundTime
        1               0               5               0               5
        3               2               3               3               6
        2               3               4               5               9
Avg turnaround time = 4.000
Avg waiting time = 2.667

Process returned 25 (0x19)   execution time : 26.010 s
Press any key to continue.
```

SJF (pre-emptive & Non-pre-emptive)

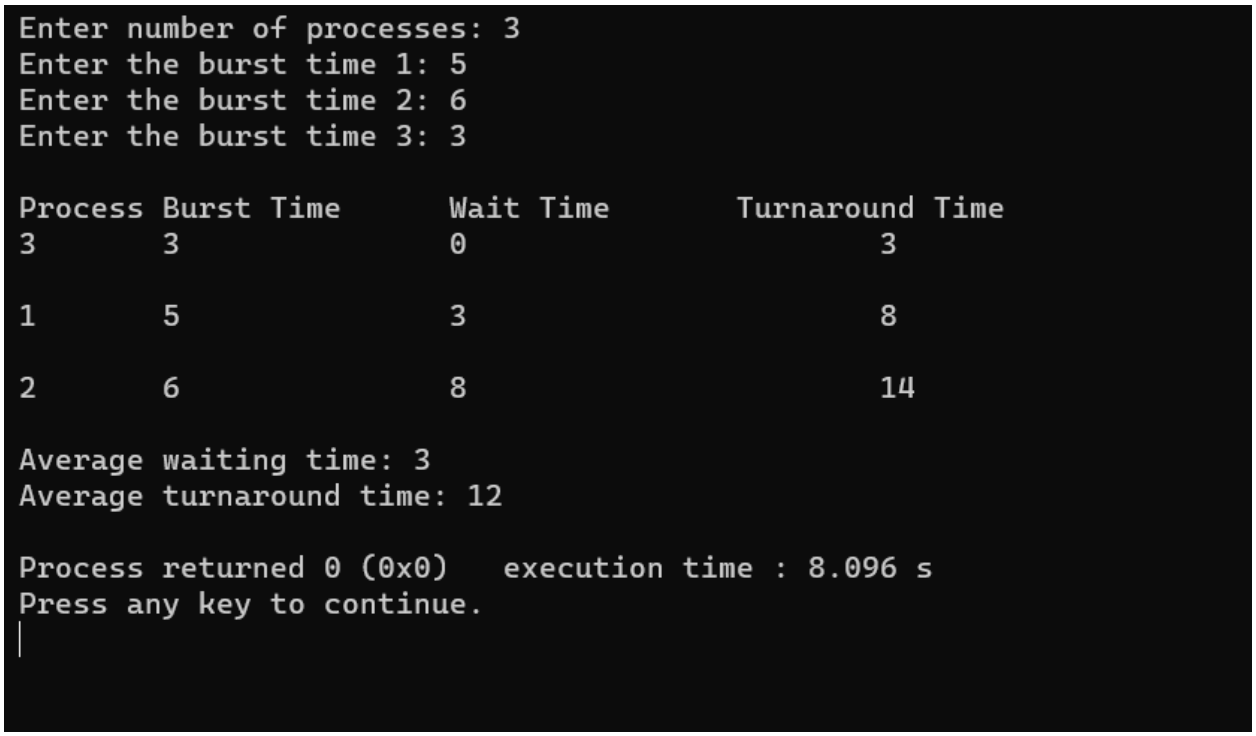
```
#include<stdio.h>
#include<conio.h>

void sort(int burst_time[], int n, int proc[]){
   int i, j, a;
   for (i = 0; i < n; i++){
      for (j = i + 1; j < n; j++){
         if (burst_time[i] > burst_time[j]){
            a = burst_time[i];
            burst_time[i] = burst_time[j];
            burst_time[j] = a;
            a = proc[i];
```

```
            proc[i] = proc[j];
            proc[j] = a;
        }
      }
   }
}

int waitingtime(int wait_time[], int n, int burst_time[]){
   int i;
   int tot_wt = 0;
   for(i=1; i<n; i++){
      wait_time[i] = wait_time[i-1] + burst_time[i-1];
      tot_wt += wait_time[i];
   }
   return tot_wt;
}

int turnaround(int wait_time[], int burst_time[], int n, int turn_around[]){
   int i, tot_tt;
   for(i=0; i<n; i++){
      turn_around[i] = wait_time[i] + burst_time[i];
      tot_tt += turn_around[i];
   }
   return tot_tt;
}

int main(){
```

```
    int n, i, tot_wt, tot_tt;
    int proc[100], burst_time[100], wait_time[100], turn_around[100];

    printf("Enter number of processes: ");
    scanf("%d", &n);

    for(i=0; i<n; i++){
        proc[i] = i+1;
        printf("Enter the burst time %d: ", i+1);
        scanf("%d", &burst_time[i]);
    }

    sort(burst_time, n, proc);

    wait_time[0] = 0;

    tot_wt = waitingtime(wait_time, n, burst_time);
    tot_tt = turnaround(wait_time, burst_time, n, turn_around);

    printf("\nProcess\tBurst Time\tWait Time\tTurnaround Time\n");
    for(i=0; i<n; i++){
        printf("%d  \t%d  \t\t%d \t\t\t%d\n",proc[i], burst_time[i], wait_time[i],
burst_time[i]+wait_time[i]);
        printf("\n");
    }

    printf("Average waiting time: %d\n", tot_wt/n);
    printf("Average turnaround time: %d\n", tot_tt/n);
```

}

OUTPUT:


Enter number of processes: 3
Enter the burst time 1: 5
Enter the burst time 2: 6
Enter the burst time 3: 3
Process Burst Time Wait Time Turnaround Time
3 3 0 3
1 5 3 8
2 6 8 14
Average waiting time: 3
Average turnaround time: 12
Process returned 0 (0x0) execution time : 8.096 s
Press any key to continue.

EXPERIMENT 2

Aim of the program: Write a C program to simulate the following CPU scheduling algorithm to find turnaround time and waiting time.

 Priority (pre-emptive & Non-pre-emptive)

Round Robin (Experiment with different quantum sizes for RR algorithm)

Program:

Priority (preemptive & Non-pre-emptive)

```
#include<stdio.h>

void waitingtime(int proc[], int n, int burst_time[], int wait_time[]){
   wait_time[0]=0;
   for(int i=1;i<n;i++){
      wait_time[i]=burst_time[i-1] + wait_time[i-1] ;
   }
}

void turnaroundtime( int proc[], int n, int burst_time[], int wait_time[], int tat[]){
   for  (int i = 0 ;i < n ; i++){
     tat[i] = burst_time[i] + wait_time[i];
  }
}


void avgtime(int proc[],int n,int burst_time[],int priority[]){
```

```
 int wait_time[n];
 int tat[n];
 int total_wt=0,total_tat=0;
 waitingtime(proc, n, burst_time, wait_time);
 turnaroundtime(proc, n, burst_time, wait_time, tat);
  printf("\npnum \t burst\t wait\t turnaround\t priority");
 for(int i=0;i<n;i++){
   total_wt+=wait_time[i];
   total_tat+=tat[i];
  printf("\n %d \t %d \t %d \t %d \t\t %d",
         proc[i],burst_time[i],wait_time[i],tat[i],priority[i]);
 }

 printf("\n\n Average waiting time: %f ",(float)total_wt/n);
 printf("\n Average turn around time: %f",(float)total_tat/n);

}


void main(){
 int val=0,i,j,temp;
 int  n;
 printf("\n enter number of processes");
 scanf("%d",&n);
  int proc[n],burst_time[n],priority[n];
 for (i=0;i<n;i++){
    proc[i]=i+1;
 }
```

```
 for(int i=0;i<n;i++){
 printf("\n enter burst time and priority for process %d:",i+1);
 scanf("%d\t%d",&burst_time[i],&priority[i]);
 }


 for(i=0;i<n;i++){
   for(j=i;j<n;j++){
      if(priority[i]>priority[j]){
         temp=priority[i];
         priority[i]=priority[j];
         priority[j]=temp;

         temp=burst_time[i];
         burst_time[i]=burst_time[j];
         burst_time[j]=temp;

         temp=proc[i];
         proc[i]=proc[j];
         proc[j]=temp;
      }
   }
 }

 avgtime(proc,n,burst_time,priority);
}
```

OUTPUT:

```
 enter number of processes 4

 enter burst time and priority for process 1: 4 2

 enter burst time and priority for process 2:5 1

 enter burst time and priority for process 3: 6 3

 enter burst time and priority for process 4: 3 4

pnum     burst   wait    turnaround      priority
 2       5       0       5               1
 1       4       5       9               2
 3       6       9       15              3
 4       3       15      18              4

 Average waiting time: 7.250000
 Average turn around time: 11.750000
Process returned 37 (0x25)   execution time : 29.405 s
Press any key to continue.
```

Round Robin (Experiment with different quantum sizes for RR algorithm)

```
#include<stdio.h>


void main(){
   int n, proc[100], burst_time[100], wait_time[100], tq, i, burst_update[100], t=0, turnaround[100], c, tot_wt=0, tot_tt=0;


   printf("Enter the number of process: ");
   scanf("%d", &n);
   c = n;
```

```
printf("Enter the Time Quantum: ");
scanf("%d", &tq);

printf("Enter the burst times!\n");
for(i=0; i<n; i++){
   proc[i] = i+1;
   printf("Enter the burst time of process %d: ", i+1);
   scanf("%d", &burst_time[i]);
   burst_update[i] = burst_time[i];
}
i = 0;
while(c!=0){
   if(proc[i]!=0){
      if(burst_update[i]>tq){
         burst_update[i] -= tq;
         t += tq;

      }
      else{
         t += burst_update[i];
         burst_update[i] = 0;
         proc[i] = 0;
         turnaround[i] = t;
         c--;
         wait_time[i] = turnaround[i] - burst_time[i];
      }
   }
   i = (i+1)%n;
}
```

```
    for(i=0; i<n; i++){
        tot_tt += turnaround[i];
        tot_wt += wait_time[i];
    }

    printf("\n\nProcess\t\tBurst Time\t\tWait Time\t\tTurnaround Time\n");
    for(i=0; i<n; i++)
        printf("%d\t\t%d\t\t\t%d\t\t\t%d\n",i+1, burst_time[i], wait_time[i], turnaround[i]);

    printf("\n\nAverage Turn Around time is: %d\n", tot_tt/n);
    printf("Average Waiting Time is: %d\n", tot_wt/n);
}
```

OUTPUT:

```
Enter the number of process: 3
Enter the Time Quantum: 2
Enter the burst times!
Enter the burst time of process 1: 5
Enter the burst time of process 2: 6
Enter the burst time of process 3: 8


Process         Burst Time              Wait Time               Turnaround Time
1               5                       8                       13
2               6                       9                       15
3               8                       11                      19


Average Turn Around time is: 15
Average Waiting Time is: 9

Process returned 27 (0x1B)   execution time : 18.573 s
Press any key to continue.
```

EXPERIMENT 3

Aim of the program: Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.

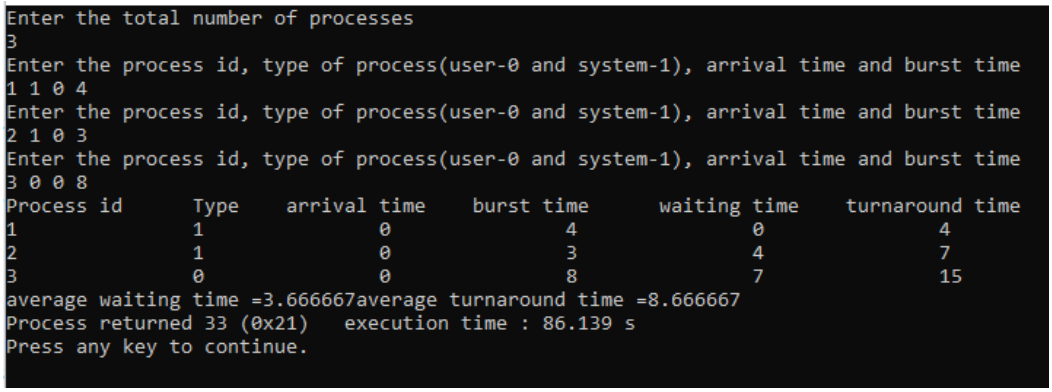
Program:

```
#include<stdio.h>
 void swap(int *a,int *b)
{
    int temp;
    temp=*a;
    *a=*b;
    *b=temp;
}
 void main()
{
    int n,pid[10],burst[10],type[10],arr[10],wt[10],ta[10],i,j;
    float avgwt=0,avgta=0;
    printf("Enter the total number of processes\n");
    scanf("%d",&n);
    for(i=0;i<n;i++)
    {
        printf("Enter the process id, type of process(user-0 and system-1), arrival time and
burst time\n");
        scanf("%d",&pid[i]);
        scanf("%d",&type[i]);
```

```
    scanf("%d",&arr[i]);
    scanf("%d",&burst[i]);
}
for(i=0;i<n-1;i++)
{
    for(j=0;j<n-i-1;j++)
    {
        if(arr[j]>arr[j+1])
        {
            swap(&arr[j],&arr[j+1]);
            swap(&pid[j],&pid[j+1]);
            swap(&burst[j],&burst[j+1]);
            swap(&type[j],&type[j+1]);

        }
    }
}
for(i=0;i<n-1;i++)
{
    for(j=0;j<n-i-1;j++)
    {
        if(arr[j]==arr[j+1] && type[j]<type[j+1])
        {
            swap(&arr[j],&arr[j+1]);
            swap(&pid[j],&pid[j+1]);
            swap(&burst[j],&burst[j+1]);
            swap(&type[j],&type[j+1]);
        }
    }
```

```
    }
    wt[0]=0;
    for(i=1;i<n;i++)
    {
        wt[i]=wt[i-1]+burst[i-1]-arr[i];
    }
    for(i=0;i<n;i++)
    {
        ta[i]=wt[i]+burst[i];
    }
    printf("Process id\tType\tarrival time\tburst time\twaiting time\tturnaround time\n");
    for(i=0;i<n;i++)
    {
        avgta+=ta[i];
        avgwt+=wt[i];
        printf("%d\t\t%d\t\t%d\t\t%d\t\t%d\t\t%d\n",pid[i],type[i],arr[i],burst[i],wt[i],ta[i]);
    }
    printf("average waiting time =%f",avgwt/n);
    printf("average turnaround time =%f",avgta/n);

}
```

OUTPUT:



EXPERIMENT 4

Aim of the program: Write a C program to simulate Real-Time CPU Scheduling

algorithms:

a) Rate- Monotonic

b) Earliest-deadline First

c) Proportional scheduling

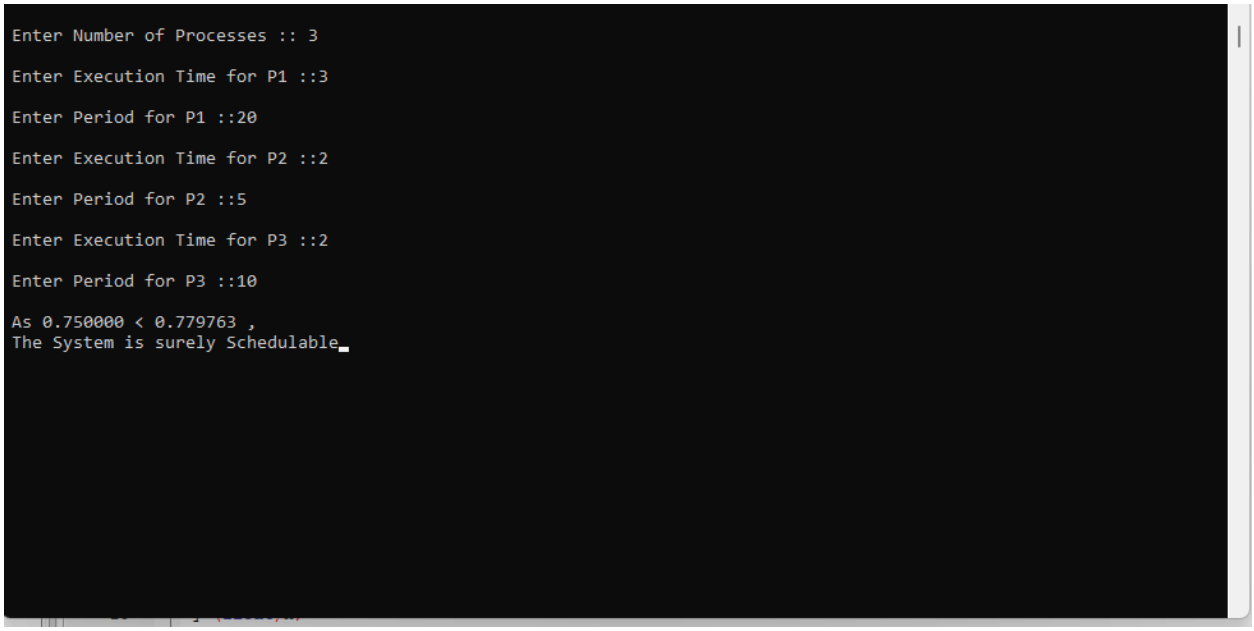
Program:

a)Rate- Monotonic

```
#include<stdio.h>
#include<conio.h>
#include<math.h>
 void main()
 {
int n;
float e[20],p[20];
int i;
float ut,u,x,y;



printf("\n Enter Number of Processes :: ");
 scanf("%d",&n);
 for(i=0;i<n;i++)
{
```

```
 printf("\n Enter Execution Time for P%d ::",(i+1));
 scanf("%f",&e[i]);
 printf("\n Enter Period for P%d ::",(i+1));
 scanf("%f",&p[i]);
}
 //calculate the utilization
for(i=0;i<n;i++)
 {
 x=e[i]/p[i];
ut+=x;
 }
 //calculate value of U
 y=(float)n;
y=y*((pow(2.0,1/y))-1);
 u=y;

 if(ut<u)
 {
 printf("\n As %f < %f ,",ut,u);
printf("\n The System is surely Schedulable");
 }
 else
printf("\n Not Sure.....");
 getch();
 }
```

OUTPUT:



b)Earliest-deadline First

```
#include <stdio.h>
#define MAX_TASKS 10

typedef struct {
    int arrival_time;
    int execution_time;
    int deadline;
    int remaining_time;
    int waiting_time;
    int turnaround_time;
} Task;
```

```
void initializeTasks(Task tasks[], int num_tasks) {
    for (int i = 0; i < num_tasks; i++) {
        printf("Enter arrival time for task %d: ", i + 1);
        scanf("%d", &tasks[i].arrival_time);
        printf("Enter execution time for task %d: ", i + 1);
        scanf("%d", &tasks[i].execution_time);
        printf("Enter deadline for task %d: ", i + 1);
        scanf("%d", &tasks[i].deadline);
        tasks[i].remaining_time = tasks[i].execution_time;
        tasks[i].waiting_time = 0;
        tasks[i].turnaround_time = 0;
    }
}

int findEarliestDeadlineTask(Task tasks[], int num_tasks, int current_time) {
    int earliest_deadline_task = -1;
    for (int i = 0; i < num_tasks; i++) {
        if (tasks[i].remaining_time > 0 && tasks[i].arrival_time <= current_time) {
            if (earliest_deadline_task == -1 || tasks[i].deadline <
tasks[earliest_deadline_task].deadline) {
                earliest_deadline_task = i;
            }
        }
    }
    return earliest_deadline_task;
}

int main() {
```

```
    int num_tasks;
    printf("Enter the number of tasks: ");
    scanf("%d", &num_tasks);

    Task tasks[MAX_TASKS];
    initializeTasks(tasks, num_tasks);

    int current_time = 0;
    int completed_tasks = 0;
    int total_waiting_time = 0;
    int total_turnaround_time = 0;

    printf("\nEDF CPU Scheduling:\n");
    while (completed_tasks < num_tasks) {
        int current_task = findEarliestDeadlineTask(tasks, num_tasks, current_time);

        if (current_task != -1) {
            printf("Time %d: Running Task %d\n", current_time, current_task + 1);
            tasks[current_task].remaining_time--;

            if (tasks[current_task].remaining_time == 0) {
                completed_tasks++;
                tasks[current_task].turnaround_time = current_time + 1 -
tasks[current_task].arrival_time;
                tasks[current_task].waiting_time = tasks[current_task].turnaround_time -
tasks[current_task].execution_time;
                total_waiting_time += tasks[current_task].waiting_time;
                total_turnaround_time += tasks[current_task].turnaround_time;
```

```
            printf("Time %d: Task %d completed\n", current_time + 1, current_task + 1);
        }
    } else {
        printf("Time %d: CPU idle\n", current_time);
    }

    current_time++;
  }

  double avg_waiting_time = (double)total_waiting_time / num_tasks;
  double avg_turnaround_time = (double)total_turnaround_time / num_tasks;

   printf("\n process\t executiontime \t arrival time\deadline\twait_time\turnaround time");
   for(int i=0;i<num_tasks;i++){

printf("\n%d\t\t%d\t\t%d\t\t%d\t\t%d\t\t%d",i+1,tasks[i].execution_time,tasks[i].arrival_time,tasks[i].deadline,tasks[i].waiting_time,tasks[i].turnaround_time);
   }

  printf("\nAverage Waiting Time: %.2lf\n", avg_waiting_time);
  printf("Average Turnaround Time: %.2lf\n", avg_turnaround_time);

  return 0;
}
```

OUTPUT:

```
Enter the number of tasks: 2
Enter arrival time for task 1: 1
Enter execution time for task 1: 12
Enter deadline for task 1: 30
Enter arrival time for task 2: 2
Enter execution time for task 2: 15
Enter deadline for task 2: 25

EDF CPU Scheduling:
Time 1: Running Task 1
Time 2: Running Task 2
Time 3: Running Task 2
Time 4: Running Task 2
Time 5: Running Task 2
Time 6: Running Task 2
Time 7: Running Task 2
Time 8: Running Task 2
Time 9: Running Task 2
Time 10: Running Task 2
Time 11: Running Task 2
Time 12: Running Task 2
Time 13: Running Task 2
Time 14: Running Task 2
Time 15: Running Task 2
Time 16: Running Task 2
Time 17: Task 2 completed
Time 17: Running Task 1
Time 18: Running Task 1
Time 19: Running Task 1
Time 20: Running Task 1
Time 21: Running Task 1
Time 22: Running Task 1
Time 23: Running Task 1
Time 24: Running Task 1
Time 25: Running Task 1
Time 26: Running Task 1
Time 27: Running Task 1
Time 28: Task 1 completed

 process         executiontime   arrival time   deadline        wait_time       turnaroundtime
1               12              1              30              15              27
2               15              2              25              0               15
Average Waiting Time: 7.50
Average Turnaround Time: 21.00

Process returned 0 (0x0)   execution time : 17.672 s
Press any key to continue.
```

EXPERIMENT 5

Aim of the program : Write a C program to simulate producer-consumer problem using semaphores.

Program :

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

int mutex=1,full=0,empty=3,x=0;

int main()
{
   int n;
   void producer();
   void consumer();
   int wait(int);
   int signal(int);
   printf("\n1.Producer\n2.Consumer\n3.Exit");
   while(1)
   {
      printf("\nEnter your choice:");
      scanf("%d",&n);
      switch(n)
      {
         case 1: if((mutex==1)&&(empty!=0))
            producer();
```

```
            else
               printf("Buffer is full!!");
            break;
            case 2: if((mutex==1)&&(full!=0))
               consumer();
            else
               printf("Buffer is empty!!");
            break;
            case 3:
               exit(0);
            break;
         }
      }
      return 0;
}

int wait(int s)
{
   return (--s);
}

int signal(int s)
{
   return(++s);
}

void producer()
```

```
{
   mutex=wait(mutex);
   full=signal(full);
   empty=wait(empty);
   x++;
   printf("\nProducer produces the item %d",x);
   mutex=signal(mutex);
}

void consumer()
{
   mutex=wait(mutex);
   full=wait(full);
   empty=signal(empty);
   printf("\nConsumer consumes item %d",x);
   x--;
   mutex=signal(mutex);
}
```

OUTPUT:

```
1.Producer
2.Consumer
3.Exit
Enter your choice:1

Producer produces the item 1
Enter your choice:1

Producer produces the item 2
Enter your choice:2

Consumer consumes item 2
Enter your choice:2

Consumer consumes item 1
Enter your choice:2
Buffer is empty!!
Enter your choice:3

Process returned 0 (0x0)   execution time : 73.474 s
Press any key to continue.
```

EXPERIMENT 6

Aim of the program: Write a C program to simulate the concept of Dining-Philosophers problem.

Program:

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

#define N 5
#define THINKING 2
#define HUNGRY 1
#define EATING 0
#define LEFT (phnum + 4) % N
#define RIGHT (phnum + 1) % N

int state[N];
int phil[N] = { 0, 1, 2, 3, 4 };

sem_t mutex;
sem_t S[N];

void test(int phnum)
{
        if (state[phnum] == HUNGRY
                && state[LEFT] != EATING
                && state[RIGHT] != EATING) {
                // state that eating
                state[phnum] = EATING;
```

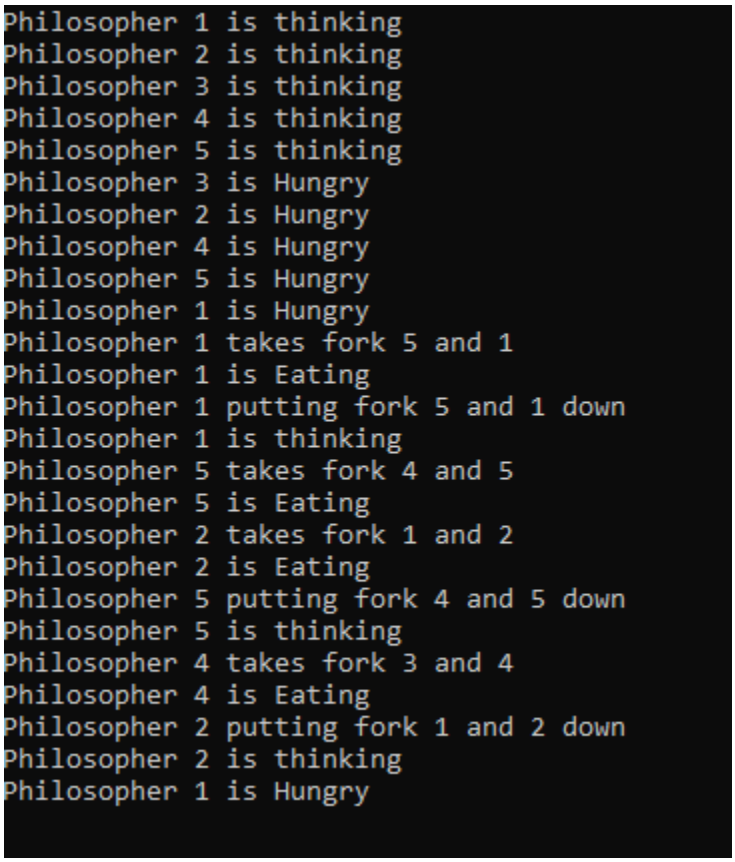
```
            sleep(2);

            printf("Philosopher %d takes fork %d and %d\n",
                                    phnum + 1, LEFT + 1, phnum + 1);

            printf("Philosopher %d is Eating\n", phnum + 1);
            sem_post(&S[phnum]);
        }
}

// take up chopsticks
void take_fork(int phnum)
{

        sem_wait(&mutex);

        // state that hungry
        state[phnum] = HUNGRY;

        printf("Philosopher %d is Hungry\n", phnum + 1);

        // eat if neighbours are not eating
        test(phnum);

        sem_post(&mutex);

        // if unable to eat wait to be signalled
        sem_wait(&S[phnum]);
```

```
        sleep(1);
}

// put down chopsticks
void put_fork(int phnum)
{

        sem_wait(&mutex);

        // state that thinking
        state[phnum] = THINKING;

        printf("Philosopher %d putting fork %d and %d down\n",
                phnum + 1, LEFT + 1, phnum + 1);
        printf("Philosopher %d is thinking\n", phnum + 1);

        test(LEFT);
        test(RIGHT);

        sem_post(&mutex);
}

void* philosopher(void* num)
{

        while (1) {

                int* i = num;
```

```
            sleep(1);

            take_fork(*i);

            sleep(0);

            put_fork(*i);
        }
}

int main()
{

        int i;
        pthread_t thread_id[N];

        // initialize the semaphores
        sem_init(&mutex, 0, 1);

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

            sem_init(&S[i], 0, 0);

        for (i = 0; i < N; i++) {

            // create philosopher processes
            pthread_create(&thread_id[i], NULL,
                                philosopher, &phil[i]);
```

```
            printf("Philosopher %d is thinking\n", i + 1);
        }

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

            pthread_join(thread_id[i], NULL);
}
```

OUTPUT:



EXPERIMENT 7

Aim of the program : Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.

Program:

```
#include <stdio.h>
int main()
{
        int n, m, i, j, k;
        printf("Enter the no.of process");
        scanf("%d",&n);
   printf("enter the no.of resources");
   scanf("%d",&m);

        int alloc[n][m];
        int max[n][m];
   printf("Enter the allocation matrix :\n");
        for(i=0;i<n;i++)
   {
      for(j=0;j<m;j++)
      {
         scanf("%d",&alloc[i][j]);
      }
   }
   printf("Enter the max matrix :\n");
   for(int p=0;p<n;p++)
   {
```

```
    for(int q=0;q<m;q++)
    {
        scanf("%d",&max[p][q]);
    }
    printf("\n");
}

        int avail[3] = { 3, 3, 2 };

        int f[n], ans[n], ind = 0;
        for (k = 0; k < n; k++) {
                f[k] = 0;
        }
        int need[n][m];
        for (i = 0; i < n; i++) {
                for (j = 0; j < m; j++)
                        need[i][j] = max[i][j] - alloc[i][j];
        }
        int y = 0;
        for (k = 0; k < n; k++) {
                for (i = 0; i < n; i++) {
                        if (f[i] == 0) {

                                int flag = 0;
                                for (j = 0; j < m; j++) {
                                        if (need[i][j] > avail[j]){
                                                flag = 1;
```

```
                                        break;
                                }
                        }

                        if (flag == 0) {
                                ans[ind++] = i;
                                for (y = 0; y < m; y++)
                                        avail[y] += alloc[i][y];
                                f[i] = 1;
                        }
                }
        }
}

int flag = 1;

for(int i=0;i<n;i++)
{
if(f[i]==0)
{
        flag=0;
        printf("The following system is not safe");
        break;
}
}

if(flag==1)
```

```
        {
        printf("Following is the SAFE Sequence\n");
        for (i = 0; i < n - 1; i++)
                printf(" P%d ->", ans[i]);
        printf(" P%d", ans[n - 1]);
        }


        return (0);

}
```

OUTPUT:

EXPERIMENT 8

Aim of the program : Write a C program to simulate deadlock detection

Program :

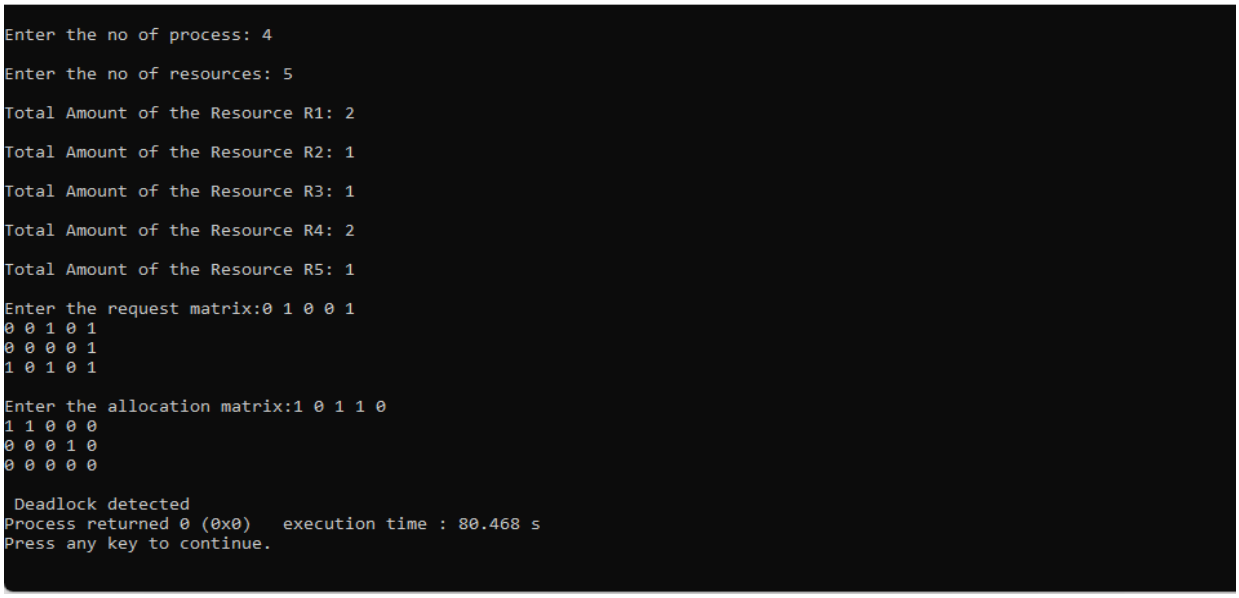
```
#include<stdio.h>
static int mark[20];
int i,j,np,nr;

int main()
{
   int alloc[10][10],request[10][10],avail[10],r[10],w[10];

   printf("\nEnter the no of process: ");
   scanf("%d",&np);
   printf("\nEnter the no of resources: ");
   scanf("%d",&nr);
   for(i=0;i<nr;i++)
   {
      printf("\nTotal Amount of the Resource R%d: ",i+1);
      scanf("%d",&r[i]);
   }


   printf("\nEnter the request matrix:");

   for(i=0;i<np;i++)
      for(j=0;j<nr;j++)
```

```
        scanf("%d",&request[i][j]);

printf("\nEnter the allocation matrix:");
for(i=0;i<np;i++)
    for(j=0;j<nr;j++)
        scanf("%d",&alloc[i][j]);
for(j=0;j<nr;j++)
{
    avail[j]=r[j];
    for(i=0;i<np;i++)
    {
    avail[j]-=alloc[i][j];

    }
}


for(i=0;i<np;i++)
{
int count=0;
 for(j=0;j<nr;j++)
   {
      if(alloc[i][j]==0)
        count++;
      else
        break;
    }
```

```
 if(count==nr)
 mark[i]=1;
}

for(j=0;j<nr;j++)
   w[j]=avail[j];

for(i=0;i<np;i++)
{
   int canbeprocessed=0;
    if(mark[i]!=1)
   {
      for(j=0;j<nr;j++)
       {
         if(request[i][j]<=w[j])
           canbeprocessed=1;
         else
           {
            canbeprocessed=0;
            break;
            }
       }
       if(canbeprocessed)
       {
          mark[i]=1;

          for(j=0;j<nr;j++)
```

```
            w[j]+=alloc[i][j];
        }
    }
}

//checking for unmarked processes
int deadlock=0;
for(i=0;i<np;i++)
{
    if(mark[i]!=1)
    {
        deadlock=1;
    }


}

if(deadlock)
printf("\n Deadlock detected");
else
printf("\n No Deadlock possible");
}
```

OUTPUT:


Enter the no of process: 4
Enter the no of resources: 5
Total Amount of the Resource R1: 2
Total Amount of the Resource R2: 1
Total Amount of the Resource R3: 1
Total Amount of the Resource R4: 2
Total Amount of the Resource R5: 1
Enter the request matrix:0 1 0 0 1
0 0 1 0 1
0 0 0 0 1
1 0 1 0 1
Enter the allocation matrix:1 0 1 1 0
1 1 0 0 0
0 0 0 1 0
0 0 0 0 0
Deadlock detected
Process returned 0 (0x0) execution time : 80.468 s
Press any key to continue.

EXPERIMENT 9

Aim of the program : Write a C program to simulate the following contiguous memory allocation techniques

a) Worst-fit

b) Best-fit

c) First-fit

Program:

WORST-FIT

```
#include<stdio.h>
#include<conio.h>
#define max 25
void main()
{
int frag[max],b[max],f[max],i,j,nb,nf,temp,highest=0;
 static int bf[max],ff[max];
clrscr();


printf("\n\tMemory Management Scheme - Worst Fit");
 printf("\nEnter the number of blocks:");
 scanf("%d",&nb);
printf("Enter the number of files:");
scanf("%d",&nf);
printf("\nEnter the size of the blocks:-\n");
for(i=1;i<=nb;i++)
{
printf("Block %d:",i);
scanf("%d",&b[i]);
```

```
}
printf("Enter the size of the files :-\n");
for(i=1;i<=nf;i++)
{
printf("File %d:",i);
scanf("%d",&f[i]);
}
for(i=1;i<=nf;i++)
{


for(j=1;j<=nb;j++)
{
if(bf[j]!=1)    //if bf[j] is not allocated
{
temp=b[j]-f[i];
if(temp>=0)
if(highest<temp)
{
ff[i]=j;
highest=temp;

}
}
frag[i]=highest;
bf[ff[i]]=1;
 highest=0;
```

```
}

ff[i]=j;
highest=temp;
}

printf("\nFile_no:\tFile_size :\tBlock_no:\tBlock_size:\tFragement");
for(i=1;i<=nf;i++)
printf("\n%d\t\t%d\t\t%d\t\t%d\t\t%d",i,f[i],ff[i],b[ff[i]],frag[i]);
getch();
}
```

OUTPUT:

Enter the number of blocks: 3 Enter the number of files: 2

Enter the size of the blocks:- Block 1: 5

Block 2: 2

Block 3: 7

Enter the size of the files:- File 1: 1

File 2: 4

File No	File Size	Block No	Block Size	Fragment
1	1	3	7	6
2	4	1	5	1

FIRST-FIT:

```
#include<stdio.h>
#include<conio.h>
#define max 25
void main()
{
int frag[max],b[max],f[max],i,j,nb,nf,temp;
static int bf[max],ff[max];
clrscr();
printf("\n\tMemory Management Scheme - First Fit");
printf("\nEnter the number of blocks:");
scanf("%d",&nb);
printf("Enter the number of files:");
 scanf("%d",&nf);
printf("\nEnter the size of the blocks:-\n");
for(i=1;i<=nb;i++)
{
printf("Block %d:",i);
scanf("%d",&b[i]);
}
printf("Enter the size of the files :-\n");
for(i=1;i<=nf;i++)
{
printf("File %d:",i);
scanf("%d",&f[i]);
```

```
}
for(i=1;i<=nf;i++)
{
for(j=1;j<=nb;j++)
{
if(bf[j]!=1)
{
temp=b[j]-f[i];
 if(temp>=0)
{
ff[i]=j;
break;
}
}
}
frag[i]=temp; bf[ff[i]]=1;
}
printf("\nFile_no:\tFile_size :\tBlock_no:\tBlock_size:\tFragement"); for(i=1;i<=nf;i++)
printf("\n%d\t\t%d\t\t%d\t\t%d\t\t%d",i,f[i],ff[i],b[ff[i]],frag[i];
getch();
}
```

OUTPUT:

Enter the number of blocks: 3 Enter the number of files: 2

Enter the size of the blocks:- Block 1: 5

Block 2: 2

Block 3: 7

Enter the size of the files:- File 1: 1

File 2: 4

File No File Size Block No Block Size Fragment

1 1 1 5 4

2 4 3 7 3

BEST-FIT

```
#include<stdio.h>
#include<conio.h>
#define max 25
void main()
{
int frag[max],b[max],f[max],i,j,nb,nf,temp,lowest=10000;
static int bf[max],ff[max];
clrscr();
printf("\n\tMemory Management Scheme – Best Fit");
printf("\nEnter the number of blocks:"); scanf("%d",&nb);
printf("Enter the number of files:"); scanf("%d",&nf);
printf("\nEnter the size of the blocks:-\n");
for(i=1;i<=nb;i++)
printf("Block %d:",i);
scanf("%d",&b[i]);
printf("Enter the size of the files :-\n");
 for(i=1;i<=nf;i++)
{printf("File %d:",i);
scanf("%d",&f[i]);}
for(i=1;i<=nf;i++)
{
for(j=1;j<=nb;j++)
```

```
{
if(bf[j]!=1)
{
temp=b[j]-f[i];
 if(temp>=0)
if(lowest>temp)
{
ff[i]=j;
lowest=temp;
}
}
}
frag[i]=lowest;
 bf[ff[i]]=1;
 lowest=10000;
}
printf("\nFile No\tFile Size \tBlock No\tBlock Size\tFragment");
for(i=1;i<=nf && ff[i]!=0;i++)
printf("\n%d\t\t%d\t\t%d\t\t%d\t\t%d",i,f[i],ff[i],b[ff[i]],frag[i]);
getch();
}
```

OUTPUT:

Enter the number of blocks: 3 Enter the number of files: 2

Enter the size of the blocks:- Block 1: 5

Block 2: 2

Block 3: 7

Enter the size of the files:- File 1: 1

File 2: 4

File No	File Size	Block No	Block Size	Fragment
1	1	2	2	1
2	4	1	5	1

EXPERIMENT 10

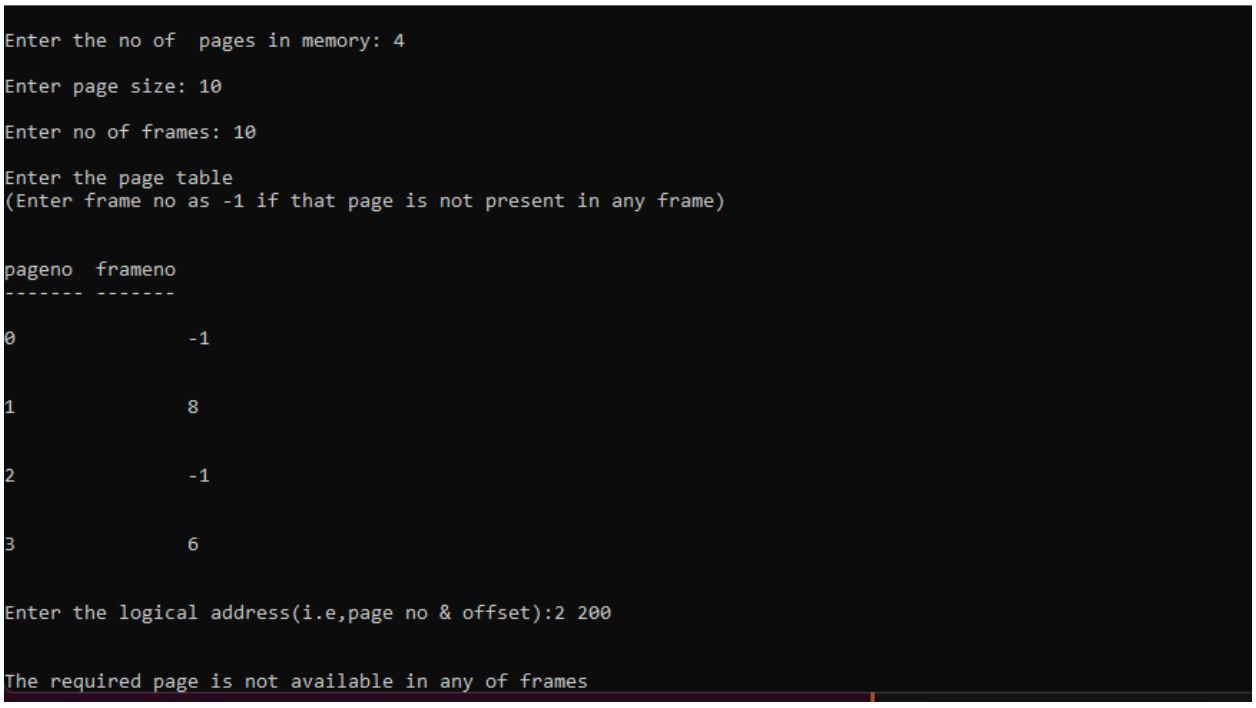
Aim of the program : Write a C program to simulate paging technique of memory management.

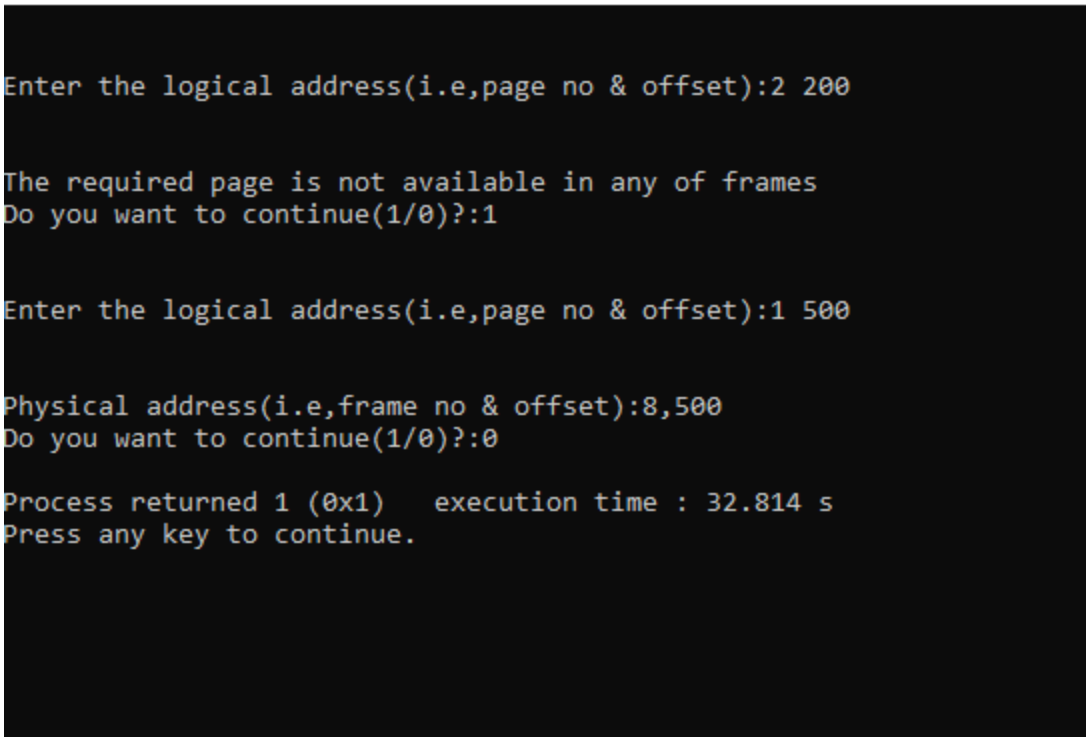
Program :

```
#include<stdio.h>
#define MAX 50
int main()
{
      int page[MAX],i,n,f,ps,off,pno;
      int choice=0;
      printf("\nEnter the no of  pages in memory: ");
      scanf("%d",&n);
      printf("\nEnter page size: ");
      scanf("%d",&ps);
      printf("\nEnter no of frames: ");
      scanf("%d",&f);
      for(i=0;i<n;i++)
      page[i]=-1;
      printf("\nEnter the page table\n");
      printf("(Enter frame no as -1 if that page is not present in any frame)\n\n");
      printf("\npageno\tframeno\n-------\t-------");
   for(i=0;i<n;i++)
   {
      printf("\n\n%d\t\t",i);
      scanf("%d",&page[i]);
   }
   do
```

```
    {
        printf("\n\nEnter the logical address(i.e,page no & offset):");
        scanf("%d%d",&pno,&off);
        if(page[pno]==-1)
        printf("\n\nThe required page is not available in any of frames");
        else
        printf("\n\nPhysical address(i.e,frame no & offset):%d,%d",page[pno],off);
        printf("\nDo you want to continue(1/0)?:");
        scanf("%d",&choice);
    }while(choice==1);
    return 1;
}
```

OUTPUT:




Enter the logical address(i.e,page no & offset):2 200
The required page is not available in any of frames
Do you want to continue(1/0)?:1
Enter the logical address(i.e,page no & offset):1 500
Physical address(i.e,frame no & offset):8,500
Do you want to continue(1/0)?:0
Process returned 1 (0x1)   execution time : 32.814 s
Press any key to continue.

EXPERIMENT 11

Aim of the program: Write a C program to simulate page replacement algorithms

a) FIFO

b) LRU

c) Optimal

Program:

```
#include<stdio.h>
int n,nf;
int in[100];
int p[50];
int hit=0;
int i,j,k;
int pgfaultcnt=0;

void getData()
{
   printf("\nEnter length of page reference sequence:");
   scanf("%d",&n);
   printf("\nEnter the page reference sequence:");
   for(i=0; i<n; i++)
      scanf("%d",&in[i]);
   printf("\nEnter no of frames:");
   scanf("%d",&nf);
}

void initialize()
```

```
{
   pgfaultcnt=0;
   for(i=0; i<nf; i++)
      p[i]=9999;
}

int isHit(int data)
{
   hit=0;
   for(j=0; j<nf; j++)
   {
      if(p[j]==data)
      {
         hit=1;
         break;
      }

   }

   return hit;
}

int getHitIndex(int data)
{
   int hitind;
   for(k=0; k<nf; k++)
   {
```

```
        if(p[k]==data)
        {
            hitind=k;
            break;
        }
    }
    return hitind;
}

void dispPages()
{
    for (k=0; k<nf; k++)
    {
        if(p[k]!=9999)
            printf(" %d",p[k]);
    }

}

void dispPgFaultCnt()
{
    printf("\nTotal no of page faults:%d",pgfaultcnt);
}

void fifo()
{
    initialize();
```

```
    for(i=0; i<n; i++)
    {
        printf("\nFor %d :",in[i]);

        if(isHit(in[i])==0)
        {

            for(k=0; k<nf-1; k++)
                p[k]=p[k+1];

            p[k]=in[i];
            pgfaultcnt++;
            dispPages();
        }
        else
            printf("No page fault");
    }
    dispPgFaultCnt();
}


void optimal()
{
    initialize();
    int near[50];
    for(i=0; i<n; i++)
    {
```

```
printf("\nFor %d :",in[i]);

if(isHit(in[i])==0)
{

   for(j=0; j<nf; j++)
   {
      int pg=p[j];
      int found=0;
      for(k=i; k<n; k++)
      {
         if(pg==in[k])
         {
            near[j]=k;
            found=1;
            break;
         }
         else
            found=0;
      }
      if(!found)
         near[j]=9999;
   }
   int max=-9999;
   int repindex;
   for(j=0; j<nf; j++)
```

```
        {
            if(near[j]>max)
            {
                max=near[j];
                repindex=j;
            }
        }
        p[repindex]=in[i];
        pgfaultcnt++;

        dispPages();
      }
      else
        printf("No page fault");
   }
   dispPgFaultCnt();
}

void lru()
{
   initialize();

   int least[50];
   for(i=0; i<n; i++)
   {

      printf("\nFor %d :",in[i]);
```

```
if(isHit(in[i])==0)
{

   for(j=0; j<nf; j++)
   {
      int pg=p[j];
      int found=0;
      for(k=i-1; k>=0; k--)
      {
         if(pg==in[k])
         {
            least[j]=k;
            found=1;
            break;
         }
         else
            found=0;
      }
      if(!found)
         least[j]=-9999;
   }
   int min=9999;
   int repindex;
   for(j=0; j<nf; j++)
   {
      if(least[j]<min)
```

```
            {
                min=least[j];
                repindex=j;
            }
          }
          p[repindex]=in[i];
          pgfaultcnt++;

          dispPages();
       }
       else
          printf("No page fault!");
    }
    dispPgFaultCnt();
}


int main()
{
    int choice;
    while(1)
    {
       printf("\nPage Replacement Algorithms\n1.Enter
data\n2.FIFO\n3.Optimal\n4.LRU\n5.Exit\nEnter your choice:");
       scanf("%d",&choice);
       switch(choice)
       {
       case 1:
```

```
            getData();
            break;
        case 2:
            fifo();
            break;
        case 3:
            optimal();
            break;
        case 4:
            lru();
            break;
        case 5:
            exit (0);
        default:
            return 0;
            break;
        }
    }
}
```

OUTPUT:

```
Page Replacement Algorithms
1.Enter data
2.FIFO
3.Optimal
4.LRU
5.Exit
Enter your choice:1

Enter length of page reference sequence:8

Enter the page reference sequence:2 3 4 2 3 5 6 2

Enter no of frames:3

Page Replacement Algorithms
1.Enter data
2.FIFO
3.Optimal
4.LRU
5.Exit
Enter your choice:2
```

```
For 2 : 2
For 3 : 2 3
For 4 : 2 3 4
For 2 :No page fault
For 3 :No page fault
For 5 : 3 4 5
For 6 : 4 5 6
For 2 : 5 6 2
Total no of page faults:6
Page Replacement Algorithms
1.Enter data
2.FIFO
3.Optimal
4.LRU
5.Exit
Enter your choice:3

For 2 : 2
For 3 : 2 3
For 4 : 2 3 4
For 2 :No page fault
For 3 :No page fault
For 5 : 2 5 4
For 6 : 2 6 4
For 2 :No page fault
Total no of page faults:5
Page Replacement Algorithms
1.Enter data
2.FIFO
3.Optimal
4.LRU
5.Exit
Enter your choice:4

For 2 : 2
For 3 : 2 3
For 4 : 2 3 4
For 2 :No page fault!
For 3 :No page fault!
For 5 : 2 3 5
For 6 : 6 3 5
For 2 : 6 2 5
Total no of page faults:6
```

EXPERIMENT 12

Aim of the program:Write a C program to simulate the following file allocation strategies.

a) Sequential

b) Indexed

c) Linked

Program:

a) Sequential

```
#include<stdio.h>
#include<conio.h>
struct fileTable
{
char name[20];
int sb, nob;
}ft[30];
void main()
{
int i, j, n;
char s[20];
clrscr();
printf("Enter no of files :");
scanf("%d",&n);
for(i=0;i<n;i++)
{
printf("\nEnter file name %d :",i+1);
scanf("%s",ft[i].name);
printf("Enter starting block of file %d :",i+1);
scanf("%d",&ft[i].sb);
printf("Enter no of blocks in file %d :",i+1);
scanf("%d",&ft[i].nob);
}
printf("\nEnter the file name to be searched -- ");
scanf("%s",s);
for(i=0;i<n;i++)
if(strcmp(s, ft[i].name)==0)
```

```
break;
if(i==n)
printf("\nFile Not Found");
else
{
printf("\nFILE NAME   START BLOCK   NO OF BLOCKS   BLOCKS OCCUPIED\n");
printf("\n%s\t\t%d\t\t%d\t",ft[i].name,ft[i].sb,ft[i].nob);
for(j=0;j<ft[i].nob;j++)
printf("%d, ",ft[i].sb+j);
}
getch();
}
```

OUTPUT:

```
Enter no of files :3

Enter file name 1 :A
Enter starting block of file 1 :58
Enter no of blocks in file 1 :4

Enter file name 2 :B
Enter starting block of file 2 :102
Enter no of blocks in file 2 :5

Enter file name 3 :C
Enter starting block of file 3 :60
Enter no of blocks in file 3 :4

Enter the file name to be searched -- B

FILE NAME   START BLOCK   NO OF BLOCKS   BLOCKS OCCUPIED

B               102             5       102, 103, 104, 105, 106,
Process returned 5 (0x5)   execution time : 104.780 s
Press any key to continue.
```

b) Indexed:

```
#include<stdio.h>
#include<conio.h>
struct fileTable
```

```
{
char name[20];
int nob, blocks[30];
}ft[30];
void main()
{
int i, j, n;
char s[20];
clrscr();
printf("Enter no of files :");
scanf("%d",&n);
for(i=0;i<n;i++)
{
printf("\nEnter file name %d :",i+1);
scanf("%s",ft[i].name);
printf("Enter no of blocks in file %d :",i+1);
scanf("%d",&ft[i].nob);
printf("Enter the blocks of the file    :");
for(j=0;j<ft[i].nob;j++)
scanf("%d",&ft[i].blocks[j]);
}
printf("\nEnter the file name to be searched -- ");
scanf("%s",s);
for(i=0;i<n;i++)
if(strcmp(s, ft[i].name)==0)
break;
if(i==n)
printf("\nFile Not Found");
else
{
printf("\nFILE NAME  NO OF BLOCKS   BLOCKS OCCUPIED");
printf("\n    %s\t\t%d\t",ft[i].name,ft[i].nob);
for(j=0;j<ft[i].nob;j++)
printf("%d, ",ft[i].blocks[j]);
}
getch();
}
```

OUTPUT:

```
Enter no of files :2

Enter file name 1 :A
Enter no of blocks in file 1 :4
Enter the blocks of the file    :12 23 9 4

Enter file name 2 :B
Enter no of blocks in file 2 :5
Enter the blocks of the file    :88 77 66 55 44

Enter the file name to be searched -- B

FILE NAME  NO OF BLOCKS   BLOCKS OCCUPIED
    B           5       88, 77, 66, 55, 44,
Process returned 5 (0x5)   execution time : 35.132 s
Press any key to continue.
```

c) Linked

```
include<stdio.h>
#include<conio.h>
struct fileTable
{
char name[20];
int nob;
struct block *sb;
}ft[30];
struct block
{
int bno;
struct block *next;
};
void main()
{
int i, j, n;
char s[20];
struct block *temp;
clrscr();
printf("Enter no of files :");
scanf("%d",&n);
```

```
for(i=0;i<n;i++)
{
printf("\nEnter file name %d :",i+1);
scanf("%s",ft[i].name);
printf("Enter no of blocks in file %d :",i+1);
scanf("%d",&ft[i].nob);
ft[i].sb=(struct block*)malloc(sizeof(struct block));
temp = ft[i].sb;
printf("Enter the blocks of the file    :");
scanf("%d",&temp->bno);
temp->next=NULL;
for(j=1;j<ft[i].nob;j++)
{
temp->next = (struct block*)malloc(sizeof(struct block));
temp = temp->next;
scanf("%d",&temp->bno);
}
temp->next = NULL;
}
printf("\nEnter the file name to be searched  --   ");
scanf("%s",s);
for(i=0;i<n;i++)
if(strcmp(s, ft[i].name)==0)
break;
if(i==n)
printf("\nFile Not Found");
else
{
printf("\nFILE NAME  NO OF BLOCKS   BLOCKS OCCUPIED");
printf("\n    %s\t\t%d\t",ft[i].name,ft[i].nob);
temp=ft[i].sb;
for(j=0;j<ft[i].nob;j++)
{
printf("%d ",temp->bno);
temp = temp->next;
}
}
getch();
}
```

OUTPUT:

```
Enter no of files :2

Enter file name 1 :A
Enter no of blocks in file 1 :4
Enter the blocks of the file    :12 23 9 4

Enter file name 2 :B
Enter no of blocks in file 2 :5
Enter the blocks of the file    :88 77 66 55 44

Enter the file name to be searched  --   B

FILE NAME  NO OF BLOCKS   BLOCKS OCCUPIED
    B           5       88 77 66 55 44
Process returned 5 (0x5)   execution time : 30.038 s
Press any key to continue.
```

EXPERIMENT 13

Aim of the program: Write a C program to simulate the following file organization techniques

a) Single level directory

b) Two level directory

c) Hierarchical

Program:

a) Single level directory

```
#include<stdio.h>
struct
{
char dname[10],fname[10][10];
int fcnt;
}dir;
void main()
{
int i,ch;
char f[30];
clrscr();
dir.fcnt = 0;
printf("\nEnter name of directory -- ");
scanf("%s", dir.dname);
while(1)
{
printf("\n\n 1. Create File\t2. Delete File\t3. Search File \n 4. Display Files\t5. Exit\nEnter
your choice -- ");
scanf("%d",&ch);
switch(ch)
{
case 1: printf("\n Enter the name of the file -- ");
scanf("%s",dir.fname[dir.fcnt]);
dir.fcnt++;
break;
```

```
case 2: printf("\n Enter the name of the file -- ");
scanf("%s",f);
for(i=0;i<dir.fcnt;i++)
{
if(strcmp(f, dir.fname[i])==0)
{
printf("File %s is deleted ",f);
strcpy(dir.fname[i],dir.fname[dir.fcnt-1]);
break;
}
}
if(i==dir.fcnt)
printf("File %s not found",f);
else
dir.fcnt--;
break;
case 3: printf("\n Enter the name of the file -- ");
scanf("%s",f);
for(i=0;i<dir.fcnt;i++)
{
if(strcmp(f, dir.fname[i])==0)
{
printf("File %s is found ", f);
break;
}
}
if(i==dir.fcnt)
printf("File %s not found",f);
break;
case 4: if(dir.fcnt==0)
printf("\n Directory Empty");
else
{
printf("\n The Files are -- ");
for(i=0;i<dir.fcnt;i++)
printf("\t%s",dir.fname[i]);
}
break;
default: exit(0);
}
}
```

```
getch();
}
```

OUTPUT:

```
Enter name of directory -- CSE


 1. Create File 2. Delete File  3. Search File
 4. Display Files       5. Exit
Enter your choice -- 1

 Enter the name of the file -- A


 1. Create File 2. Delete File  3. Search File
 4. Display Files       5. Exit
Enter your choice -- 1

 Enter the name of the file -- B


 1. Create File 2. Delete File  3. Search File
 4. Display Files       5. Exit
Enter your choice -- 4

 The Files are --       A       B

 1. Create File 2. Delete File  3. Search File
 4. Display Files       5. Exit
Enter your choice -- 3

 Enter the name of the file -- B
File B is found

 1. Create File 2. Delete File  3. Search File
 4. Display Files       5. Exit
Enter your choice -- 2

 Enter the name of the file -- B
File B is deleted

 1. Create File 2. Delete File  3. Search File
 4. Display Files       5. Exit
```

b) Two level directory

```
#include<stdio.h>
struct
{
char dname[10],fname[10][10];
int fcnt;
}dir[10];
void main()
{
int i,ch,dcnt,k;
char f[30], d[30];
clrscr();
dcnt=0;
while(1)
{
printf("\n\n 1. Create Directory\t 2. Create File\t 3. Delete File");
printf("\n 4. Search File \t \t 5. Display \t 6. Exit \t Enter your choice -- ");
scanf("%d",&ch);
switch(ch)
{
case 1: printf("\n Enter name of directory -- ");
scanf("%s", dir[dcnt].dname);
dir[dcnt].fcnt=0;
dcnt++;
printf("Directory created");
break;
case 2: printf("\n Enter name of the directory -- ");
scanf("%s",d);
for(i=0;i<dcnt;i++)
if(strcmp(d,dir[i].dname)==0)
{
printf("Enter name of the file -- ");
scanf("%s",dir[i].fname[dir[i].fcnt]);
dir[i].fcnt++;
printf("File created");
break;
}
if(i==dcnt)
printf("Directory %s not found",d);
```

```
break;
case 3: printf("\nEnter name of the directory -- ");
scanf("%s",d);
for(i=0;i<dcnt;i++)
{
if(strcmp(d,dir[i].dname)==0)
{
printf("Enter name of the file -- ");
scanf("%s",f);
for(k=0;k<dir[i].fcnt;k++)
{
if(strcmp(f, dir[i].fname[k])==0)
{
printf("File %s is deleted ",f);
dir[i].fcnt--;
strcpy(dir[i].fname[k],dir[i].fname[dir[i].fcnt]);
goto jmp;
}
}
printf("File %s not found",f);
goto jmp;
}
}
printf("Directory %s not found",d);
jmp : break;
case 4: printf("\nEnter name of the directory -- ");
scanf("%s",d);
for(i=0;i<dcnt;i++)
{

if(strcmp(d,dir[i].dname)==0)
{
printf("Enter the name of the file -- ");
scanf("%s",f);
for(k=0;k<dir[i].fcnt;k++)
{
if(strcmp(f, dir[i].fname[k])==0)
{
printf("File %s is found ",f);
goto jmp1;
}
```

```
}
printf("File %s not found",f);
goto jmp1;}
}
printf("Directory %s not found",d);
jmp1: break;
case 5: if(dcnt==0)
printf("\nNo Directory's ");
else
{
printf("\nDirectory\tFiles");
for(i=0;i<dcnt;i++)
{
printf("\n%s\t\t",dir[i].dname);
for(k=0;k<dir[i].fcnt;k++)
printf("\t%s",dir[i].fname[k]);
}
}
break;
default:exit(0);
}
}
getch();
}
```

OUTPUT:

```
 1. Create Directory     2. Create File  3. Delete File
 4. Search File                  5. Display      6. Exit         Enter your choice -- 1

 Enter name of directory -- Dir1
Directory created

 1. Create Directory     2. Create File  3. Delete File
 4. Search File                  5. Display      6. Exit         Enter your choice -- 1

 Enter name of directory -- Dir2
Directory created

 1. Create Directory     2. Create File  3. Delete File
 4. Search File                  5. Display      6. Exit         Enter your choice -- 2

 Enter name of the directory -- Dir1
Enter name of the file -- A
File created

 1. Create Directory     2. Create File  3. Delete File
 4. Search File                  5. Display      6. Exit         Enter your choice -- 2

 Enter name of the directory -- Dir2
Enter name of the file -- A@
File created

 1. Create Directory     2. Create File  3. Delete File
 4. Search File                  5. Display      6. Exit         Enter your choice -- 5

Directory       Files
Dir1                    A
Dir2                    A@

 1. Create Directory     2. Create File  3. Delete File
 4. Search File                  5. Display      6. Exit         Enter your choice -- 6

Process returned 0 (0x0)   execution time : 63.227 s
Press any key to continue.
```

c) Hierarchical

```
#include<stdio.h>
#include<graphics.h>
struct tree_element
{
char name[20];
int x,y,ftype,lx,rx,nc,level;
struct tree_element *link[5];
};
typedef struct tree_element
node; void main()
{
int gd=DETECT,gm;
node *root;
root=NULL;
clrscr();
create(&root,0,"root",0,639,320);
clrscr();
initgraph(&gd,&gm,"c:\\tc\\BGI");
display(root);
getch();
closegraph();
}
create(node **root,int lev,char *dname,int lx,int rx,int x)
{
int i,gap;
if(*root==NULL)
{
(*root)=(node *)malloc(sizeof(node));
printf("Enter name of dir/file(under %s) :",dname);
fflush(stdin);
gets((*root)->name);
printf("enter 1 for Dir/2 forfile :");
scanf("%d",&(*root)->ftype);
(*root)->level=lev;
(*root)->y=50+lev*50;
(*root)->x=x;
(*root)->lx=lx;
(*root)->rx=rx;
```

```
for(i=0;i<5;i++)
(*root)->link[i]=NULL;
if((*root)->ftype==1)
{
printf("No of sub directories/files(for %s):",(*root)->name); scanf("%d",&(*root)->nc);
if((*root)->nc==0)
gap=rx-lx;
else gap=(rx-lx)/(*root)->nc;
for(i=0;i<(*root)->nc;i++)
create(&((*root)->link[i]),lev+1,(*root)->name,lx+gap*i,lx+gap*i+gap,lx+gap*i+gap/2);
}
else (*root)->nc=0;
}
}
display(node *root)
{
int i;
settextstyle(2,0,4);
settextjustify(1,1);
setfillstyle(1,BLUE);
setcolor(14); if(root!=NULL)
{
for(i=0;i<root->nc;i++)
{
line(root->x,root->y,root->link[i]->x,root->link[i]->y);
}
if(root->ftype==1) bar3d(root->x-20,root->y-10,root->x+20,root->y+10,0,0); else
fillellipse(root->x,root->y,20,20);
outtextxy(root->x,root->y,root->name); for(i=0;i<root->nc;i++)
{
display(root->link[i]);
}
}
}
```

EXPERIMENT 14

Aim of the program: Write a C program to simulate disk scheduling algorithms

a) FCFS

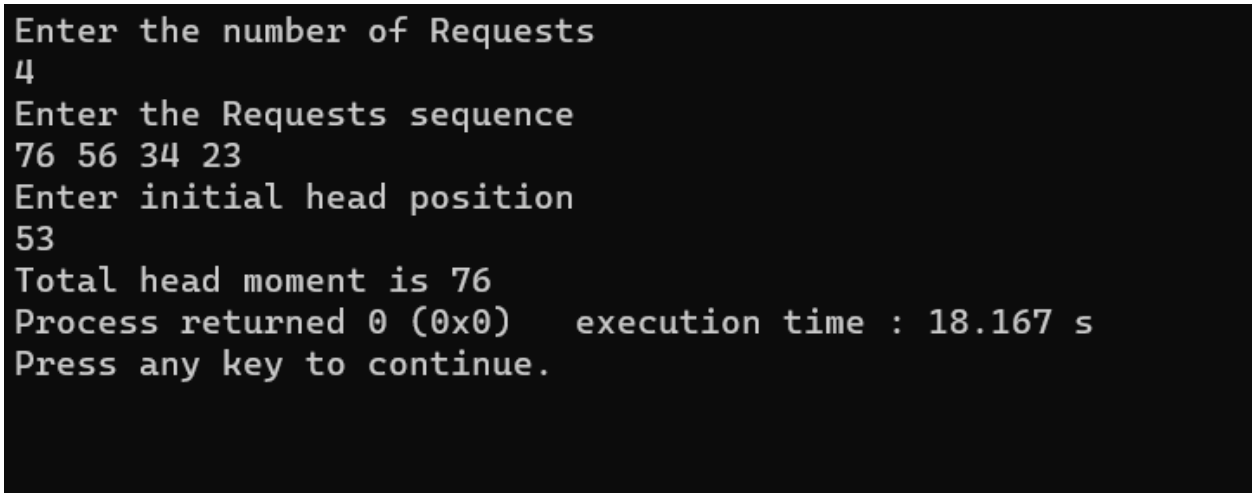
b) SCAN

c) C-SCAN

Program:

```
/*FCFCS*/
#include<stdio.h>
#include<stdlib.h>
int main()
{
   int RQ[100],i,n,TotalHeadMoment=0,initial;
   printf("Enter the number of Requests\n");
   scanf("%d",&n);
   printf("Enter the Requests sequence\n");
   for(i=0;i<n;i++)
    scanf("%d",&RQ[i]);
   printf("Enter initial head position\n");
   scanf("%d",&initial);

   // logic for FCFS disk scheduling

   for(i=0;i<n;i++)
   {
      TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
      initial=RQ[i];
   }

   printf("Total head moment is %d",TotalHeadMoment);
   return 0;

}
```

OUTPUT:



/*SCAN*/

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
   int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
   printf("Enter the number of Requests\n");
   scanf("%d",&n);
   printf("Enter the Requests sequence\n");
   for(i=0;i<n;i++)
    scanf("%d",&RQ[i]);
   printf("Enter initial head position\n");
   scanf("%d",&initial);
   printf("Enter total disk size\n");
   scanf("%d",&size);
```

```
printf("Enter the head movement direction for high 1 and for low 0\n");
scanf("%d",&move);

// logic for Scan disk scheduling

   /*logic for sort the request array */
for(i=0;i<n;i++)
{
   for(j=0;j<n-i-1;j++)
   {
      if(RQ[j]>RQ[j+1])
      {
         int temp;
         temp=RQ[j];
         RQ[j]=RQ[j+1];
         RQ[j+1]=temp;
      }

   }
}

int index;
for(i=0;i<n;i++)
{
   if(initial<RQ[i])
   {
      index=i;
      break;
   }
```

```
}

// if movement is towards high value
if(move==1)
{
   for(i=index;i<n;i++)
   {
      TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
      initial=RQ[i];
   }
   //  last movement for max size
   TotalHeadMoment=TotalHeadMoment+abs(size-RQ[i-1]-1);
   initial = size-1;
   for(i=index-1;i>=0;i--)
   {
       TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
       initial=RQ[i];

   }
}
// if movement is towards low value
else
{
   for(i=index-1;i>=0;i--)
   {
      TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
      initial=RQ[i];
   }
   //  last movement for min size
```

```
        TotalHeadMoment=TotalHeadMoment+abs(RQ[i+1]-0);
        initial =0;
        for(i=index;i<n;i++)
        {
            TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];

        }
    }

    printf("Total head movement is %d",TotalHeadMoment);
    return 0;
}
```

OUTPUT:

```
Enter the number of Requests
4
Enter the Requests sequence
65 43 28 99
Enter initial head position
53
Enter total disk size
120
Enter the head movement direction for high 1 and for low 0
0
Total head movement is 152
Process returned 0 (0x0)   execution time : 36.194 s
Press any key to continue.
```

/*C-SCAN*/

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
```

```
int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
printf("Enter the number of Requests\n");
scanf("%d",&n);
printf("Enter the Requests sequence\n");
for(i=0;i<n;i++)
 scanf("%d",&RQ[i]);
printf("Enter initial head position\n");
scanf("%d",&initial);
printf("Enter total disk size\n");
scanf("%d",&size);
printf("Enter the head movement direction for high 1 and for low 0\n");
scanf("%d",&move);

// logic for C-Scan disk scheduling

   /*logic for sort the request array */
for(i=0;i<n;i++)
{
   for( j=0;j<n-i-1;j++)
   {
      if(RQ[j]>RQ[j+1])
      {
         int temp;
         temp=RQ[j];
         RQ[j]=RQ[j+1];


         RQ[j+1]=temp;
      }

   }
}

int index;
for(i=0;i<n;i++)
{
   if(initial<RQ[i])
   {
      index=i;
      break;
   }
}

// if movement is towards high value
```

```
    if(move==1)
    {
       for(i=index;i<n;i++)
       {
          TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
          initial=RQ[i];
       }
       //  last movement for max size
       TotalHeadMoment=TotalHeadMoment+abs(size-RQ[i-1]-1);
       /*movement max to min disk */
       TotalHeadMoment=TotalHeadMoment+abs(size-1-0);
       initial=0;
       for( i=0;i<index;i++)
       {
           TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
           initial=RQ[i];

       }
    }
    // if movement is towards low value
    else
    {
       for(i=index-1;i>=0;i--)
       {
          TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
          initial=RQ[i];
       }
       //  last movement for min size
       TotalHeadMoment=TotalHeadMoment+abs(RQ[i+1]-0);
       /*movement min to max disk */
       TotalHeadMoment=TotalHeadMoment+abs(size-1-0);
       initial =size-1;
       for(i=n-1;i>=index;i--)
       {
           TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
           initial=RQ[i];

       }
    }

    printf("Total head movement is %d",TotalHeadMoment);
    return 0;
}
```

OUTPUT:

```
Enter the number of Requests
4
Enter the Requests sequence
76 56 43 23
Enter initial head position
53
Enter total disk size
100
Enter the head movement direction for high 1 and for low 0
1
Total head movement is 188
Process returned 0 (0x0)   execution time : 18.838 s
Press any key to continue.
```

EXPERIMENT 15

Aim of the program: Write a C program to simulate disk scheduling algorithms

a) SSTF

b) LOOK

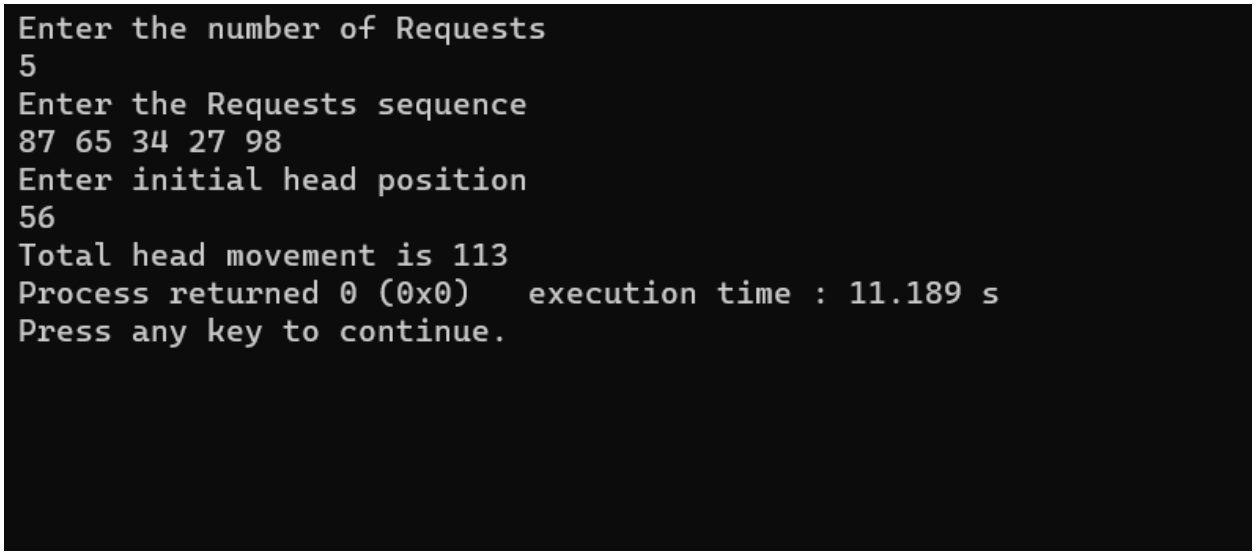
c) c-LOOK

Program:

```
/*SSTF*/
#include<stdio.h>
#include<stdlib.h>
int main()
{
   int RQ[100],i,n,TotalHeadMoment=0,initial,count=0;
   printf("Enter the number of Requests\n");
   scanf("%d",&n);
   printf("Enter the Requests sequence\n");
   for(i=0;i<n;i++)
    scanf("%d",&RQ[i]);
   printf("Enter initial head position\n");
   scanf("%d",&initial);

   // logic for sstf disk scheduling

      /* loop will execute until all process is completed*/
   while(count!=n)
   {
      int min=1000,d,index;
      for(i=0;i<n;i++)
      {
        d=abs(RQ[i]-initial);
        if(min>d)
        {
           min=d;
           index=i;
        }

      }
```

```
        TotalHeadMoment=TotalHeadMoment+min;
        initial=RQ[index];
        // 1000 is for max
        // you can use any number
        RQ[index]=1000;
        count++;
    }

    printf("Total head movement is %d",TotalHeadMoment);
    return 0;
}
```

OUTPUT:



/*LOOK*/

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
    int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
    printf("Enter the number of Requests\n");
    scanf("%d",&n);
    printf("Enter the Requests sequence\n");
    for(i=0;i<n;i++)
     scanf("%d",&RQ[i]);
```

```
printf("Enter initial head position\n");
scanf("%d",&initial);
printf("Enter total disk size\n");
scanf("%d",&size);
printf("Enter the head movement direction for high 1 and for low 0\n");
scanf("%d",&move);

// logic for look disk scheduling

   /*logic for sort the request array */
for(i=0;i<n;i++)
{
   for(j=0;j<n-i-1;j++)
   {
      if(RQ[j]>RQ[j+1])
      {
         int temp;
         temp=RQ[j];
         RQ[j]=RQ[j+1];
         RQ[j+1]=temp;
      }

   }
}

int index;
for(i=0;i<n;i++)
{
   if(initial<RQ[i])
   {
      index=i;
      break;
   }
}

// if movement is towards high value
if(move==1)
{
   for(i=index;i<n;i++)
   {
      TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
      initial=RQ[i];
   }
```

```
        for(i=index-1;i>=0;i--)
        {
            TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];

        }
    }
    // if movement is towards low value
    else
    {
        for(i=index-1;i>=0;i--)
        {
           TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
           initial=RQ[i];
        }

        for(i=index;i<n;i++)
        {
            TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];

        }
    }

    printf("Total head movement is %d",TotalHeadMoment);
    return 0;
}
```

OUTPUT:

```
Enter the number of Requests
5
Enter the Requests sequence
87 56 34 85 23
Enter initial head position
56
Enter total disk size
90
Enter the head movement direction for high 1 and for low 0
0
Total head movement is 97
Process returned 0 (0x0)   execution time : 21.884 s
Press any key to continue.
```

/*C-LOOK*/

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
   int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
   printf("Enter the number of Requests\n");
   scanf("%d",&n);
   printf("Enter the Requests sequence\n");
   for(i=0;i<n;i++)
    scanf("%d",&RQ[i]);
   printf("Enter initial head position\n");
   scanf("%d",&initial);
   printf("Enter total disk size\n");
   scanf("%d",&size);
   printf("Enter the head movement direction for high 1 and for low 0\n");
   scanf("%d",&move);

   // logic for C-look disk scheduling

      /*logic for sort the request array */
   for(i=0;i<n;i++)
   {
      for( j=0;j<n-i-1;j++)
      {
         if(RQ[j]>RQ[j+1])
         {
            int temp;
```

```
            temp=RQ[j];
            RQ[j]=RQ[j+1];
            RQ[j+1]=temp;
        }

    }
}

int index;
for(i=0;i<n;i++)
{
    if(initial<RQ[i])
    {
        index=i;
        break;
    }
}

// if movement is towards high value
if(move==1)
{
    for(i=index;i<n;i++)
    {
        Total Head Moment=Total Head Moment+abs(RQ[i]-initial);
        initial=RQ[i];
    }

    for( i=0;i<index;i++)
    {
```

```
            Total Head Moment=Total Head Moment+abs(RQ[i]-initial);
            initial=RQ[i];

        }
    }
    // if movement is towards low value
    else
    {
        for(i=index-1;i>=0;i--)
        {
            TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];
        }

        for(i=n-1;i>=index;i--)
        {
            TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];

        }
    }

    printf("Total head movement is %d",TotalHeadMoment);
    return 0;
}
```

OUTPUT:

```
Enter the number of Requests
5
Enter the Requests sequence
54 45 34 78 29
Enter initial head position
34
Enter total disk size
80
Enter the head movement direction for high 1 and for low 0
1
Total head movement is 98
Process returned 0 (0x0)   execution time : 21.948 s
Press any key to continue.
```