VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT

on

Operating Systems

(22CS4PCOPS)

Submitted by:

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in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING

(Autonomous Institution under VTU)

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CERTIFICATE

This is to certify that the Lab work entitled "**Operating Systems**" carried out by **Varun S (1BM21CS238),** 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 2022-23. The Lab report has been approved as it satisfies the academic requirements in respect of **Operating Systems - (22CS4PCOPS)** work prescribed for the said degree.

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Table Of Contents

1. Course Outcomes

CO1: Apply the different concepts and functionalities of Operating System.

CO2: Analyse various Operating system strategies and techniques.

CO3: Demonstrate the different functionalities of Operating System.

CO4: Conduct practical experiments to implement the functionalities of Operating system.

2. Experiments

2.1 Experiment - 1

2.1.1 Question:

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

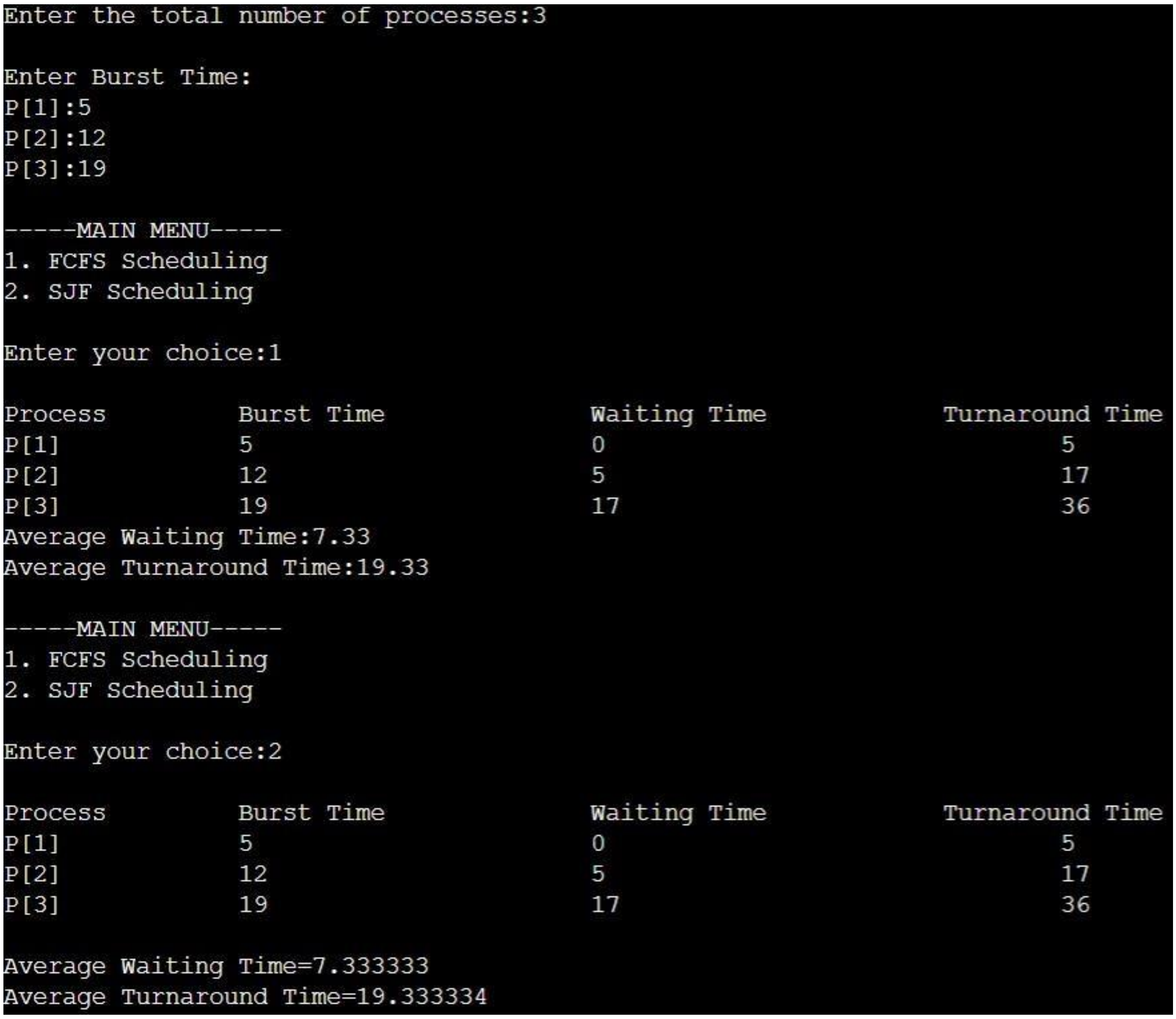
(a) FCFS

(b) SJF

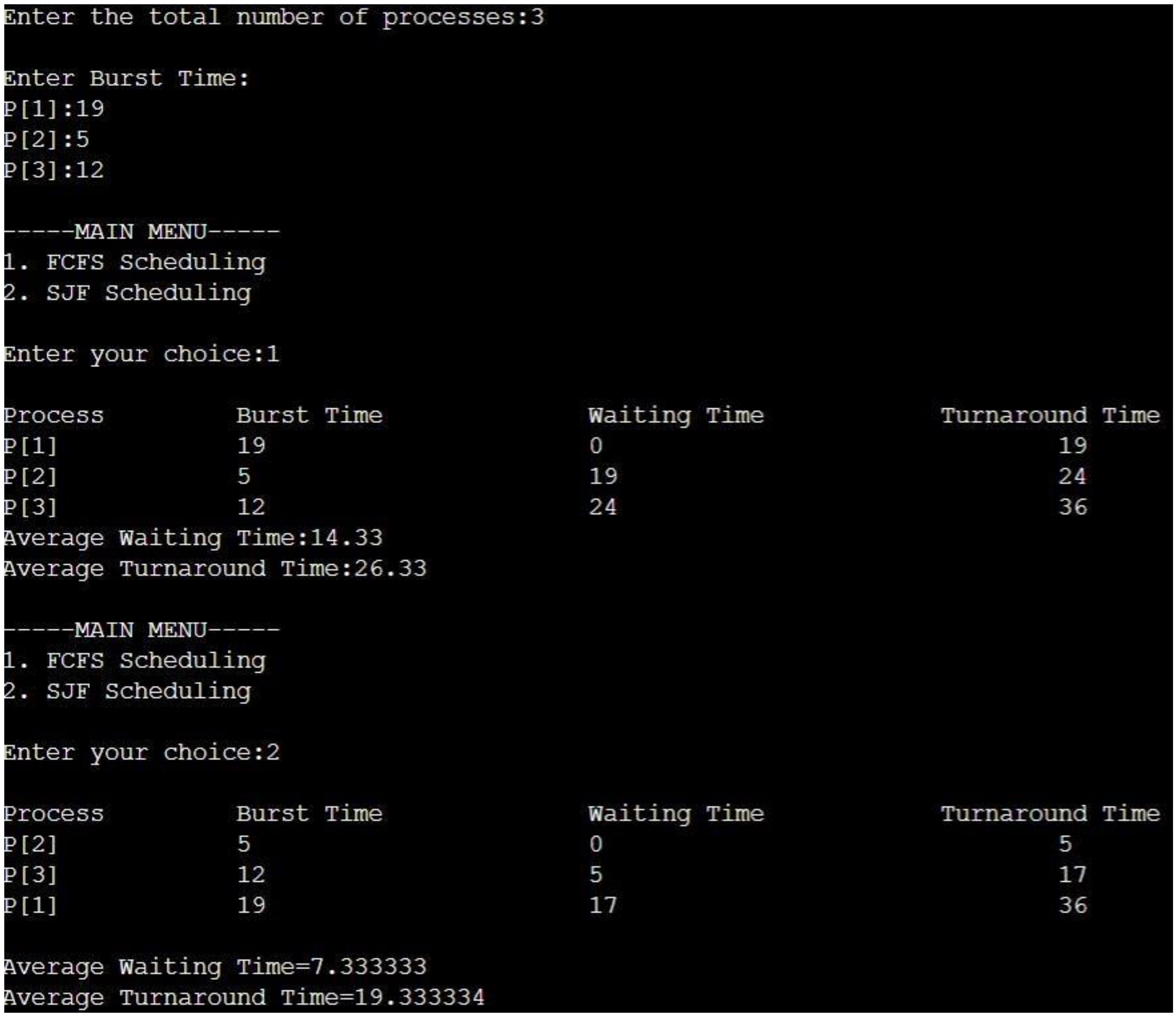
2.1.2 Code:

```
#include<stdio.h>
   int n, i, j, pos, temp, choice, Burst_time[20], Waiting_time[20], Turn_around_time[20],
   process[20], total=0;
   float avg_Turn_around_time=0, avg_Waiting_time=0;

int FCFS()
{
   Waiting_time[0]=0;

   for(i=1;i<n;i++)
   {
      Waiting_time[i]=0;
      for(j=0;j<i;j++)
         Waiting_time[i]+=Burst_time[j];
   }

   printf("\nProcess\t\tBurst Time\t\tWaiting Time\t\tTurnaround Time");

   for(i=0;i<n;i++)
   {
      Turn_around_time[i]=Burst_time[i]+Waiting_time[i];
      avg_Waiting_time+=Waiting_time[i];
      avg_Turn_around_time+=Turn_around_time[i];

printf("\nP[%d]\t\t%d\t\t\t%d\t\t\t\t%d",i+1,Burst_time[i],Waiting_time[i],Turn_around_time
[i]);
   }

   avg_Waiting_time =(float)(avg_Waiting_time)/(float)i;
   avg_Turn_around_time=(float)(avg_Turn_around_time)/(float)i;
   printf("\nAverage Waiting Time:%.2f",avg_Waiting_time);
   printf("\nAverage Turnaround Time:%.2f\n",avg_Turn_around_time);
   return 0;
}

int SJF()
{
   //sorting
   for(i=0;i<n;i++)
   {
      pos=i;
      for(j=i+1;j<n;j++)
      {
         if(Burst_time[j]<Burst_time[pos])
            pos=j;
      }

      temp=Burst_time[i];
      Burst_time[i]=Burst_time[pos];
      Burst_time[pos]=temp;

      temp=process[i];
      process[i]=process[pos];
      process[pos]=temp;
   }
      Waiting_time[0]=0;


   for(i=1;i<n;i++)
   {
      Waiting_time[i]=0;

      for(j=0;j<i;j++)
         Waiting_time[i]+=Burst_time[j];

      total+=Waiting_time[i];
   }

   avg_Waiting_time=(float)total/n;
   total=0;

   printf("\nProcess\t\tBurst Time\t\tWaiting Time\t\tTurnaround Time");

   for(i=0;i<n;i++)
   {
      Turn_around_time[i]=Burst_time[i]+Waiting_time[i];
      total+=Turn_around_time[i];
printf("\nP[%d]\t\t%d\t\t\t%d\t\t\t\t%d",process[i],Burst_time[i],Waiting_time[i],Turn_aroun
d_time[i]);
   }

   avg_Turn_around_time=(float)total/n;
   printf("\n\nAverage Waiting Time=%f",avg_Waiting_time);
   printf("\nAverage Turnaround Time=%f\n",avg_Turn_around_time);
}

int main()
{
   printf("Enter the total number of processes:");
   scanf("%d",&n);

   printf("\nEnter Burst Time:\n");
   for(i=0;i<n;i++)
   {
      printf("P[%d]:",i+1);
      scanf("%d",&Burst_time[i]);
      process[i]=i+1;
   }

   while(1)
   {   printf("\n-----MAIN MENU ----\n");
      printf("1. FCFS Scheduling\n2. SJF Scheduling\n");
      printf("\nEnter your choice:");
      scanf("%d", &choice);
      switch(choice)
      {
         case 1: FCFS();
         break;

         case 2: SJF();
         break;

         default: printf("Invalid Input!!!");
      }
   }
   return 0;
}
```

2.1.3 Output:



```
Enter the total number of processes:3

Enter Burst Time:
P[1]:5
P[2]:12
P[3]:19

-----MAIN MENU-----
1. FCFS Scheduling
2. SJF Scheduling

Enter your choice:1

Process         Burst Time              Waiting Time            Turnaround Time
P[1]            5                       0                               5
P[2]            12                      5                               17
P[3]            19                      17                              36
Average Waiting Time:7.33
Average Turnaround Time:19.33

-----MAIN MENU-----
1. FCFS Scheduling
2. SJF Scheduling

Enter your choice:2

Process         Burst Time              Waiting Time            Turnaround Time
P[1]            5                       0                               5
P[2]            12                      5                               17
P[3]            19                      17                              36

Average Waiting Time=7.333333
Average Turnaround Time=19.333334
```



```
Enter the total number of processes:3

Enter Burst Time:
P[1]:19
P[2]:5
P[3]:12

-----MAIN MENU-----
1. FCFS Scheduling
2. SJF Scheduling

Enter your choice:1

Process         Burst Time                Waiting Time              Turnaround Time
P[1]            19                        0                                 19
P[2]            5                         19                                24
P[3]            12                        24                                36
Average Waiting Time:14.33
Average Turnaround Time:26.33

-----MAIN MENU-----
1. FCFS Scheduling
2. SJF Scheduling

Enter your choice:2

Process         Burst Time                Waiting Time              Turnaround Time
P[2]            5                         0                                 5
P[3]            12                        5                                 17
P[1]            19                        17                                36

Average Waiting Time=7.333333
Average Turnaround Time=19.333334
```

2.2 Experiment - 2

2.2.1 Question:

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

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

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

2.2.2 Code:

(a) Priority (Non-pre-emptive)

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

struct process {
    int process_id;
    int burst_time;
    int priority;
    int waiting_time;
    int turnaround_time;
};

void find_average_time(struct process[], int);

void priority_scheduling(struct process[], int);

int main()
{
    int n, i;
    struct process proc[10];

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

for(i = 0; i< n; i++)
    {
        printf("\nEnter the process ID: ");
        scanf("%d", &proc[i].process_id);

        printf("Enter the burst time: ");
        scanf("%d", &proc[i].burst_time);

        printf("Enter the priority: ");
        scanf("%d", &proc[i].priority);
    }
    priority_scheduling(proc, n);
    return 0;
}

void find_waiting_time(struct process proc[], int n, int wt[])
{
    int i;
    wt[0] = 0;

    for(i = 1; i< n; i++)
    {
        wt[i] = proc[i - 1].burst_time + wt[i - 1];
    }
}

void find_turnaround_time(struct process proc[], int n, int wt[], int tat[])
{
    int i;
    for(i = 0; i< n; i++)
    {
        tat[i] = proc[i].burst_time + wt[i];
    }
}

void find_average_time(struct process proc[], int n)
{
    int wt[10], tat[10], total_wt = 0, total_tat = 0, i;

    find_waiting_time(proc, n, wt);
    find_turnaround_time(proc, n, wt, tat);

    printf("\nProcess ID\tBurst Time\tPriority\tWaiting Time\tTurnaround Time");

    for(i = 0; i< n; i++)
    {
        total_wt = total_wt + wt[i];
        total_tat = total_tat + tat[i];
        printf("\n%d\t\t%d\t\t%d\t\t%d\t\t%d", proc[i].process_id, proc[i].burst_time,
proc[i].priority, wt[i],              tat[i]);
    }
    printf("\n\nAverage Waiting Time = %f", (float)total_wt/n);
    printf("\nAverage Turnaround Time = %f\n", (float)total_tat/n);
}
void priority_scheduling(struct process proc[], int n)
{
    int i, j, pos;
    struct process temp;
    for(i = 0; i< n; i++)
    {
        pos = i;
        for(j = i + 1; j < n; j++)
        {
            if(proc[j].priority< proc[pos].priority)
            pos = j;
        }
        temp = proc[i];
        proc[i] = proc[pos];
        proc[pos] = temp;
    }
    find_average_time(proc, n);
}
```

(b) Round Robin (Non-pre-emptive)

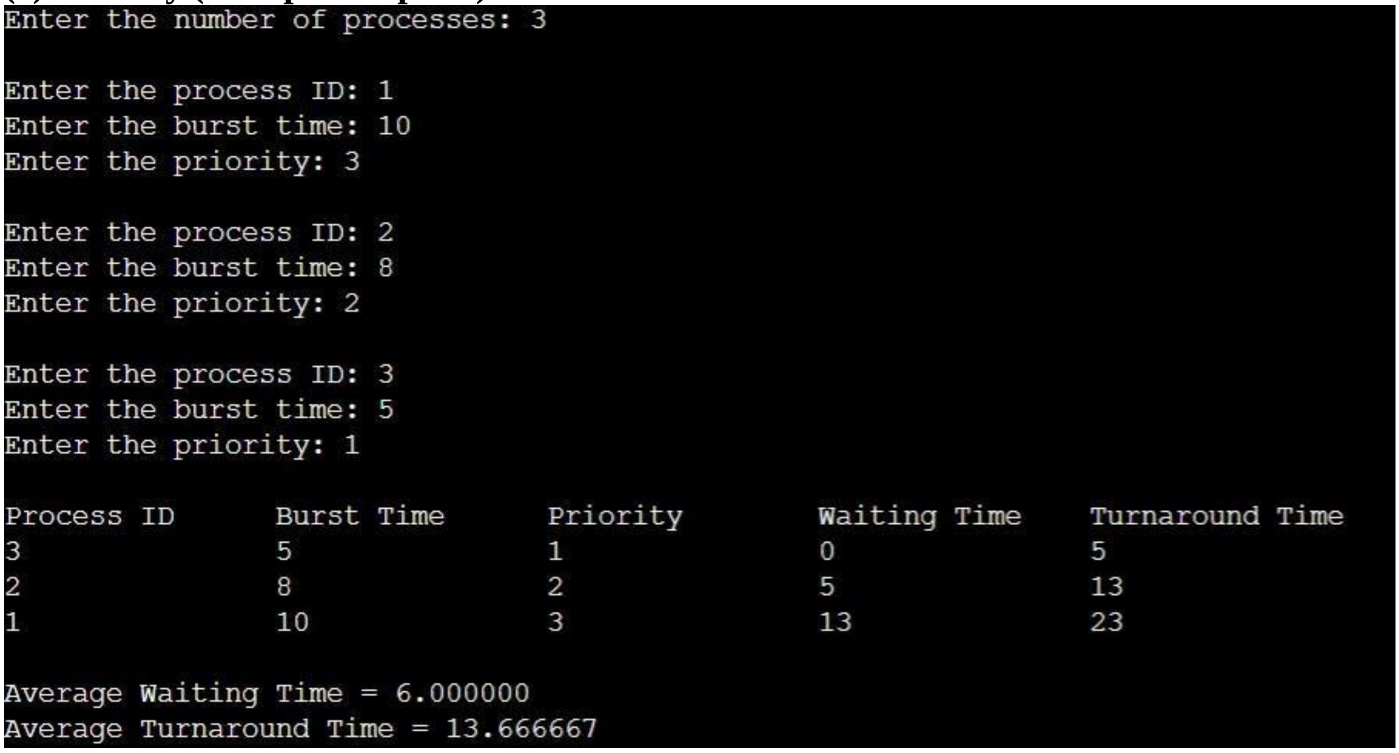
```
#include <stdio.h>
#include <stdbool.h>

int turnarroundtime(int processes[], int n, int bt[], int wt[], int tat[]) {
   for (int i = 0; i < n ; i++)
   tat[i] = bt[i] + wt[i];
   return 1;
}

int waitingtime(int processes[], int n, int bt[], int wt[], int quantum)
{
   int rem_bt[n];
   for (int i = 0 ; i < n ; i++)
   rem_bt[i] = bt[i];
   int t = 0;

    while (1)
    {
        bool done = true;

        for (int i = 0 ; i < n; i++)
        {
            if (rem_bt[i] > 0)
            {
                done = false;
                if (rem_bt[i] > quantum)
                {
```

```
                t += quantum;
                rem_bt[i] -= quantum;
            }

            else
            {
                t = t + rem_bt[i];
                wt[i] = t - bt[i];
                rem_bt[i] = 0;
            }
        }
    }
    if (done == true)
      break;
  }
  return 1;
}

int findavgTime(int processes[], int n, int bt[], int quantum) {
   int wt[n], tat[n], total_wt = 0, total_tat = 0;

   waitingtime(processes, n, bt, wt, quantum);
   turnarroundtime(processes, n, bt, wt, tat);

   printf("\n\nProcesses\t\t Burst Time\t\t Waiting Time\t\t turnaround time\n");
   for (int i=0; i<n; i++)
   {
      total_wt = total_wt + wt[i];
      total_tat = total_tat + tat[i];
      printf("\n\t%d\t\t\t%d\t\t\t%d\t\t\t%d\n",i+1, bt[i], wt[i], tat[i]);
   }

   printf("\nAverage waiting time = %f", (float)total_wt / (float)n);
   printf("\nAverage turnaround time = %f", (float)total_tat / (float)n);
   return 1;
}

int main()
{
  int n, processes[n], burst_time[n], quantum;
  printf("Enter the Number of Processes: ");
  scanf("%d",&n);

  printf("\nEnter the quantum time: ");
  scanf("%d",&quantum);
```

```
    int i=0;
    for(i=0;i<n;i++)
    {
        printf("\nEnter the process: ");
        scanf("%d",&processes[i]);
        printf("Enter the Burst Time:");
        scanf("%d",&burst_time[i]);
   }

   findavgTime(processes, n, burst_time, quantum);
   return 0;
}
```

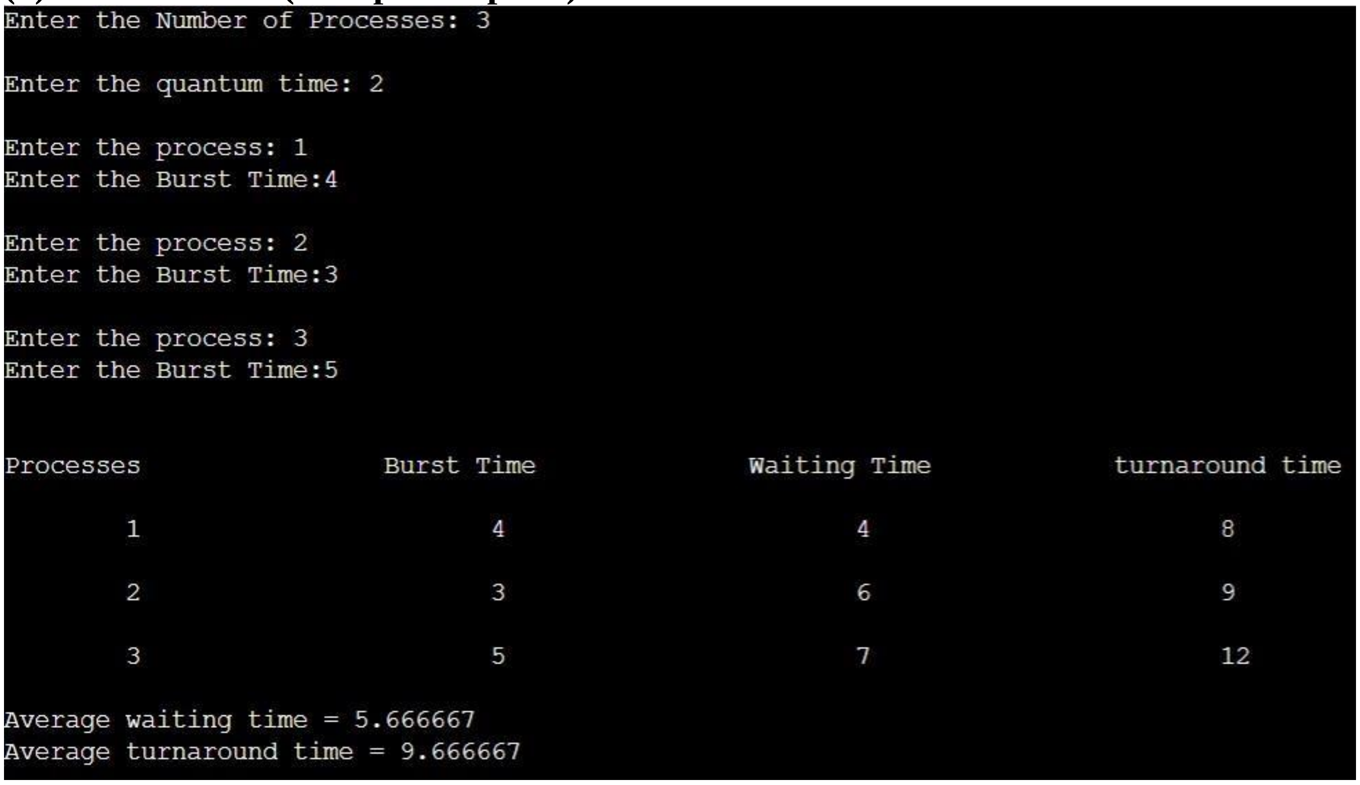
2.2.3 Output:

(a) Priority (Non-pre-emptive)



```
Enter the number of processes: 3

Enter the process ID: 1
Enter the burst time: 10
Enter the priority: 3

Enter the process ID: 2
Enter the burst time: 8
Enter the priority: 2

Enter the process ID: 3
Enter the burst time: 5
Enter the priority: 1

Process ID      Burst Time      Priority        Waiting Time    Turnaround Time
3               5               1               0               5
2               8               2               5               13
1               10              3               13              23

Average Waiting Time = 6.000000
Average Turnaround Time = 13.666667
```

(b) Round Robin (Non-pre-emptive)



```
Enter the Number of Processes: 3

Enter the quantum time: 2

Enter the process: 1
Enter the Burst Time:4

Enter the process: 2
Enter the Burst Time:3

Enter the process: 3
Enter the Burst Time:5


Processes                Burst Time              Waiting Time            turnaround time

        1                       4                       4                       8

        2                       3                       6                       9

        3                       5                       7                       12

Average waiting time = 5.666667
Average turnaround time = 9.666667
```

2.3 Experiment - 3

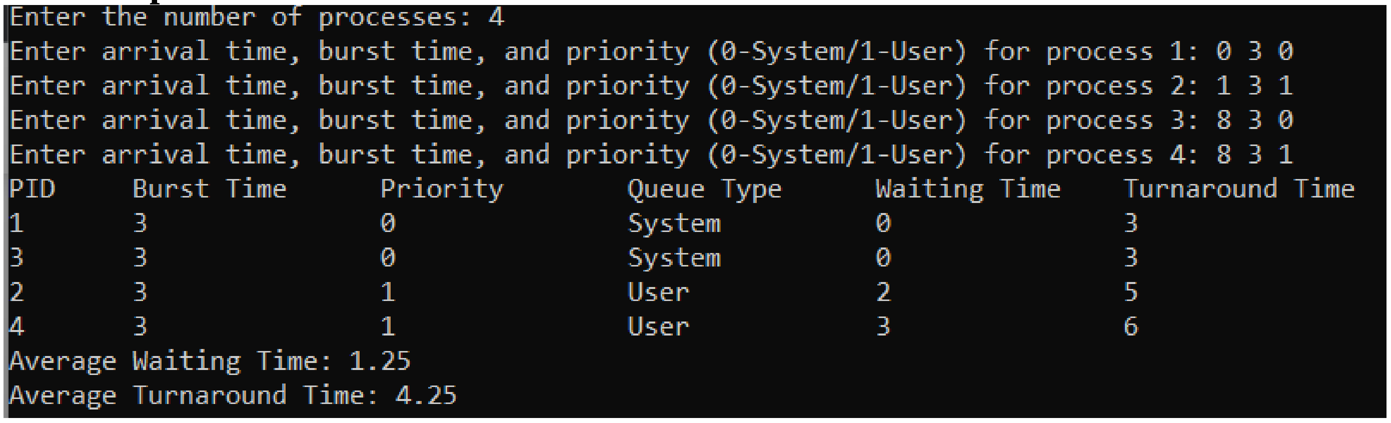
2.3.1 Question:

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.

2.3.2 Code:

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

struct process {
    int pid;
    int arrival_time;
    int burst_time;
    int priority;
    int waiting_time;
    int turnaround_time;
};

void FCFS(struct process *queue, int n) {
    int i, j;
    struct process temp;
    for (i = 0; i < n; i++) {
        for (j = i + 1; j < n; j++) {
            if (queue[i].arrival_time > queue[j].arrival_time) {
                temp = queue[i];
                queue[i] = queue[j];
                queue[j] = temp;
            }
        }
    }
}

int main() {
    int n, i;
    struct process *system_queue, *user_queue;
    int system_n = 0, user_n = 0;
    float avg_waiting_time = 0, avg_turnaround_time = 0;

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

    system_queue = (struct process *) malloc(n * sizeof(struct process));
    user_queue = (struct process *) malloc(n * sizeof(struct process));
    for (i = 0; i < n; i++) {
        struct process p;
        printf("Enter arrival time, burst time, and priority (0-System/1-User) for process %d: ",
i + 1);
        scanf("%d %d %d", &p.arrival_time, &p.burst_time, &p.priority);
        p.pid = i + 1;
        p.waiting_time = 0;
        p.turnaround_time = 0;
        if (p.priority == 0) {
            system_queue[system_n++] = p;
        } else {
            user_queue[user_n++] = p;
        }
    }

    FCFS(system_queue, system_n);
    FCFS(user_queue, user_n);

    int time = 0;
    int s=0,u=0;
    while(s<system_n || u<user_n){
        if(system_queue[s].arrival_time <= time){
            if(user_queue[u].arrival_time <= time &&  user_queue[u].arrival_time <
system_queue[s].arrival_time){
                user_queue[u].waiting_time = time - user_queue[u].arrival_time;
                time += user_queue[u].burst_time;
                user_queue[u].turnaround_time = user_queue[u].waiting_time +
user_queue[u].burst_time;
                avg_waiting_time += user_queue[u].waiting_time;
                avg_turnaround_time += user_queue[u].turnaround_time;
                u++;
            }
            else{
                system_queue[s].waiting_time = time - system_queue[s].arrival_time;
                time += system_queue[s].burst_time;
                system_queue[s].turnaround_time = system_queue[s].waiting_time +
system_queue[s].burst_time;
                avg_waiting_time += system_queue[s].waiting_time;
                avg_turnaround_time += system_queue[s].turnaround_time;
                s++;
            }
        }
        else if(user_queue[u].arrival_time <= time){
            user_queue[u].waiting_time = time - user_queue[u].arrival_time;
                time += user_queue[u].burst_time;
            user_queue[u].turnaround_time = user_queue[u].waiting_time +
user_queue[u].burst_time;
            avg_waiting_time += user_queue[u].waiting_time;
            avg_turnaround_time += user_queue[u].turnaround_time;
            u++;
        }
        else{
          if(system_queue[s].arrival_time <= user_queue[u].arrival_time){
            time = system_queue[s].arrival_time;
          }
          else{
            time = user_queue[u].arrival_time;
          }
        }
    }

    avg_waiting_time /= n;
    avg_turnaround_time /= n;

    printf("PID\tBurst Time\tPriority\tQueue Type\tWaiting Time\tTurnaround Time\n");
    for (i = 0; i < system_n; i++) {
        printf("%d\t%d\t\t%d\t\tSystem\t\t%d\t\t%d\n", system_queue[i].pid,
system_queue[i].burst_time, system_queue[i].priority, system_queue[i].waiting_time,
system_queue[i].turnaround_time);
    }
    for (i = 0; i < user_n; i++) {
        printf("%d\t%d\t\t%d\t\tUser\t\t%d\t\t%d\n", user_queue[i].pid,
user_queue[i].burst_time, user_queue[i].priority, user_queue[i].waiting_time,
user_queue[i].turnaround_time);
    }

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

    free(system_queue);
    free(user_queue);

    return 0;
}
```

2.3.3 Output:



```
Enter the number of processes: 4
Enter arrival time, burst time, and priority (0-System/1-User) for process 1: 0 3 0
Enter arrival time, burst time, and priority (0-System/1-User) for process 2: 1 3 1
Enter arrival time, burst time, and priority (0-System/1-User) for process 3: 8 3 0
Enter arrival time, burst time, and priority (0-System/1-User) for process 4: 8 3 1
PID     Burst Time      Priority        Queue Type      Waiting Time    Turnaround Time
1       3               0               System          0               3
3       3               0               System          0               3
2       3               1               User            2               5
4       3               1               User            3               6
Average Waiting Time: 1.25
Average Turnaround Time: 4.25
```

2.4 Experiment - 4

2.4.1 Question:

Write a C program to simulate Real-Time CPU Scheduling algorithms:

(a) Rate- Monotonic

(b) Earliest-deadline First

(c) Proportional scheduling

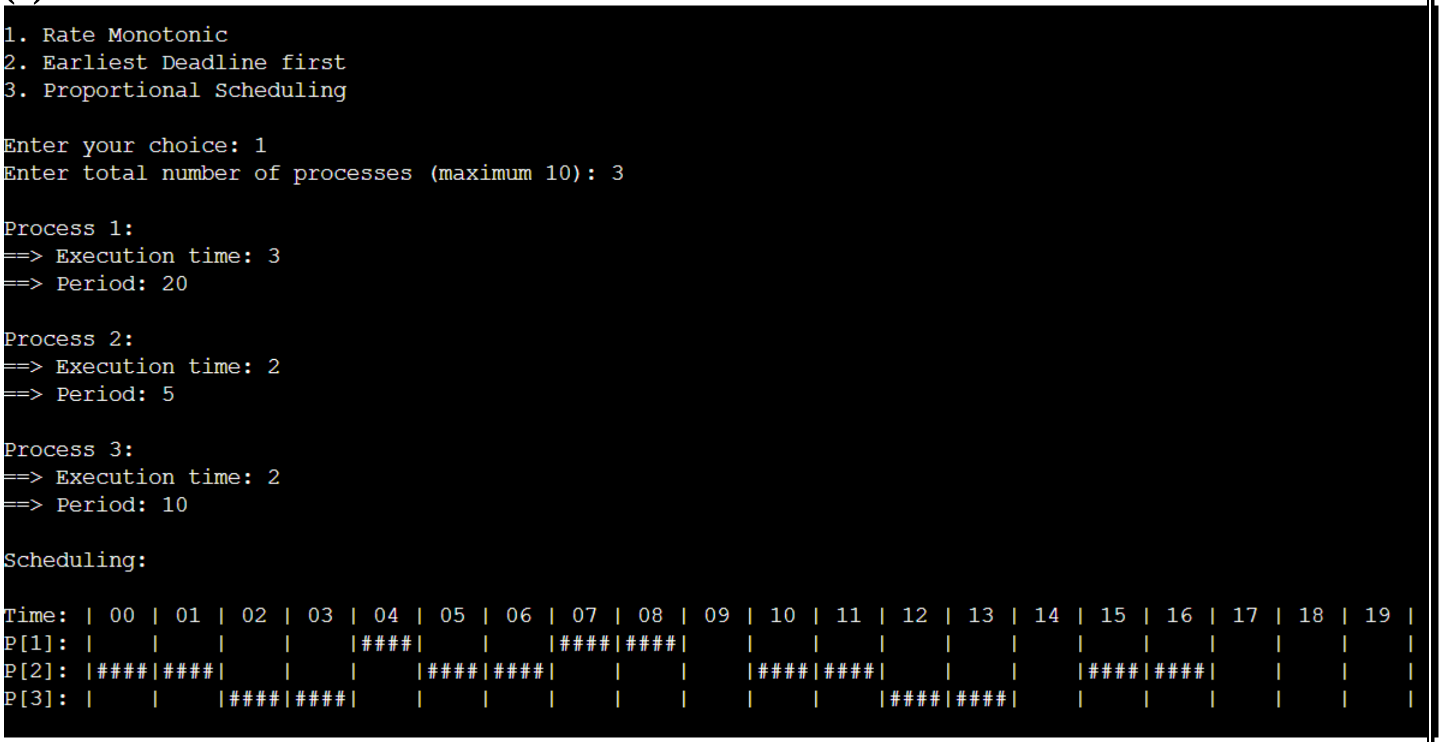
2.4.2 Code:

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

#define MAX_PROCESS 10

typedef struct {
    int id;
    int burst_time;
    float priority;
} Task;

int num_of_process;
int execution_time[MAX_PROCESS], period[MAX_PROCESS],
remain_time[MAX_PROCESS], deadline[MAX_PROCESS],
remain_deadline[MAX_PROCESS];

void get_process_info(int selected_algo)
{
    printf("Enter total number of processes (maximum %d): ", MAX_PROCESS);
    scanf("%d", &num_of_process);
    if (num_of_process < 1)
    {
        exit(0);
    }

    for (int i = 0; i < num_of_process; i++)
    {
        printf("\nProcess %d:\n", i + 1);
        printf("==> Execution time: ");
        scanf("%d", &execution_time[i]);
        remain_time[i] = execution_time[i];
        if (selected_algo == 2)
        {
            printf("==> Deadline: ");
            scanf("%d", &deadline[i]);
        }
        else
        {
            printf("==> Period: ");
            scanf("%d", &period[i]);
        }
    }
}

int max(int a, int b, int c)
{
    int max;
    if (a >= b && a >= c)
        max = a;
    else if (b >= a && b >= c)
        max = b;
    else if (c >= a && c >= b)
        max = c;
    return max;
}

int get_observation_time(int selected_algo)
{
    if (selected_algo == 1)
    {
        return max(period[0], period[1], period[2]);
    }
    else if (selected_algo == 2)
    {
        return max(deadline[0], deadline[1], deadline[2]);
    }
}

void print_schedule(int process_list[], int cycles)
{
    printf("\nScheduling:\n\n");
    printf("Time: ");
    for (int i = 0; i < cycles; i++)
    {
        if (i < 10)
            printf("| 0%d ", i);
        else
            printf("| %d ", i);
    }
    printf("|\n");
    for (int i = 0; i < num_of_process; i++)
    {
        printf("P[%d]: ", i + 1);
        for (int j = 0; j < cycles; j++)
        {
            if (process_list[j] == i + 1)
                printf("|####");
            else
                printf("|    ");
        }
        printf("|\n");
    }
}

void rate_monotonic(int time)
{
    int process_list[100] = {0}, min = 999, next_process = 0;
    float utilization = 0;
    for (int i = 0; i < num_of_process; i++)
    {
        utilization += (1.0 * execution_time[i]) / period[i];
    }
    int n = num_of_process;
    int m = (float) (n * (pow(2, 1.0 / n) - 1));
    if (utilization > m)
    {
        printf("\nGiven problem is not schedulable under the said scheduling algorithm.\n");
    }
    for (int i = 0; i < time; i++)
    {
        min = 1000;
        for (int j = 0; j < num_of_process; j++)
        {
            if (remain_time[j] > 0)
            {
                if (min > period[j])
                {
                    min = period[j];
                    next_process = j;
                }
            }
        }
        if (remain_time[next_process] > 0)
        {
            process_list[i] = next_process + 1;
            remain_time[next_process] -= 1;
        }
        for (int k = 0; k < num_of_process; k++)
        {
            if ((i + 1) % period[k] == 0)
            {
                remain_time[k] = execution_time[k];
                next_process = k;
            }
        }
    }
    print_schedule(process_list, time);
}

void earliest_deadline_first(int time){
    float utilization = 0;
    for (int i = 0; i < num_of_process; i++){
        utilization += (1.0*execution_time[i])/deadline[i];
    }
    int n = num_of_process;

    int process[num_of_process];
    int max_deadline, current_process=0, min_deadline,process_list[time];
    bool is_ready[num_of_process];

    for(int i=0; i<num_of_process; i++){
        is_ready[i] = true;
        process[i] = i+1;
    }

    max_deadline=deadline[0];
    for(int i=1; i<num_of_process; i++){
         if(deadline[i] > max_deadline)
           max_deadline = deadline[i];
    }

    for(int i=0; i<num_of_process; i++){
        for(int j=i+1; j<num_of_process; j++){
            if(deadline[j] <  deadline[i]){
                int temp = execution_time[j];
                execution_time[j] = execution_time[i];
                execution_time[i] = temp;
                temp = deadline[j];
                deadline[j] = deadline[i];
                deadline[i] = temp;
                temp = process[j];
                process[j] = process[i];
                process[i] = temp;
            }
        }
    }

    for(int i=0; i<num_of_process; i++){
        remain_time[i] = execution_time[i];
        remain_deadline[i] = deadline[i];
    }

    for (int t = 0; t < time; t++){
        if(current_process != -1){
            --execution_time[current_process];
            process_list[t] = process[current_process];
        }
        else
            process_list[t] = 0;

        for(int i=0;i<num_of_process;i++){
            --deadline[i];
            if((execution_time[i] == 0) && is_ready[i]){
                deadline[i] += remain_deadline[i];
                is_ready[i] = false;
            }
            if((deadline[i] <= remain_deadline[i]) && (is_ready[i] == false)){
                execution_time[i] = remain_time[i];
                is_ready[i] = true;
            }
        }

        min_deadline = max_deadline;
        current_process = -1;
        for(int i=0;i<num_of_process;i++){
            if((deadline[i] <= min_deadline) && (execution_time[i] > 0)){
                current_process = i;
                min_deadline = deadline[i];
            }
        }
    }
    print_schedule(process_list, time);
}

void proportionalScheduling() {
    int n;
    printf("Enter the number of tasks: ");
    scanf("%d", &n);

    Task tasks[n];
    printf("Enter burst time and priority for each task:\n");
    for (int i = 0; i < n; i++) {
        tasks[i].id = i + 1;
        printf("Task %d - Burst Time: ", tasks[i].id);
        scanf("%d", &tasks[i].burst_time);
        printf("Task %d - Priority: ", tasks[i].id);
        scanf("%f", &tasks[i].priority);
    }

    // Sort tasks based on priority (ascending order)
    for (int i = 0; i < n - 1; i++) {
        for (int j = 0; j < n - i - 1; j++) {
            if (tasks[j].priority > tasks[j + 1].priority) {
                // Swap tasks
                Task temp = tasks[j];
                tasks[j] = tasks[j + 1];
                tasks[j + 1] = temp;
            }
        }
    }

    printf("\nProportional Scheduling:\n");

    int total_burst_time = 0;
    float total_priority = 0.0;

    for (int i = 0; i < n; i++) {
        total_burst_time += tasks[i].burst_time;
        total_priority += tasks[i].priority;
    }

    for (int i = 0; i < n; i++) {
        float time_slice = (tasks[i].priority / total_priority) * total_burst_time;
        printf("Task %d executes for %.2f units of time\n", tasks[i].id, time_slice);
    }
}


int main()
{
    int option;
    int observation_time;

    while (1)
    {
```

```
    printf("\n1. Rate Monotonic\n2. Earliest Deadline first\n3. Proportional
Scheduling\n\nEnter your choice: ");
    scanf("%d", &option);
    switch(option)
    {
        case 1: get_process_info(option);
                observation_time = get_observation_time(option);
                rate_monotonic(observation_time);
                break;
        case 2: get_process_info(option);
                observation_time = get_observation_time(option);
                earliest_deadline_first(observation_time);
                break;
        case 3: proportionalScheduling();
                break;
        case 4: exit (0);
        default: printf("\nInvalid Statement");
    }
    }
    return 0;
}
```

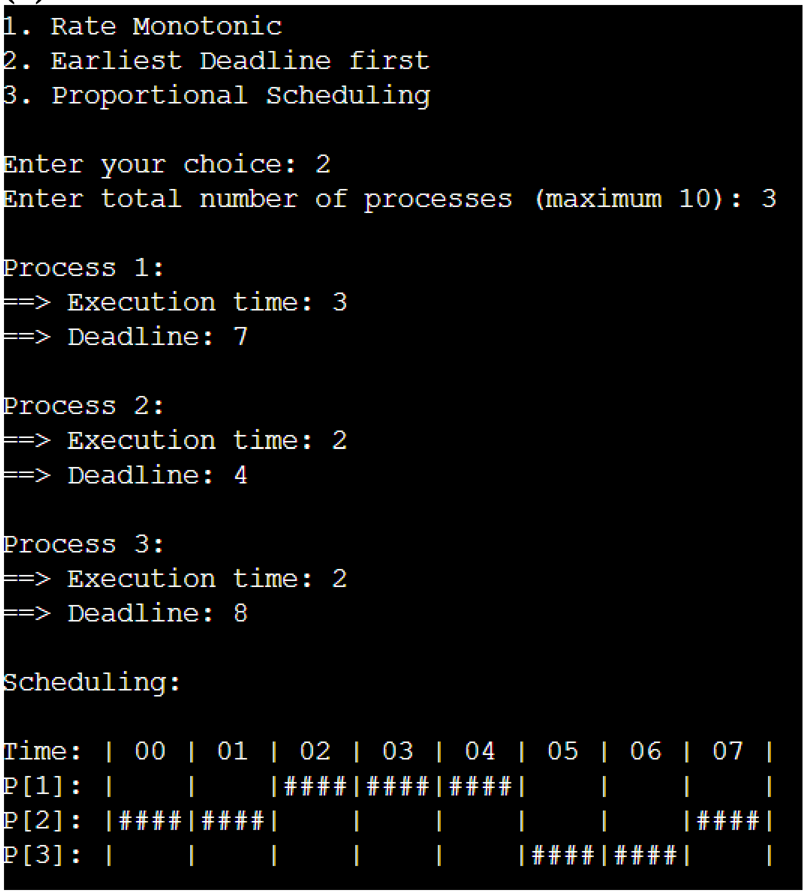
2.4.3 Output:

(a) Rate Monotonic:



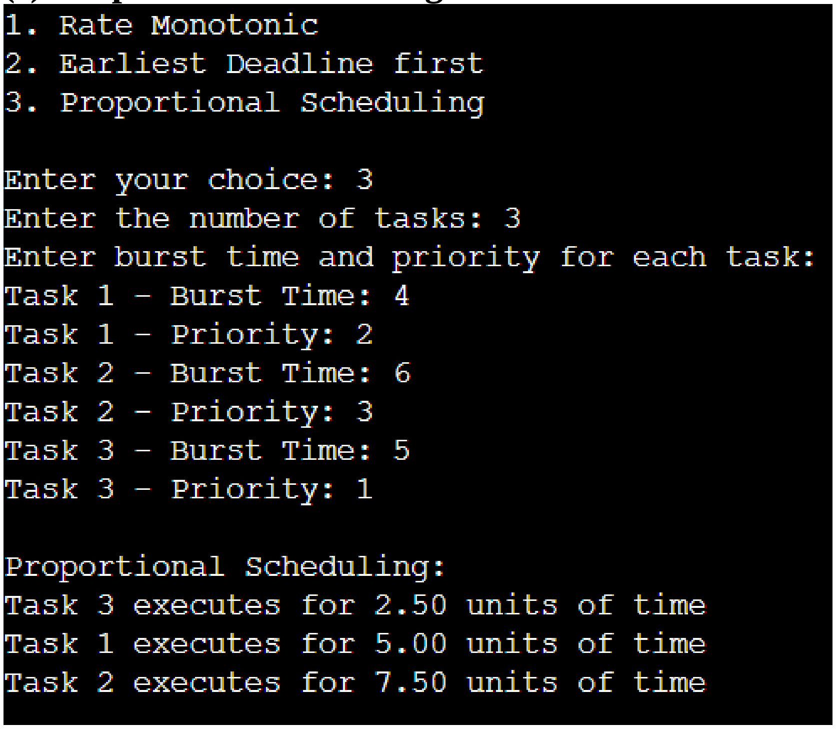
```
1. Rate Monotonic
2. Earliest Deadline first
3. Proportional Scheduling

Enter your choice: 1
Enter total number of processes (maximum 10): 3

Process 1:
==> Execution time: 3
==> Period: 20

Process 2:
==> Execution time: 2
==> Period: 5

Process 3:
==> Execution time: 2
==> Period: 10

Scheduling:

Time: | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
P[1]: |    |    |    |    |####|    |    |####|####|    |    |    |    |    |    |    |    |    |    |    |
P[2]: |####|####|    |    |    |####|####|    |    |    |####|####|    |    |    |####|####|    |    |    |
P[3]: |    |    |####|####|    |    |    |    |    |    |    |    |####|####|    |    |    |    |    |    |
```

(b) Earliest Deadline First:



```
1. Rate Monotonic
2. Earliest Deadline first
3. Proportional Scheduling

Enter your choice: 2
Enter total number of processes (maximum 10): 3

Process 1:
==> Execution time: 3
==> Deadline: 7

Process 2:
==> Execution time: 2
==> Deadline: 4

Process 3:
==> Execution time: 2
==> Deadline: 8

Scheduling:

Time: | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 |
P[1]: |    |    |####|####|####|    |    |    |
P[2]: |####|####|    |    |    |    |    |####|
P[3]: |    |    |    |    |    |####|####|    |
```

(c) Proportional Scheduling:



```
1. Rate Monotonic
2. Earliest Deadline first
3. Proportional Scheduling

Enter your choice: 3
Enter the number of tasks: 3
Enter burst time and priority for each task:
Task 1 - Burst Time: 4
Task 1 - Priority: 2
Task 2 - Burst Time: 6
Task 2 - Priority: 3
Task 3 - Burst Time: 5
Task 3 - Priority: 1

Proportional Scheduling:
Task 3 executes for 2.50 units of time
Task 1 executes for 5.00 units of time
Task 2 executes for 7.50 units of time
```

2.5 Experiment - 5

2.5.1 Question:

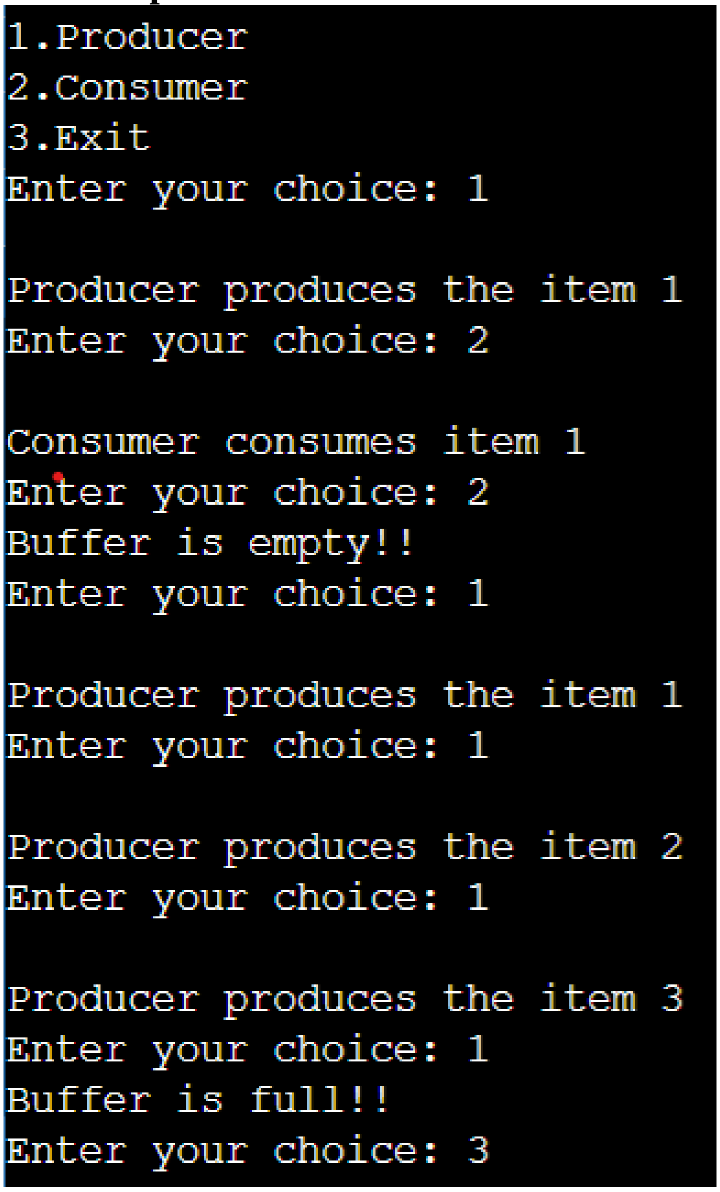
Write a C program to simulate producer-consumer problem using semaphores.

2.5.2 Code:

```
#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);
}
```

2.5.3 Output:



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

Producer produces the item 1
Enter your choice: 2

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

Producer produces the item 1
Enter your choice: 1

Producer produces the item 2
Enter your choice: 1

Producer produces the item 3
Enter your choice: 1
Buffer is full!!
Enter your choice: 3
```

2.6 Experiment - 6

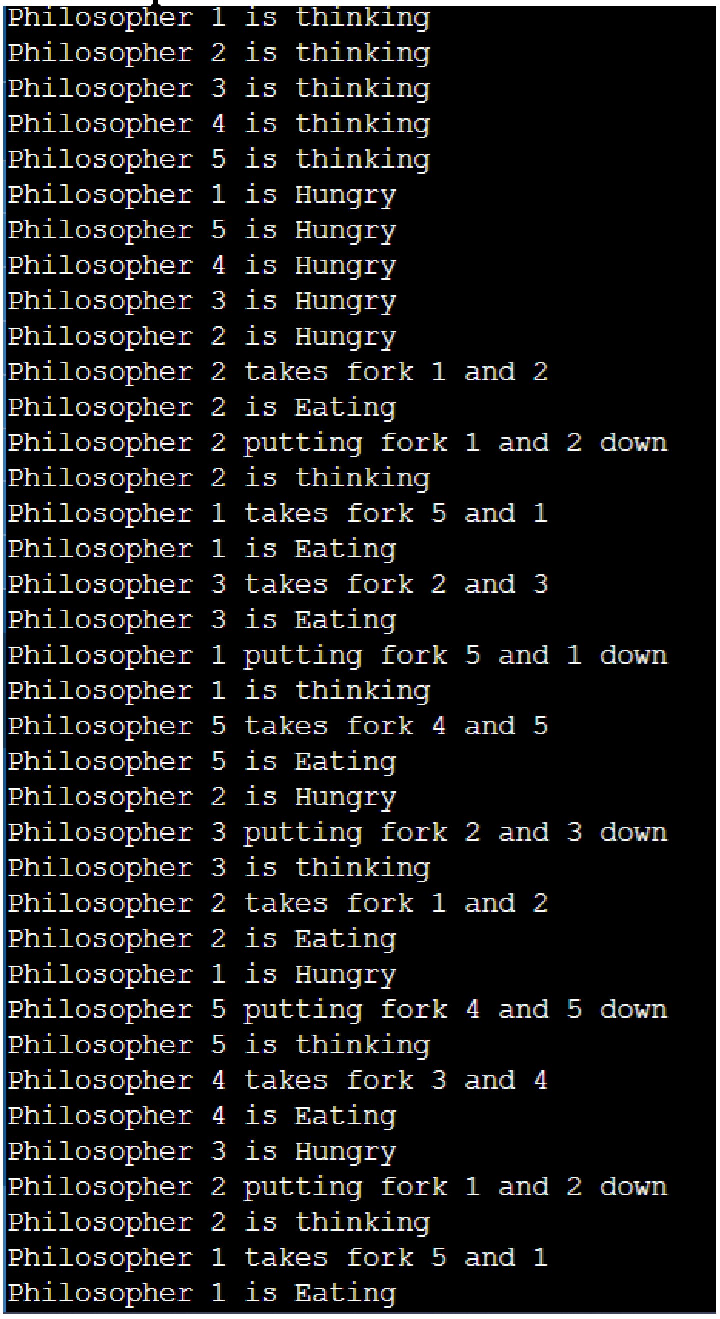
2.6.1 Question:

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

2.6.2 Code:

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

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

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

sem_t mutex;
sem_t S[N];

void test(int num_of_philosopher)
{
                if (state[num_of_philosopher] == HUNGRY && state[LEFT] != EATING &&
state[RIGHT] != EATING)
                {
                        state[num_of_philosopher] = EATING;

                        sleep(2);

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

                        printf("Philosopher %d is Eating\n", num_of_philosopher +1);

                        sem_post(&S[num_of_philosopher]);
        }
}

void take_fork(int num_of_philosopher)
{
        sem_wait(&mutex);
        state[num_of_philosopher] = HUNGRY;
        printf("Philosopher %d is Hungry\n", num_of_philosopher +1);
        test(num_of_philosopher);
        sem_post(&mutex);
        sem_wait(&S[num_of_philosopher]);
        sleep(1);
}

void put_fork(int num_of_philosopher)
{
        sem_wait(&mutex);
        state[num_of_philosopher] = THINKING;

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

        printf("Philosopher %d is thinking\n", num_of_philosopher +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];

        sem_init(&mutex,0,1);

        for (i =0; i < N; i++)
                sem_init(&S[i],0,0);

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

2.6.3 Output:



```
Philosopher 1 is thinking
Philosopher 2 is thinking
Philosopher 3 is thinking
Philosopher 4 is thinking
Philosopher 5 is thinking
Philosopher 1 is Hungry
Philosopher 5 is Hungry
Philosopher 4 is Hungry
Philosopher 3 is Hungry
Philosopher 2 is Hungry
Philosopher 2 takes fork 1 and 2
Philosopher 2 is Eating
Philosopher 2 putting fork 1 and 2 down
Philosopher 2 is thinking
Philosopher 1 takes fork 5 and 1
Philosopher 1 is Eating
Philosopher 3 takes fork 2 and 3
Philosopher 3 is Eating
Philosopher 1 putting fork 5 and 1 down
Philosopher 1 is thinking
Philosopher 5 takes fork 4 and 5
Philosopher 5 is Eating
Philosopher 2 is Hungry
Philosopher 3 putting fork 2 and 3 down
Philosopher 3 is thinking
Philosopher 2 takes fork 1 and 2
Philosopher 2 is Eating
Philosopher 1 is Hungry
Philosopher 5 putting fork 4 and 5 down
Philosopher 5 is thinking
Philosopher 4 takes fork 3 and 4
Philosopher 4 is Eating
Philosopher 3 is Hungry
Philosopher 2 putting fork 1 and 2 down
Philosopher 2 is thinking
Philosopher 1 takes fork 5 and 1
Philosopher 1 is Eating
```

2.7 Experiment - 7

2.7.1 Question:

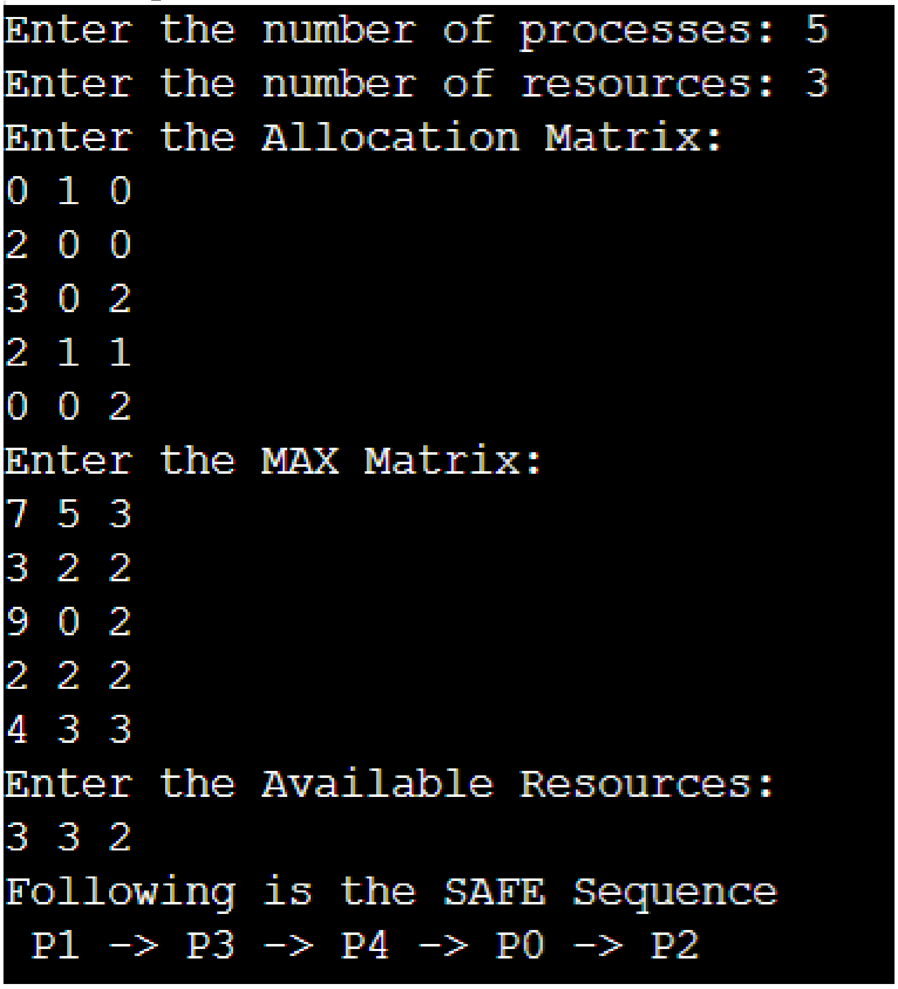
Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.

2.7.2 Code:

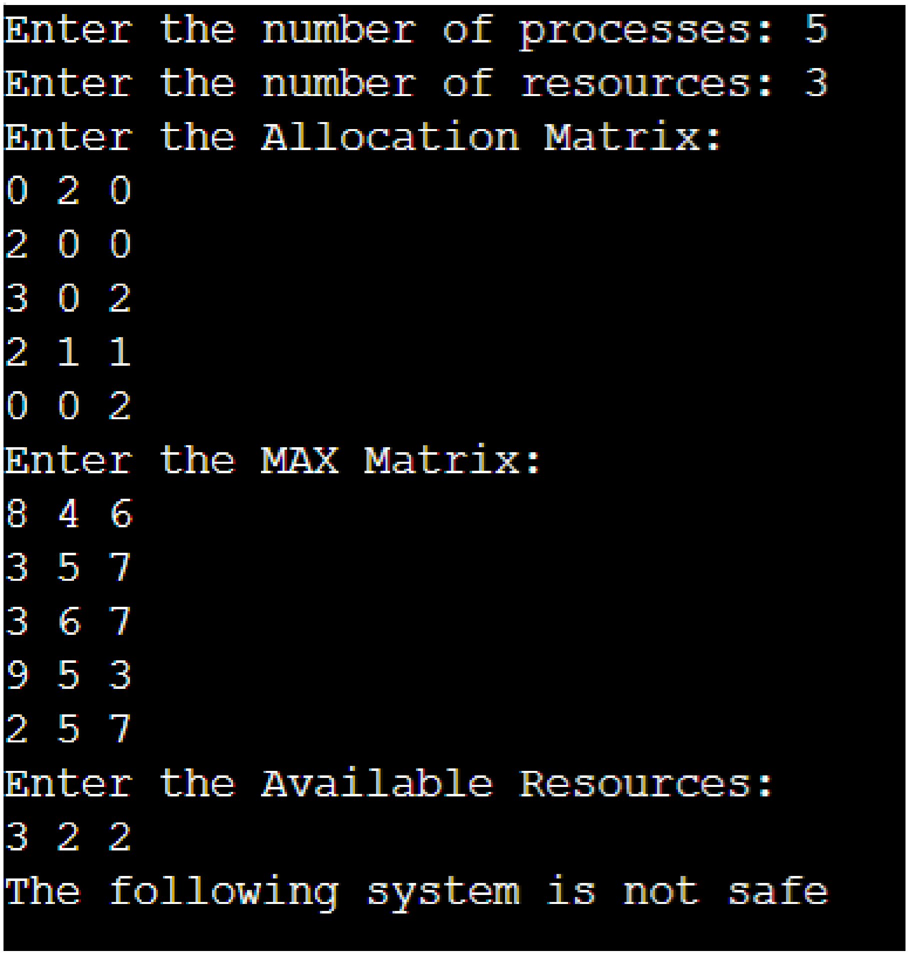
```
#include <stdio.h>

int main()
{
    int n, m, i, j, k;
    printf("Enter the number of processes: ");
    scanf("%d", &n);
    printf("Enter the number of resources: ");
    scanf("%d", &m);

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

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

    int available[m];
    printf("Enter the Available Resources:\n");
    for (i = 0; i < m; i++)
    {
        scanf("%d", &available[i]);
    }

    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] - allocation[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] > available[j])
                {
                    flag = 1;
                    break;
                }
            }

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

int flag = 1;
for (i = 0; i < n; i++)
{
    if (f[i] == 0)
    {
            flag = 0;
            printf("The following system is not safe\n");
            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\n", ans[n - 1]);
    }
    return 0;
}
```

2.7.3 Output:



```
Enter the number of processes: 5
Enter the number of resources: 3
Enter the Allocation Matrix:
0 1 0
2 0 0
3 0 2
2 1 1
0 0 2
Enter the MAX Matrix:
7 5 3
3 2 2
9 0 2
2 2 2
4 3 3
Enter the Available Resources:
3 3 2
Following is the SAFE Sequence
 P1 -> P3 -> P4 -> P0 -> P2
```



```
Enter the number of processes: 5
Enter the number of resources: 3
Enter the Allocation Matrix:
0 2 0
2 0 0
3 0 2
2 1 1
0 0 2
Enter the MAX Matrix:
8 4 6
3 5 7
3 6 7
9 5 3
2 5 7
Enter the Available Resources:
3 2 2
The following system is not safe
```

2.8 \Experiment - 8

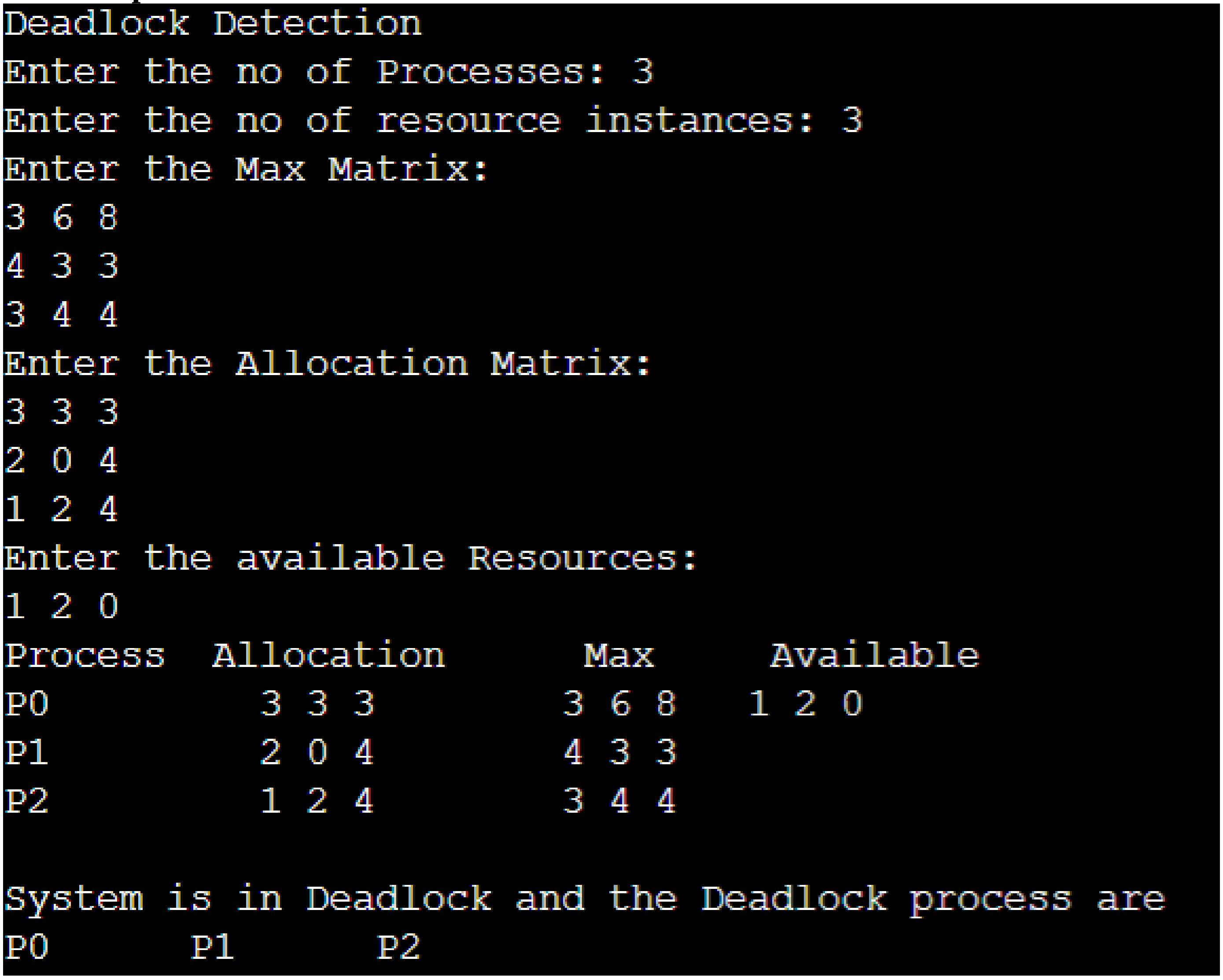
2.8.1 Question:

Write a C program to simulate deadlock detection.

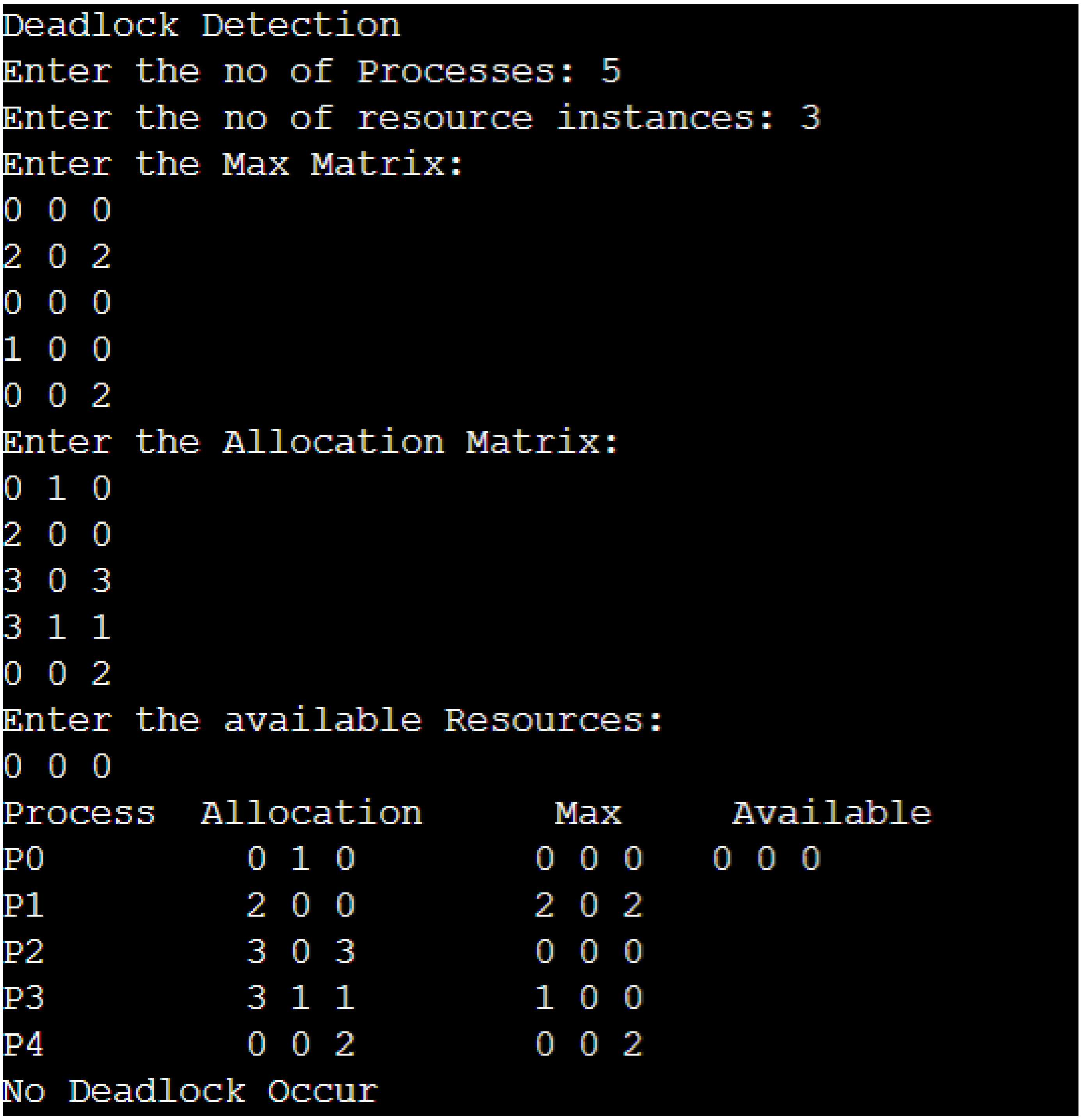
2.8.2 Code:

```
#include<stdio.h>

int max[100][100];
int allocation[100][100];
int need[100][100];
int available[100];
int n,r;

int main()
{
    int i,j;
    printf("Deadlock Detection\n");
    input();
    show();
    cal();
    return 0;
}

void input()
{
    int i,j;
    printf("Enter the no of Processes: ");
    scanf("%d",&n);
    printf("Enter the no of resource instances: ");
    scanf("%d",&r);
    printf("Enter the Max Matrix:\n");
    for(i=0;i<n;i++)
    {
        for(j=0;j<r;j++)
        {
            scanf("%d",&max[i][j]);
        }
    }
    printf("Enter the Allocation Matrix:\n");
    for(i=0;i<n;i++)
    {
        for(j=0;j<r;j++)
        {
            scanf("%d",&allocation[i][j]);
        }
    }
    printf("Enter the available Resources:\n");
    for(j=0;j<r;j++)
    {
        scanf("%d",&available[j]);
    }
}

void show()
{
    int i,j;
    printf("Process\t Allocation\t Max\t Available\t");
    for(i=0;i<n;i++)
    {
        printf("\nP%d\t  ",i+1);
        for(j=0;j<r;j++)
        {
            printf("%d ",allocation[i][j]);
        }
        printf("\t");
        for(j=0;j<r;j++)
        {
            printf("%d ",max[i][j]);
        }
        printf("\t");
        if(i==0)
        {
            for(j=0;j<r;j++)
            printf("%d ",available[j]);
        }
    }
}

void cal()
{
    int finish[100],temp,need[100][100],flag=1,k,c1=0;
    int dead[100];
    int safe[100];
    int i,j;
    for(i=0;i<n;i++)
    {
        finish[i]=0;
    }

    for(i=0;i<n;i++)
    {
        for(j=0;j<r;j++)
        {
            need[i][j]=max[i][j]-allocation[i][j];
        }
    }
    while(flag)
    {
        flag=0;
        for(i=0;i<n;i++)
        {
            int c=0;
            for(j=0;j<r;j++)
            {
                if((finish[i]==0)&&(need[i][j]<=available[j]))
                {
                    c++;
                    if(c==r)
                    {
                        for(k=0;k<r;k++)
                        {
                            available[k]+=allocation[i][j];
                            finish[i]=1;
                            flag=1;
                        }
                        if(finish[i]==1)
                        {
                            i=n;
                        }
                    }
                }
            }
        }
    }

    j=0;
    flag=0;
    for(i=0;i<n;i++)
    {
        if(finish[i]==0)
        {
            dead[j]=i;
            j++;
            flag=1;
        }
    }
    if(flag==1)
    {
        printf("\n\nSystem is in Deadlock and the Deadlock process are\n");
        for(i=0;i<n;i++)
        {
            printf("P%d\t",dead[i]);
        }
    }
    else
    {
        printf("\nNo Deadlock Occur");
    }
}
```

2.8.3 Output:



```
Deadlock Detection
Enter the no of Processes: 3
Enter the no of resource instances: 3
Enter the Max Matrix:
3 6 8
4 3 3
3 4 4
Enter the Allocation Matrix:
3 3 3
2 0 4
1 2 4
Enter the available Resources:
1 2 0
Process  Allocation      Max     Available
P0          3 3 3        3 6 8    1 2 0
P1          2 0 4        4 3 3
P2          1 2 4        3 4 4

System is in Deadlock and the Deadlock process are
P0      P1      P2
```



```
Deadlock Detection
Enter the no of Processes: 5
Enter the no of resource instances: 3
Enter the Max Matrix:
0 0 0
2 0 2
0 0 0
1 0 0
0 0 2
Enter the Allocation Matrix:
0 1 0
2 0 0
3 0 3
3 1 1
0 0 2
Enter the available Resources:
0 0 0
Process  Allocation      Max     Available
P0          0 1 0       0 0 0    0 0 0
P1          2 0 0       2 0 2
P2          3 0 3       0 0 0
P3          3 1 1       1 0 0
P4          0 0 2       0 0 2
No Deadlock Occur
```

2.9 Experiment - 9

2.9.1 Question:

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

(a) Worst-fit

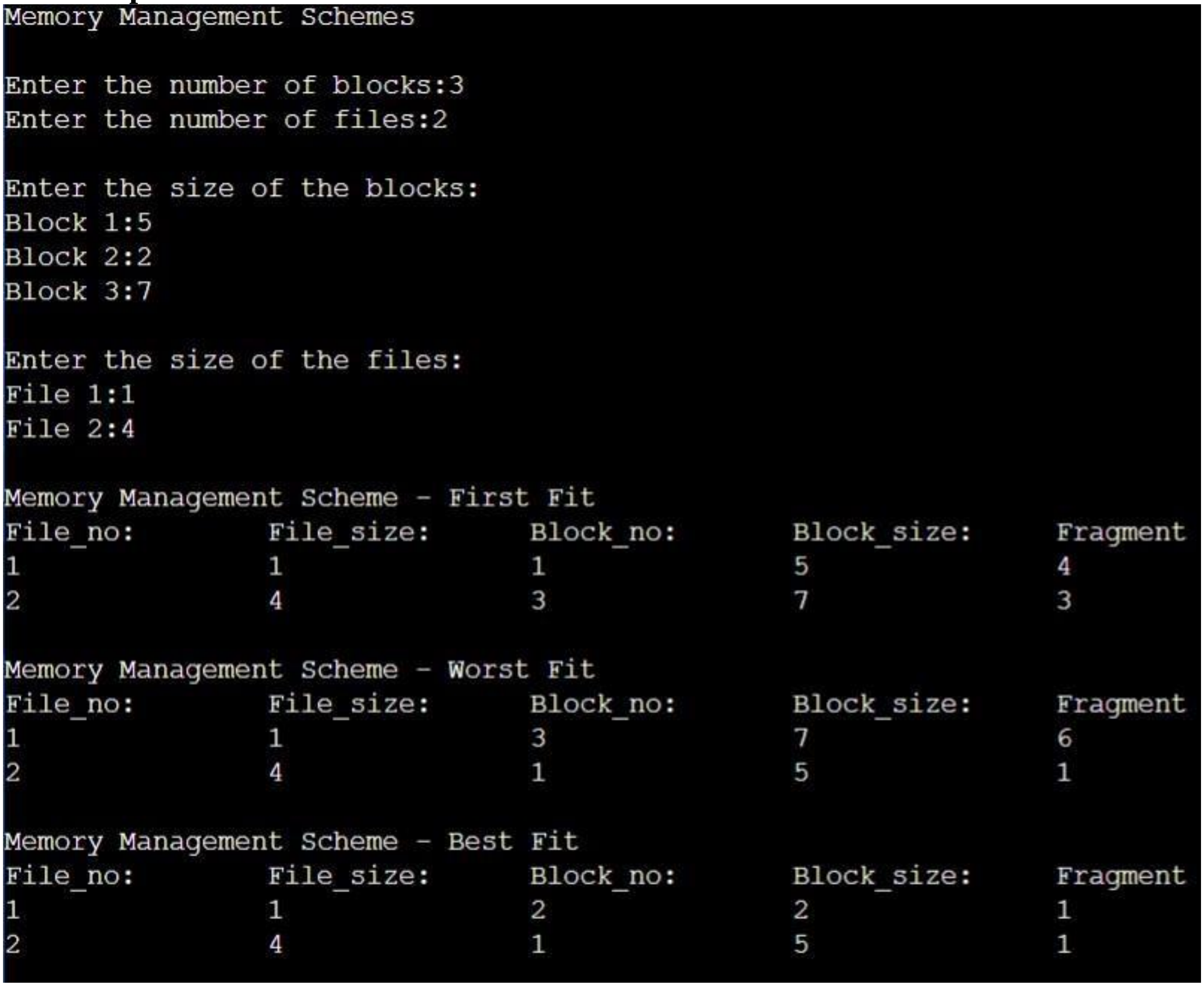
(b) Best-fit

(c) First-fit

2.9.2 Code:

```
#include <stdio.h>

#define max 25

void firstFit(int b[], int nb, int f[], int nf);
void worstFit(int b[], int nb, int f[], int nf);
void bestFit(int b[], int nb, int f[], int nf);

int main()
{
    int b[max], f[max], nb, nf;

    printf("Memory Management Schemes\n");

    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 (int i = 1; i <= nb; i++)
    {
        printf("Block %d:", i);
        scanf("%d", &b[i]);
    }

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

    printf("\nMemory Management Scheme - First Fit");
    firstFit(b, nb, f, nf);
    printf("\n\nMemory Management Scheme - Worst Fit");
    worstFit(b, nb, f, nf);

    printf("\n\nMemory Management Scheme - Best Fit");
    bestFit(b, nb, f, nf);

    return 0;
}

void firstFit(int b[], int nb, int f[], int nf)
{
    int bf[max] = {0};
    int ff[max] = {0};
    int frag[max], i, j;

    for (i = 1; i <= nf; i++)
    {
        for (j = 1; j <= nb; j++)
        {
            if (bf[j] != 1 && b[j] >= f[i])
            {
                ff[i] = j;
                bf[j] = 1;
                frag[i] = b[j] - f[i];
                break;
            }
        }
    }

    printf("\nFile_no:\tFile_size:\tBlock_no:\tBlock_size:\tFragment");
    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]);
    }
}

void worstFit(int b[], int nb, int f[], int nf)
{
    int bf[max] = {0};
    int ff[max] = {0};
    int frag[max], i, j, temp, highest = 0;

    for (i = 1; i <= nf; i++)
    {
        for (j = 1; j <= nb; j++)
        {
            if (bf[j] != 1)
            {
                temp = b[j] - f[i];
                if (temp >= 0 && highest < temp)
                {
                    ff[i] = j;
                    highest = temp;
                }
            }
        }
        frag[i] = highest;
        bf[ff[i]] = 1;
        highest = 0;
    }

    printf("\nFile_no:\tFile_size:\tBlock_no:\tBlock_size:\tFragment");
    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]);
    }
}

void bestFit(int b[], int nb, int f[], int nf)
{
    int bf[max] = {0};
    int ff[max] = {0};
    int frag[max], i, j, temp, lowest = 10000;

    for (i = 1; i <= nf; i++)
    {
        for (j = 1; j <= nb; j++)
        {
            if (bf[j] != 1)
            {
                temp = b[j] - f[i];
                if (temp >= 0 && 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]);
    }
}
```

2.9.3 Output:



```
Memory Management Schemes

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

Memory Management Scheme - First Fit
File_no:        File_size:      Block_no:       Block_size:     Fragment
1               1               1               5               4
2               4               3               7               3

Memory Management Scheme - Worst Fit
File_no:        File_size:      Block_no:       Block_size:     Fragment
1               1               3               7               6
2               4               1               5               1

Memory Management Scheme - Best Fit
File_no:        File_size:      Block_no:       Block_size:     Fragment
1               1               2               2               1
2               4               1               5               1
```

2.10 Experiment - 10

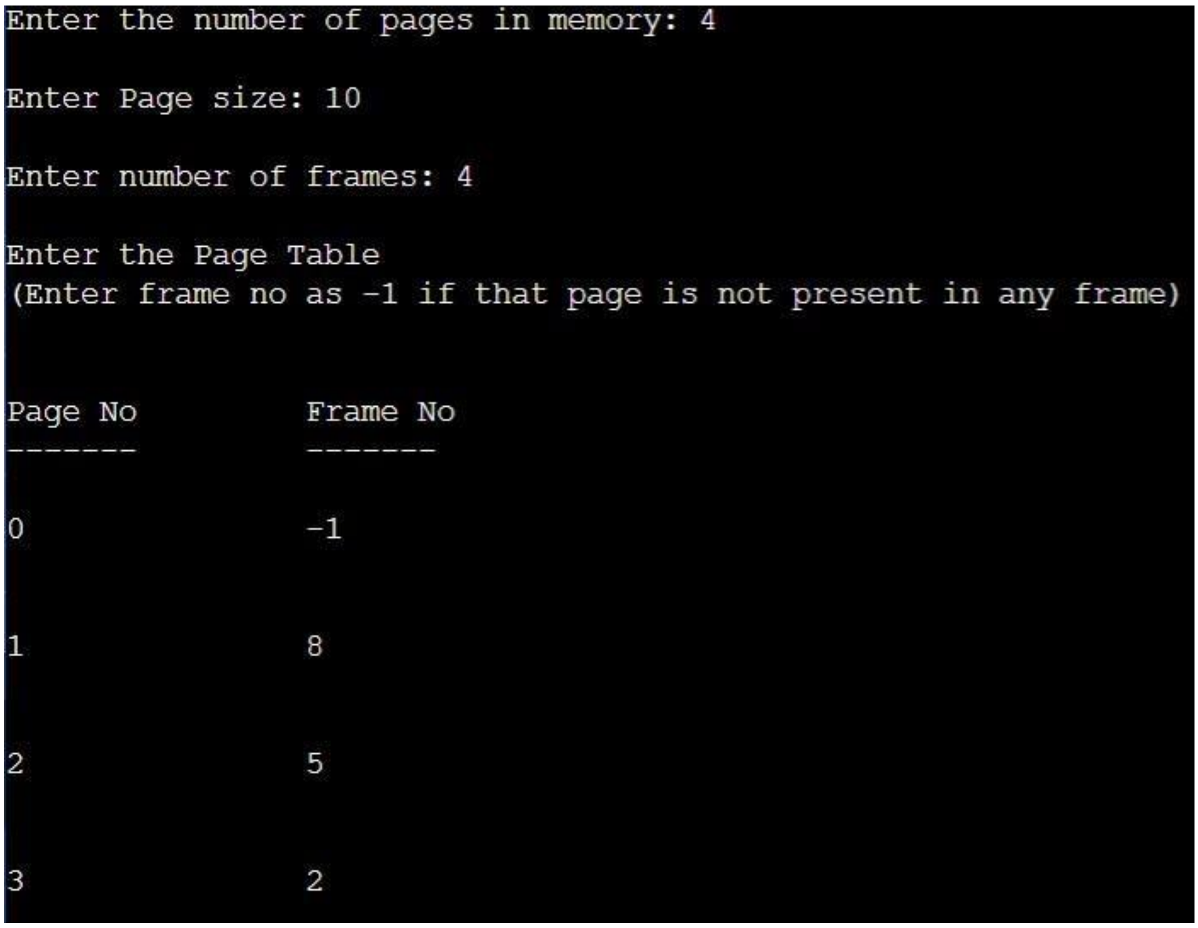
2.10.1 Question:

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

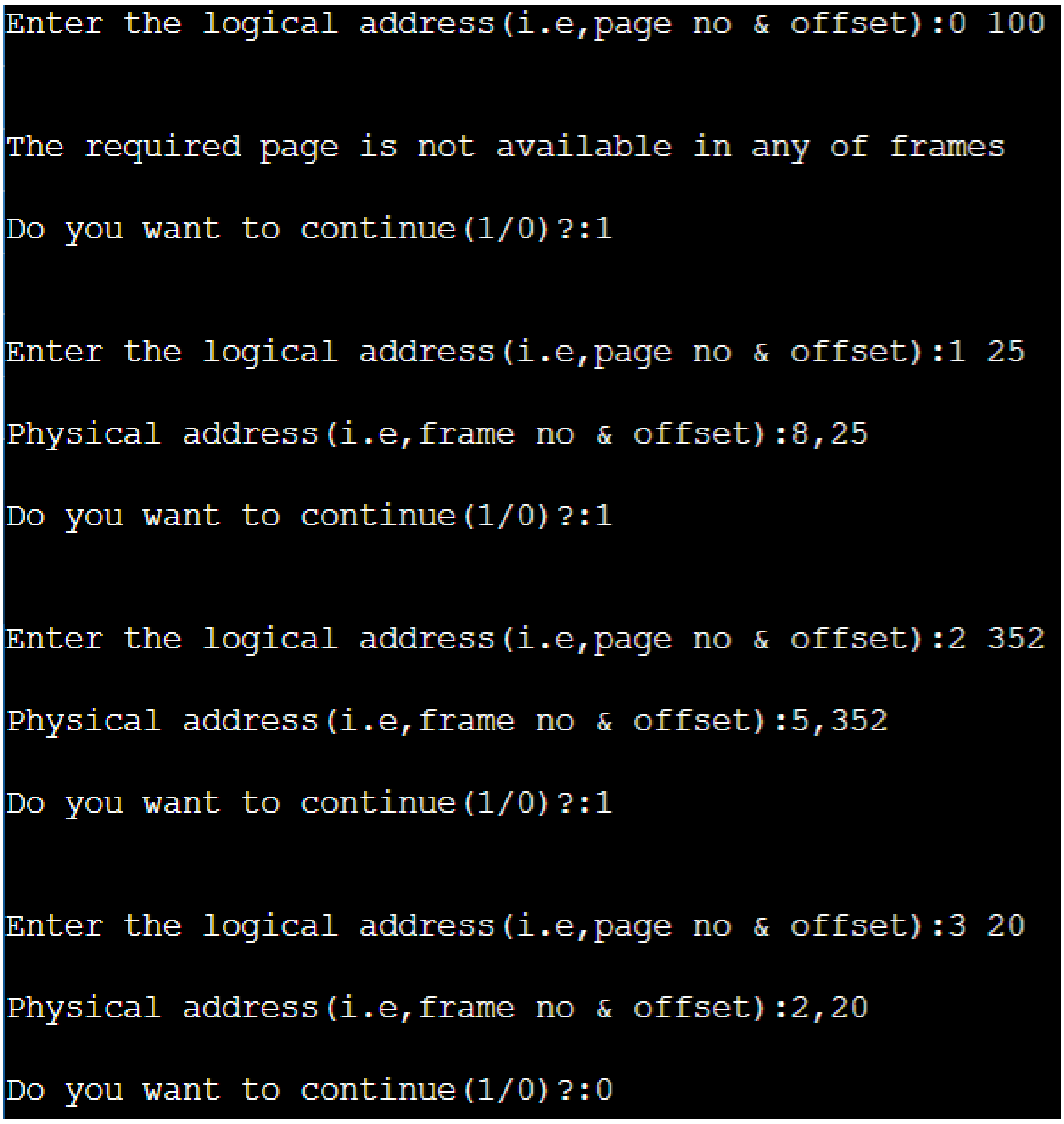
2.10.2 Code:

```
#include<stdio.h>
#define MAX 50
int main()
{
   int page[MAX],i,n,f,ps,off,pno;
   int choice=0;
   printf("Enter the number of pages in memory: ");
   scanf("%d",&n);
   printf("\nEnter Page size: ");
   scanf("%d",&ps);

   printf("\nEnter number 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("\nPage No\t\tFrame No\n-------\t\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("\nPhysical address(i.e,frame no & offset):%d,%d",page[pno],off);

      printf("\n\nDo you want to continue(1/0)?:");
      scanf("%d",&choice);
   }while(choice==1);

   return 1;
}
```

2.10.3 Output:



```
Enter the number of pages in memory: 4

Enter Page size: 10

Enter number of frames: 4

Enter the Page Table
(Enter frame no as -1 if that page is not present in any frame)


Page No         Frame No
-------         -------

0               -1


1               8


2               5


3               2
```


```
Enter the logical address(i.e,page no & offset):0 100


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 25

Physical address(i.e,frame no & offset):8,25

Do you want to continue(1/0)?:1


Enter the logical address(i.e,page no & offset):2 352

Physical address(i.e,frame no & offset):5,352

Do you want to continue(1/0)?:1


Enter the logical address(i.e,page no & offset):3 20

Physical address(i.e,frame no & offset):2,20

Do you want to continue(1/0)?:0
```

2.11 Experiment - 11

2.11.1 Question:

Write a C program to simulate page replacement algorithms:

(a) FIFO

(b) LRU

(c) Optimal

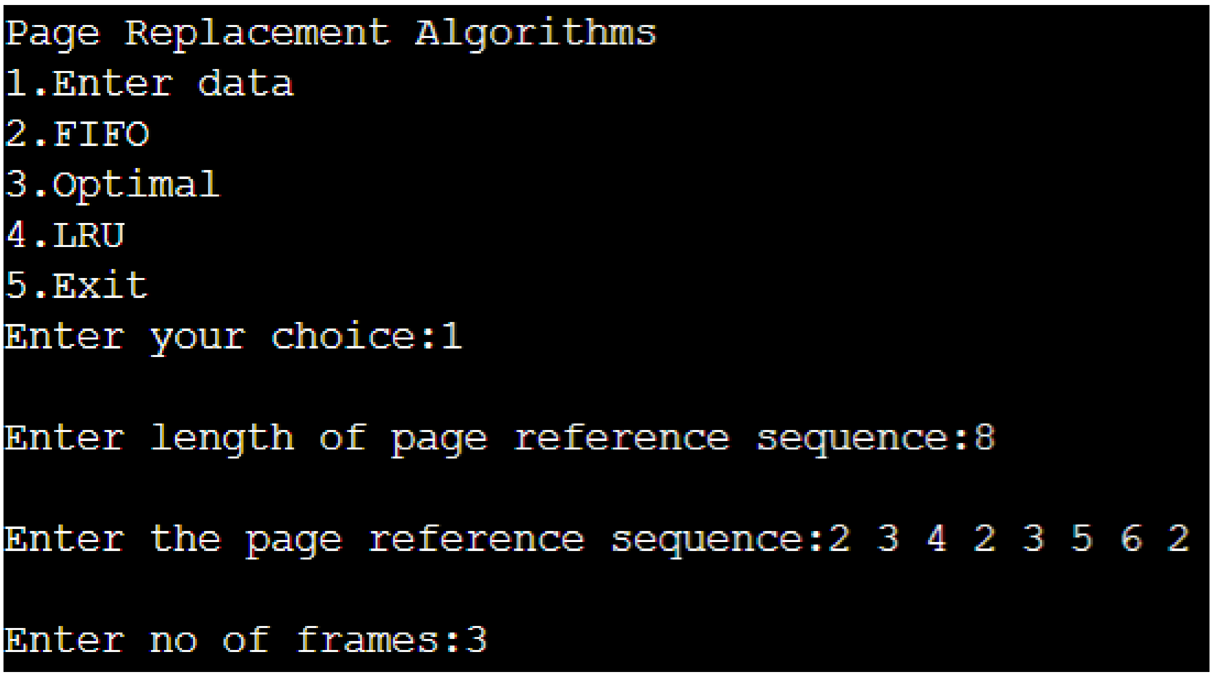
2.11.2 Code:

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

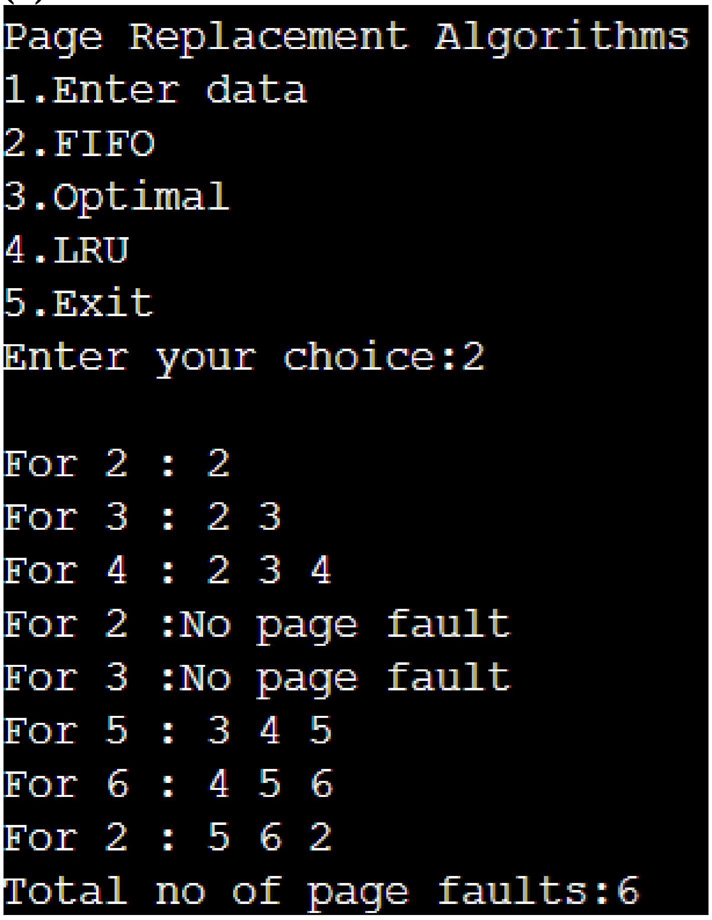
2.11.3 Output:

(a) Enter Data:



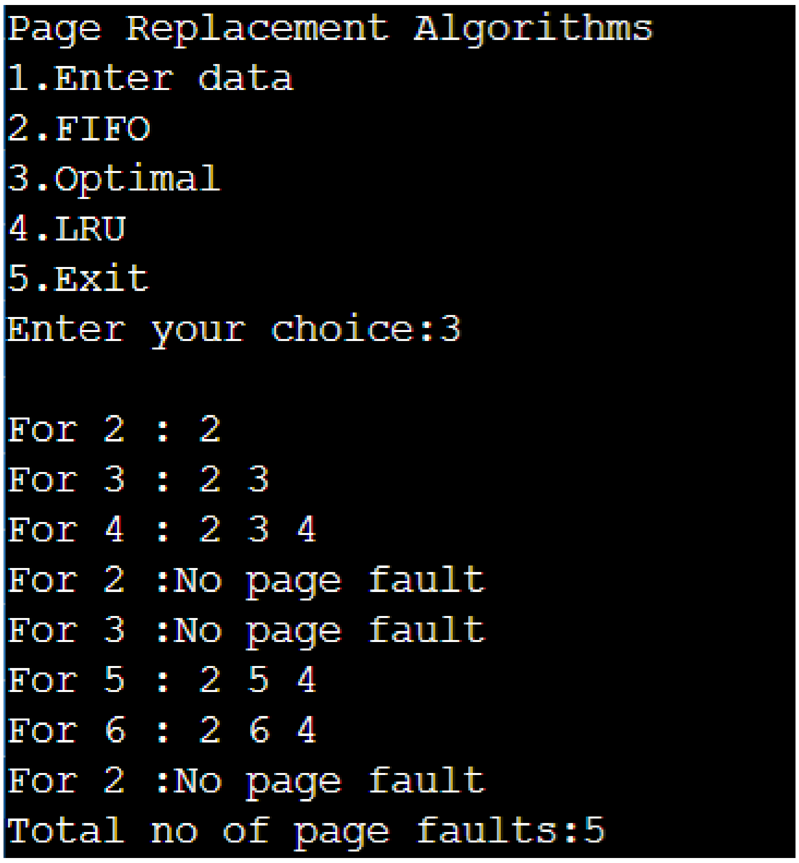
```
Page Replacement Algorithms
1.Enter data
2.FIFO
3.Optimal
4.LRU
5.Exit
Enter your choice:1

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
```

(b) FIFO:



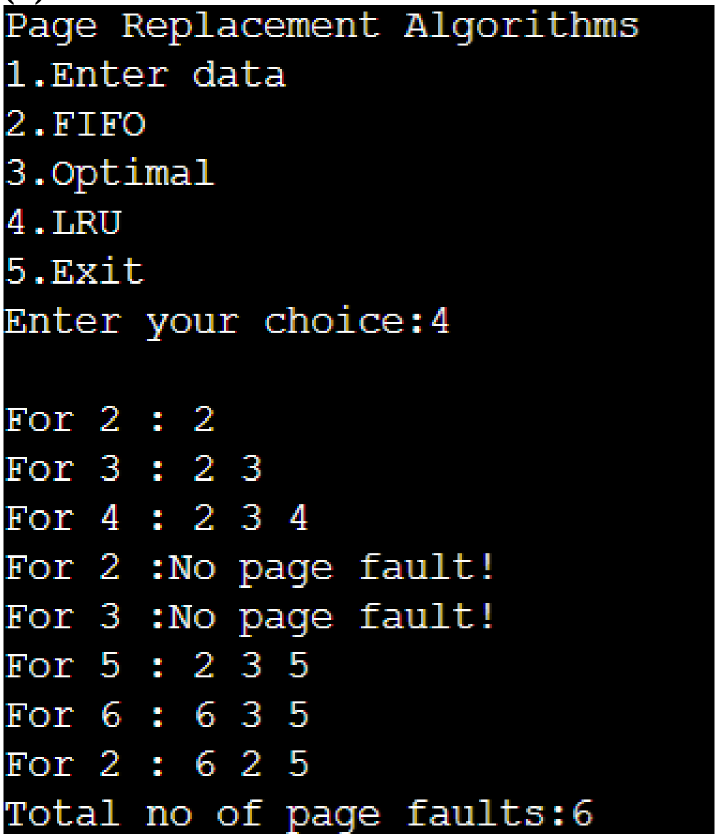
```
Page Replacement Algorithms
1.Enter data
2.FIFO
3.Optimal
4.LRU
5.Exit
Enter your choice:2

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
```

(c) OPTIMAL:



```
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
```

(d) LRU:



```
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
```

2.12 Experiment - 12

2.12.1 Question:

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

(a) Sequential

(b) Indexed

(c) Linked

2.12.2 Code:

(a) <u>Sequential</u>:

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

struct fileTable
{ char name[20];
int sb, nob; }
ft[30];

void main() {
   int i, j, n; char s[20];
   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);
   }
}
```

(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];
    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]);
    }
}
```

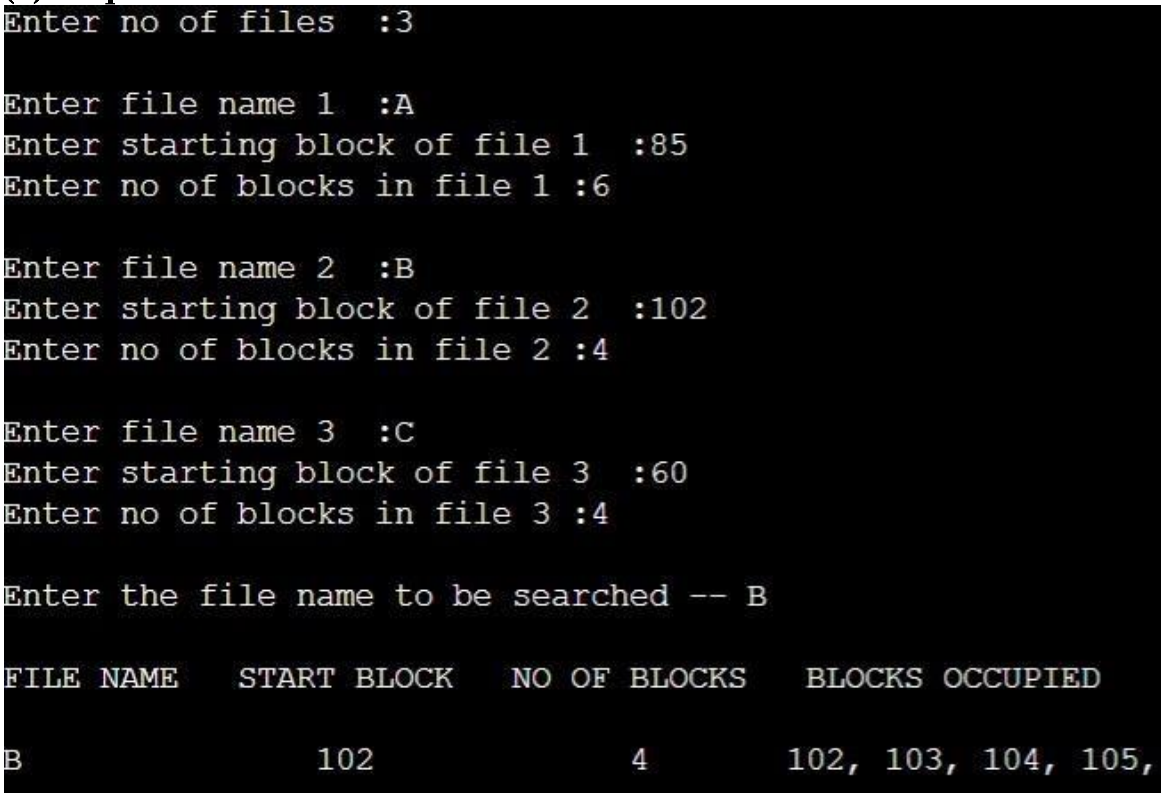
(c) Linked:

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

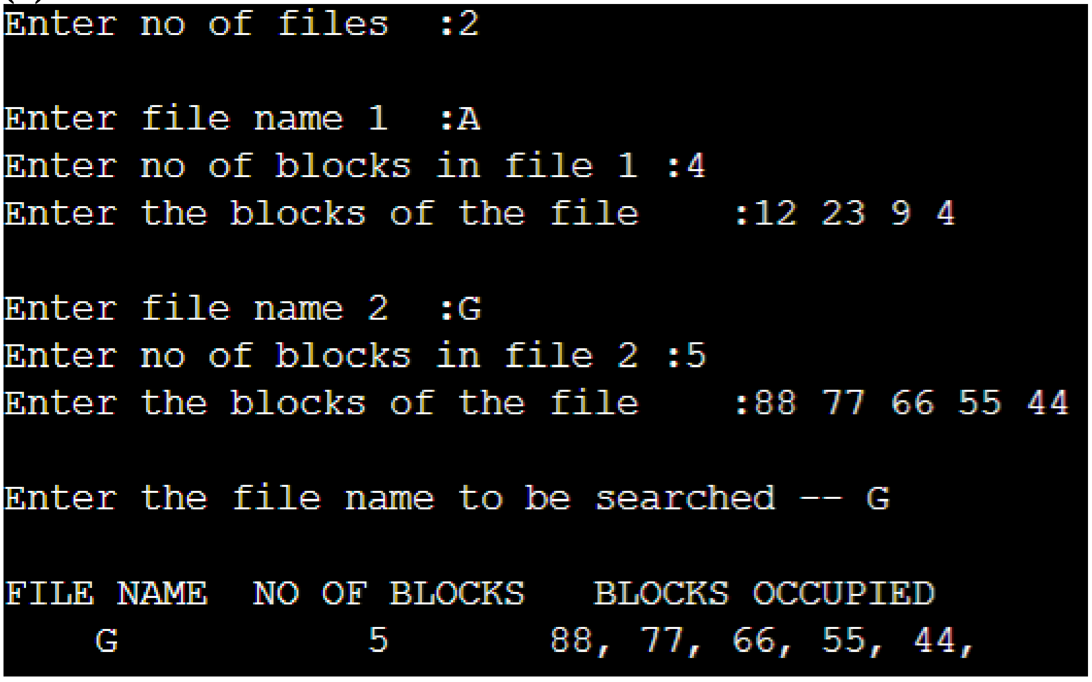
2.12.3 Output:

(a) Sequential:



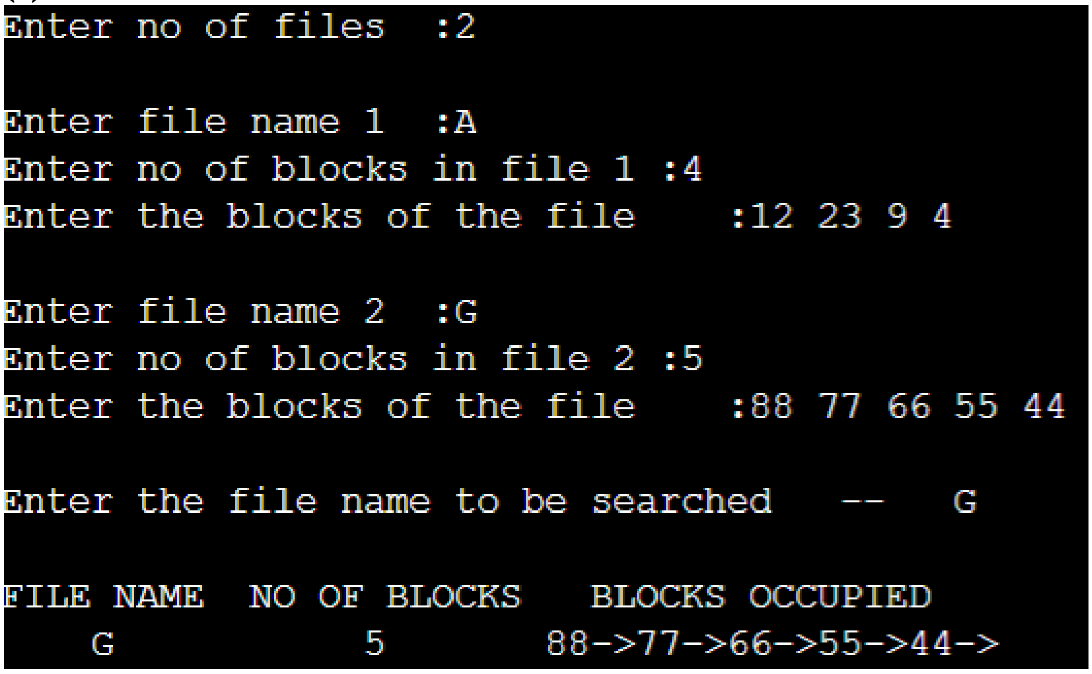
```
Enter no of files  :3

Enter file name 1  :A
Enter starting block of file 1  :85
Enter no of blocks in file 1 :6

Enter file name 2  :B
Enter starting block of file 2  :102
Enter no of blocks in file 2 :4

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            4        102, 103, 104, 105,
```

(b) Indexed:



```
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  :G
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 -- G

FILE NAME  NO OF BLOCKS   BLOCKS OCCUPIED
    G            5       88, 77, 66, 55, 44,
```

(c) Linked:



```
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   :G
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   --   G

FILE NAME  NO OF BLOCKS   BLOCKS OCCUPIED
    G            5       88->77->66->55->44->
```

2.13 Experiment - 13

2.13.1 Question:

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

(a) Single level directory

(b) Two level directory

(c) Hierarchical

2.13.2 Code:

(a) <u>Single Level Directory:</u>

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

struct
{
   char dname[10],fname[10][10];
   int fcnt;
} dir;

void main()
{
   int i,ch;
   char f[30];
   dir.fcnt = 0;
   printf("\nEnter name of directory -- ");
   scanf("%s", dir.dname);

   while(1)
   {
      printf("\n\n1. Create File\t2. Delete File\t3. Search File \n4. Display Files\t5.
Exit\nEnter your choice -- ");
      scanf("%d",&ch);

      switch(ch)
      {
         case 1: printf("\nEnter the name of the file -- ");
               scanf("%s",dir.fname[dir.fcnt]);
               dir.fcnt++;
               break;

         case 2: printf("\nEnter 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("\nEnter 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("\nDirectory Empty");
               else
               {
                   printf("\nThe Files are -- ");
                   for(i=0;i<dir.fcnt;i++)
                       printf("\t%s",dir.fname[i]);
               }
               break;

         default: exit(0);
      }
   }
}
```

(b) Two Level Directory:

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

struct
{
   char dname[10],fname[10][10];
   int fcnt;
}dir[10];

void main()
{
   int i,ch,dcnt,k;
   char f[30], d[30];
   dcnt=0;

   while(1)
   {
      printf("\n1. Create Directory\t2. Create File\t3. Delete File");
      printf("\n4. Search File\t\t5. Display\t6. Exit\nEnter your choice --");
      scanf("%d",&ch);

   switch(ch)
   {
      case 1: printf("\nEnter name of directory -- ");
            scanf("%s", dir[dcnt].dname);
            dir[dcnt].fcnt=0;
            dcnt++;
            printf("Directory created");
            break;

      case 2: 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",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);
    }
}
}
```

(c) Hierarchical:

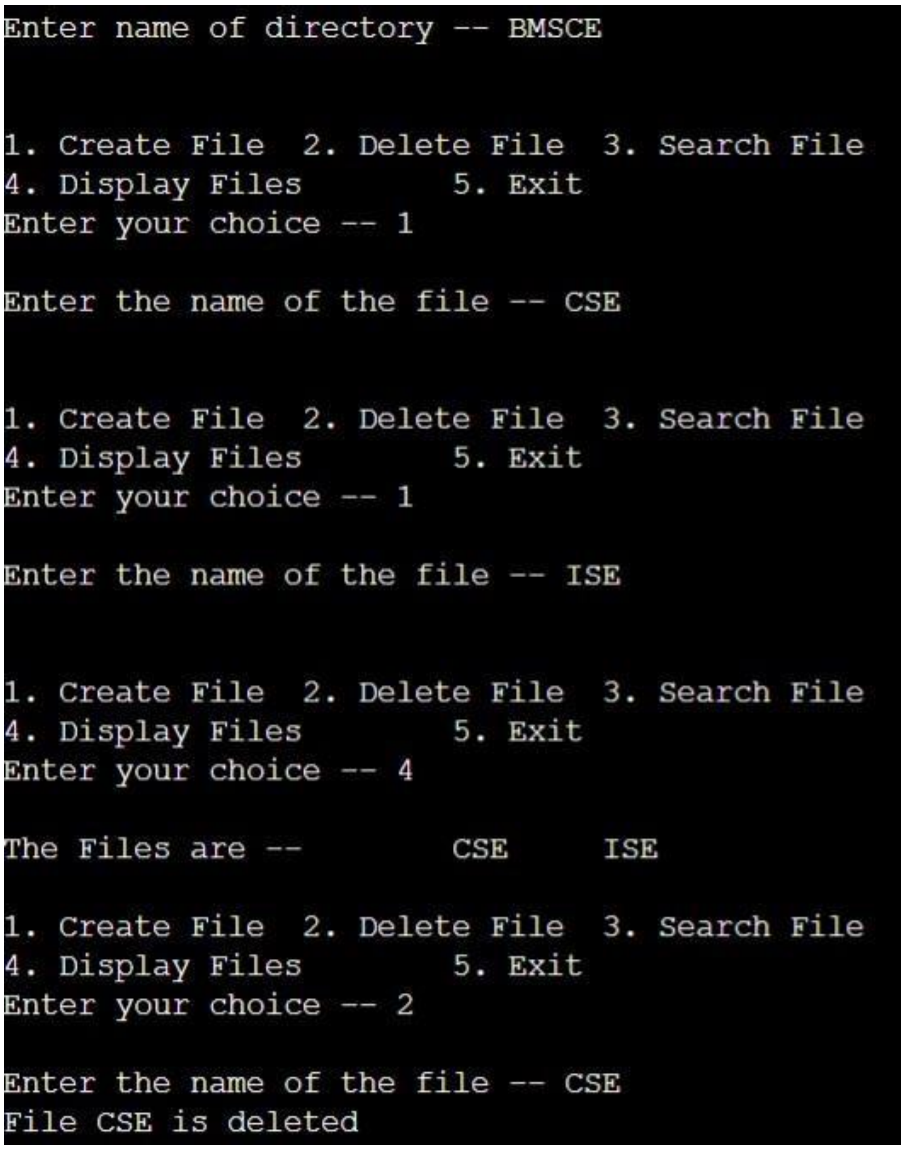
```
#include<stdio.h>
#include<string.h>
#include<stdlib.h>
//#include<graphics.h>

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 gm;
    node *root;
    root=NULL;

    create(&root,0,"root",0,639,320);
```

```
   //initgraph(&gd,&gm,"c:\\tc\\BGI");
   display(root);

   //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;
   }
}
```

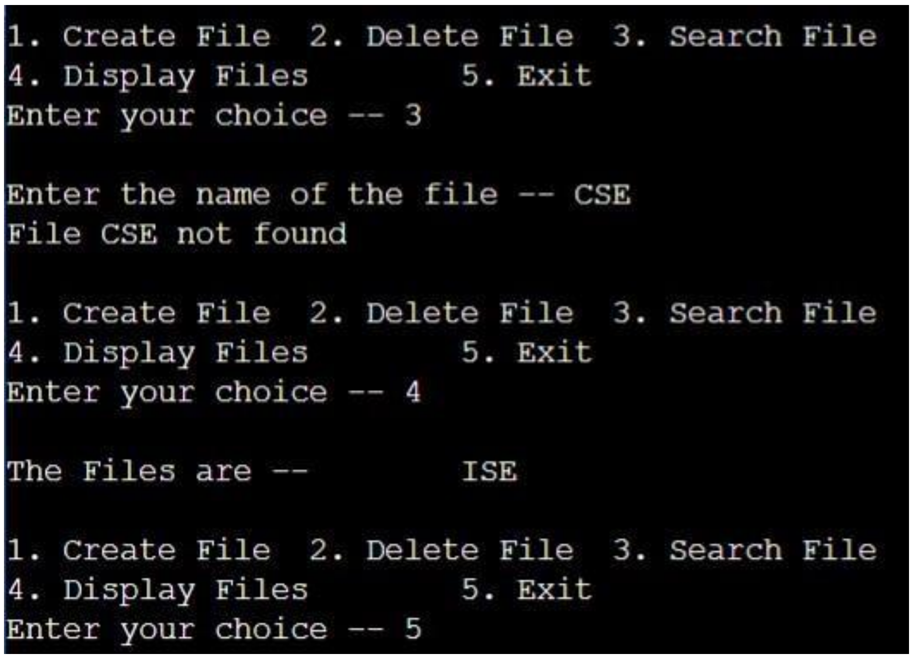
```
/*display(node *root)
{
   int i;
   settextstyle(2,0,4);
   settextjustify(1,1);
   setfillstyle(1,BLUE);
   setcolor(14);

   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]);
      }
   }
}*/
```

2.13.3 Output:

(a) Single Level Directory:

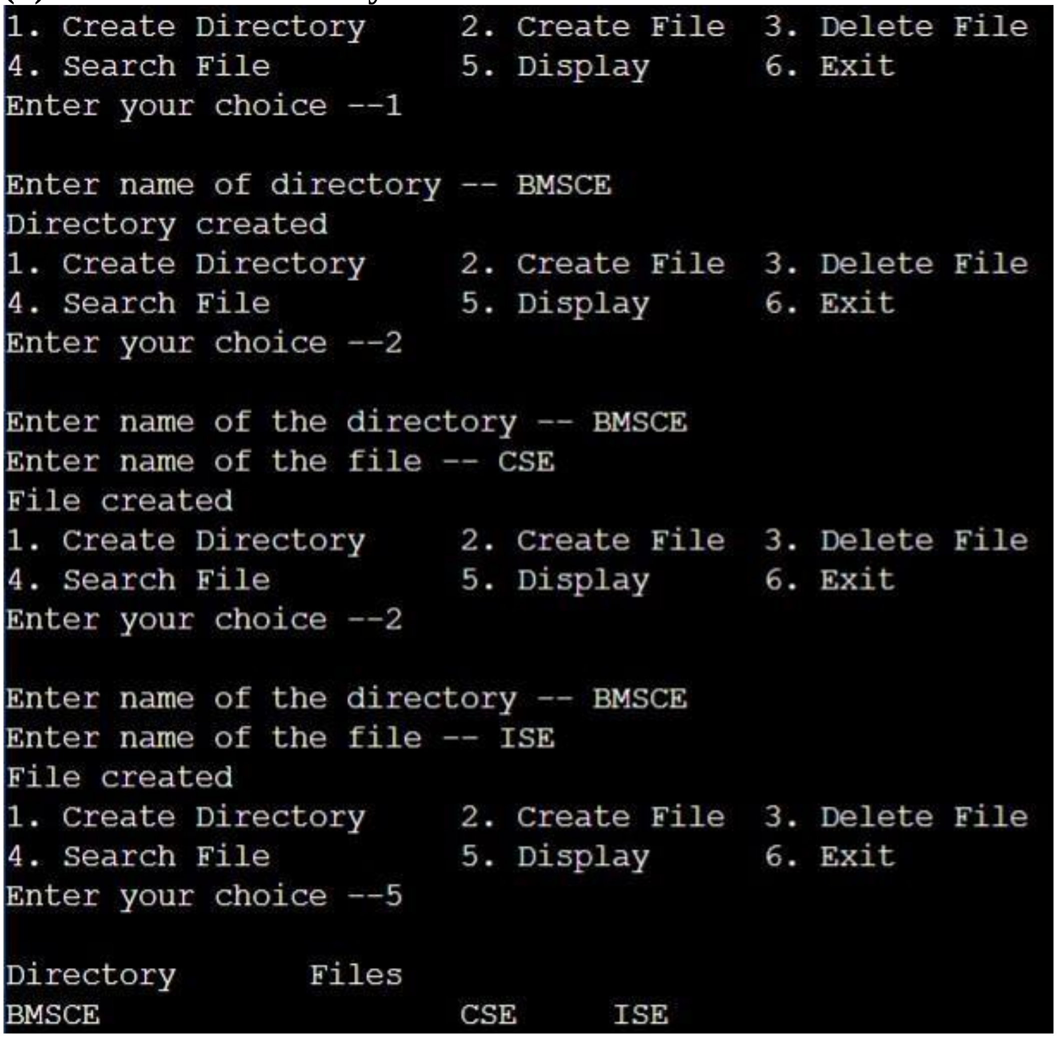


```
Enter name of directory -- BMSCE


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

Enter the name of the file -- 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 -- ISE


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

The Files are --        CSE     ISE

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

Enter the name of the file -- CSE
File CSE is deleted
```

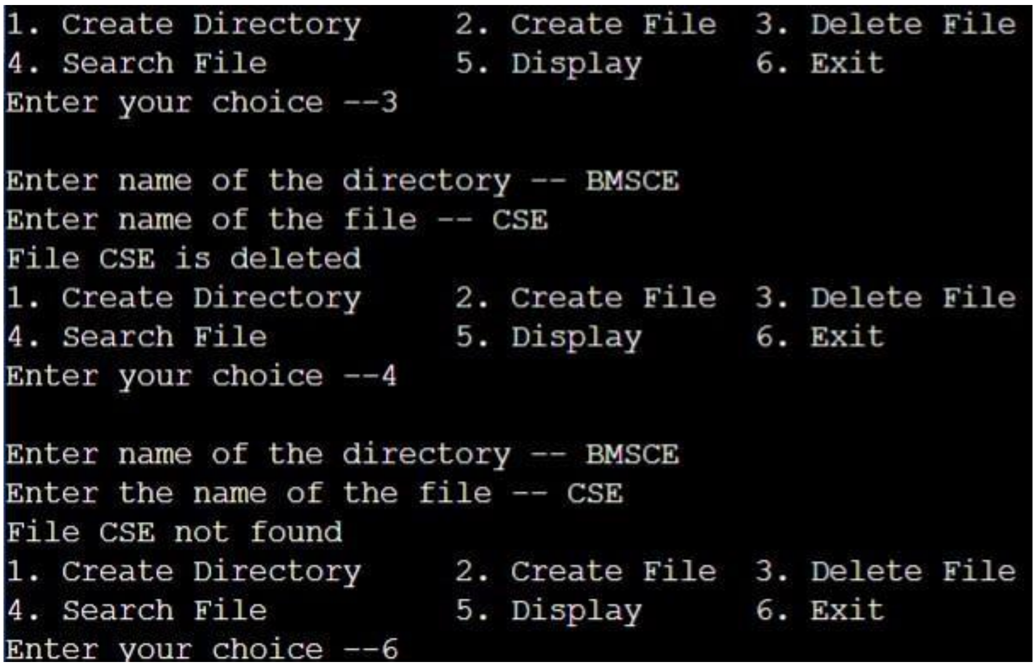


```
1. Create File  2. Delete File  3. Search File
4. Display Files        5. Exit
Enter your choice -- 3

Enter the name of the file -- CSE
File CSE not found

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

The Files are --        ISE

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

(b) Two Level Directory:



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

Enter name of directory -- BMSCE
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 -- BMSCE
Enter name of the file -- CSE
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 -- BMSCE
Enter name of the file -- ISE
File created
1. Create Directory     2. Create File  3. Delete File
4. Search File          5. Display      6. Exit
Enter your choice --5

Directory       Files
BMSCE                   CSE     ISE
```



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

Enter name of the directory -- BMSCE
Enter name of the file -- CSE
File CSE is deleted
1. Create Directory     2. Create File  3. Delete File
4. Search File          5. Display      6. Exit
Enter your choice --4

Enter name of the directory -- BMSCE
Enter the name of the file -- CSE
File CSE not found
1. Create Directory     2. Create File  3. Delete File
4. Search File          5. Display      6. Exit
Enter your choice --6
```

2.14 Experiment - 14

2.14.1 Question:

Write a C program to simulate disk scheduling algorithms:

(a) FCFS

(b) SCAN

(c) c-SCAN

2.14.2 Code:

(a) FCFS:

```
#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;

}
```

(b) 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;
}
```

(c) <u>c-SCAN:</u>

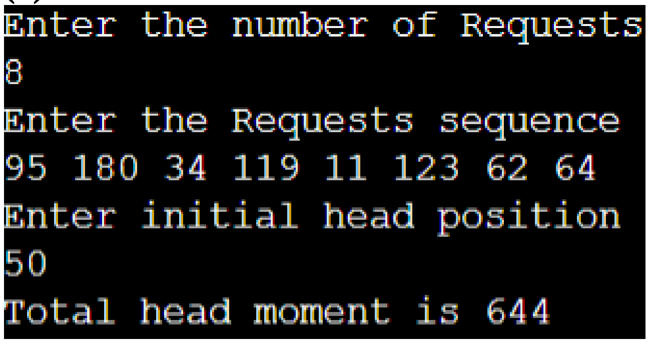
```
#include<stdio.h>
#include<stdlib.h>
int main()
{
    int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
    printf("Enter the number of Requests\n");
    scanf("%d",&n);
    printf("Enter the Requests sequence\n");
    for(i=0;i<n;i++)
     scanf("%d",&RQ[i]);
    printf("Enter initial head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

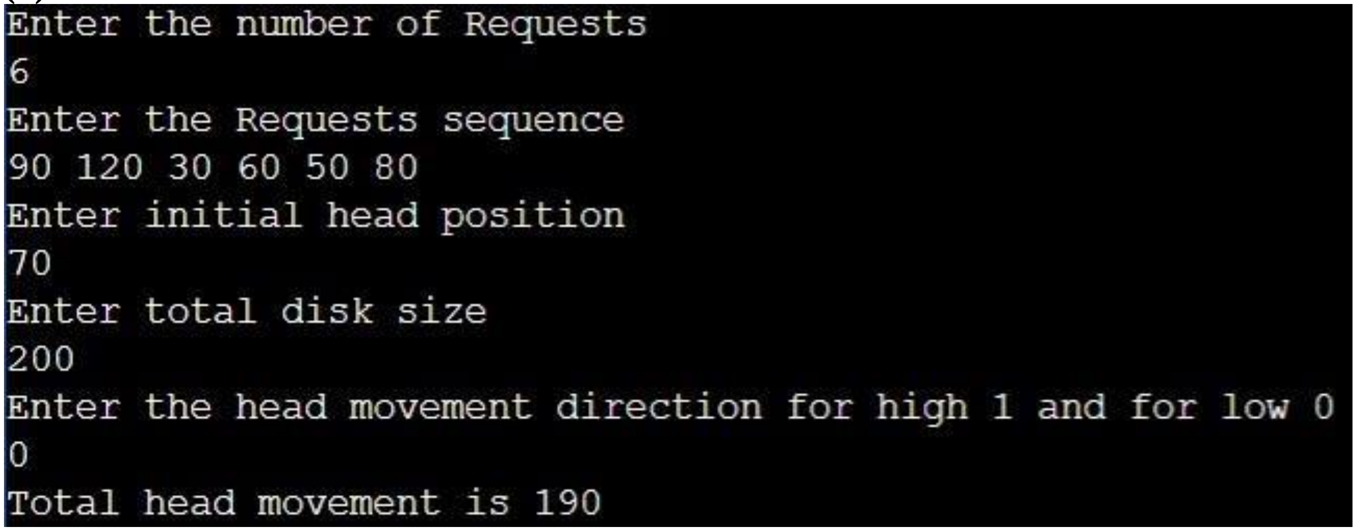
2.14.3 Output:

(a) FCFS:



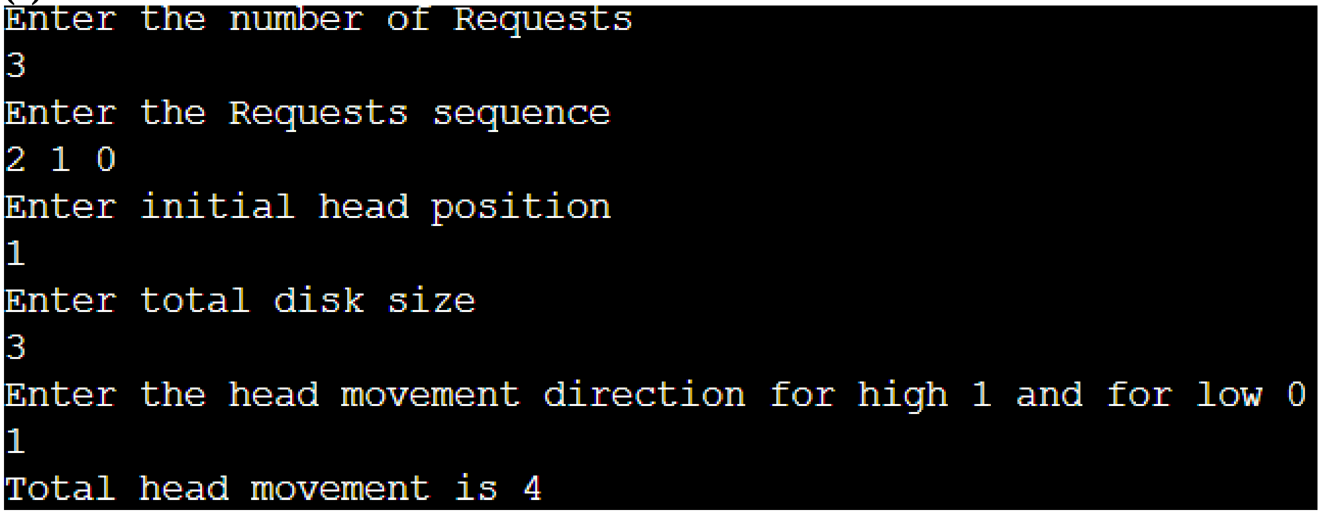
```
Enter the number of Requests
8
Enter the Requests sequence
95 180 34 119 11 123 62 64
Enter initial head position
50
Total head moment is 644
```

(b) SCAN:



```
Enter the number of Requests
6
Enter the Requests sequence
90 120 30 60 50 80
Enter initial head position
70
Enter total disk size
200
Enter the head movement direction for high 1 and for low 0
0
Total head movement is 190
```

(c) C-SCAN:



```
Enter the number of Requests
3
Enter the Requests sequence
2 1 0
Enter initial head position
1
Enter total disk size
3
Enter the head movement direction for high 1 and for low 0
1
Total head movement is 4
```

2.15 Experiment - 15

2.15.1 Question:

Write a C program to simulate disk scheduling algorithms:

(a) SSTF

(b) LOOK

(c) C-LOOK

2.15.2 Code:

(a) <u>SSTF</u>:

```
#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;
}
```

(b) LOOK:

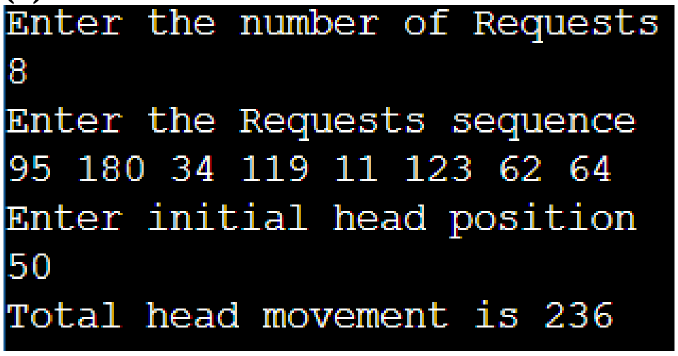
```
#include<stdio.h>
#include<stdlib.h>
int main()
{
    int RQ[100],i,j,n,TotalHeadMoment=0,initial,size,move;
    printf("Enter the number of Requests\n");
    scanf("%d",&n);
    printf("Enter the Requests sequence\n");
    for(i=0;i<n;i++)
     scanf("%d",&RQ[i]);
    printf("Enter initial head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

(c) 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++)
        {
            TotalHeadMoment=TotalHeadMoment+abs(RQ[i]-initial);
            initial=RQ[i];
        }

        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];
        }

        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;
}
```

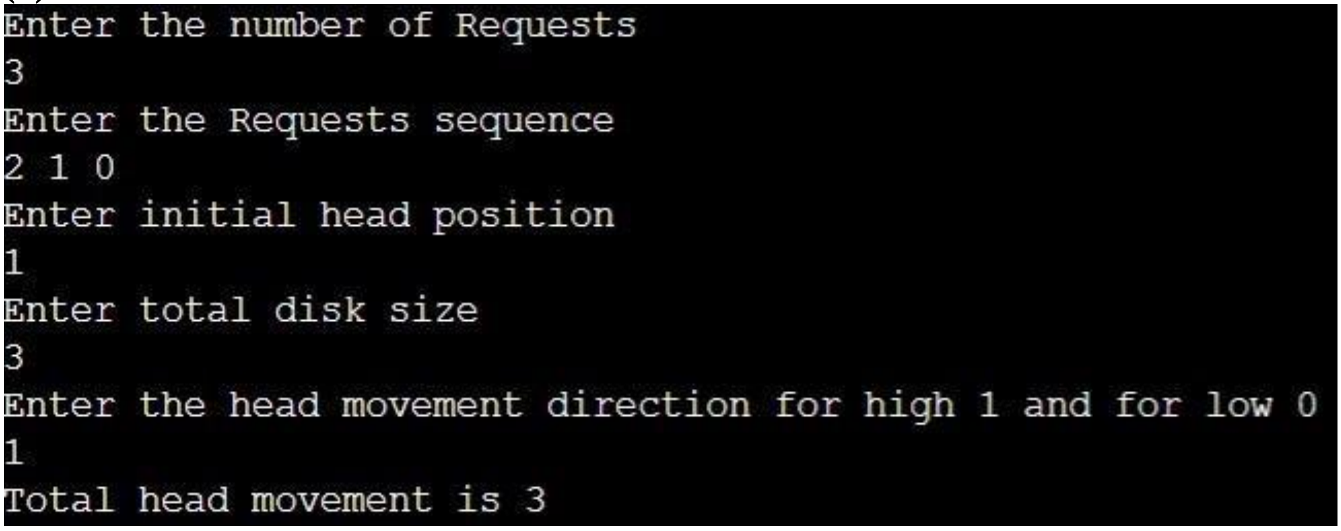
2.15.3 Output:

(a) SSTF:



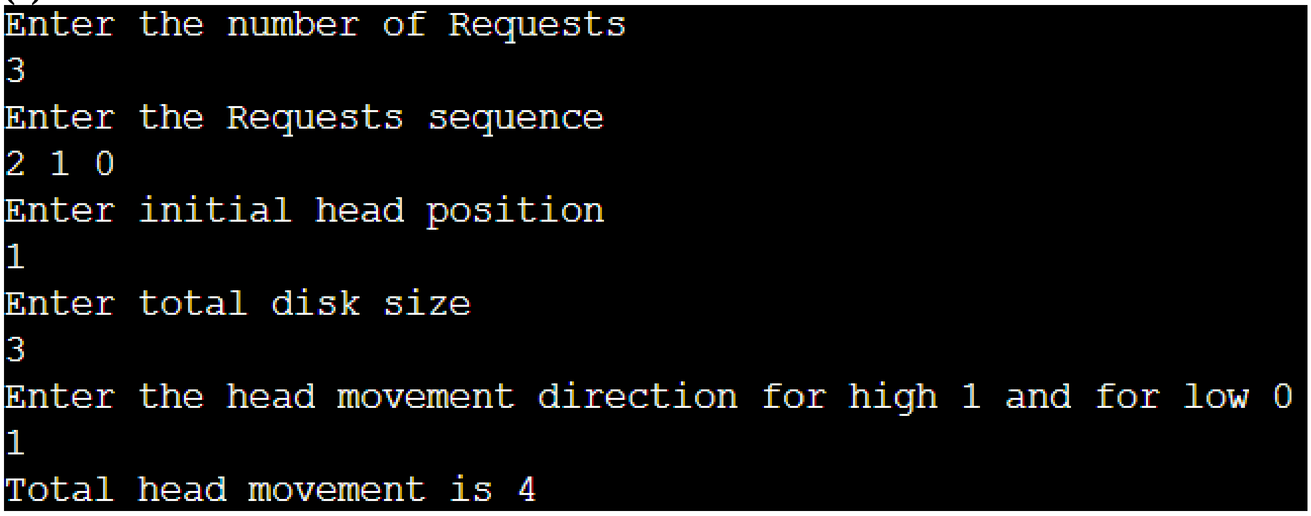
```
Enter the number of Requests
8
Enter the Requests sequence
95 180 34 119 11 123 62 64
Enter initial head position
50
Total head movement is 236
```

(b) LOOK:



```
Enter the number of Requests
3
Enter the Requests sequence
2 1 0
Enter initial head position
1
Enter total disk size
3
Enter the head movement direction for high 1 and for low 0
1
Total head movement is 3
```

(c) c-LOOK:



```
Enter the number of Requests
3
Enter the Requests sequence
2 1 0
Enter initial head position
1
Enter total disk size
3
Enter the head movement direction for high 1 and for low 0
1
Total head movement is 4
```