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"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

OPERATING SYSTEMS

Submitted by

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

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B. M. S. College of Engineering,

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(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled "OPERATING SYSTEMS" carried out by **DEEKSHA S (1BM21CS048),** 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 academic semester June-2023 to September-2023. The Lab report has been approved as it satisfies the academic requirements in respect of a OPERATING SYSTEMS **(22CS4PCOPS)** work prescribed for the said degree.

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Course Outcome

CO1	Analyze time complexity of Recursive and Non-recursive algorithms using asymptotic notations.
CO2	Apply various design techniques for the given problem.
CO3	Apply the knowledge of complexity classes P, NP, and NP-Complete and prove certain problems are NP-Complete
CO4	Design efficient algorithms and conduct practical experiments to solve problems.

PROGRAM 1

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

Program:

```
#include<stdio.h>
int at[20],cput[20];
void main(){
   int n,i,choice;
   printf("Enter the number of processes\n");
   scanf("%d",&n);
   printf("Enter arrival time and cpu time for each process respectively\n");
   for(i =0;i<n;i++){
      scanf("%d %d",&at[i],&cput[i]);
   }
   printf("Menu\n\n1.FCFS\n2.SJF(Non Preemptive)\n3.SRTF(Preemptive)\n4.Exit\n");
   while(1){
      scanf("%d",&choice);
      switch(choice){
      case 1: fcfs(n);
      break;
      case 2: sjf(n);
      break;
      case 3: srtf(n);
      break;
      case 4: exit(0);
```

```
        default:printf("Wring choice\n");
    }
    }
}

void srtf(int n) {
    int remaining_time[20], tat[20], wt[20], completion_time[20], smallest, time, i, count = 0;
    float awt=0,atat=0;
    for (i = 0; i < n; i++)
        remaining_time[i] = cput[i];

    time = 0;
    while (count != n) {
        smallest = -1;
        for (i = 0; i < n; i++) {
            if (at[i] <= time && remaining_time[i] > 0) {
                if (smallest == -1 || remaining_time[i] < remaining_time[smallest])
                    smallest = i;
            }
        }
        if (smallest == -1) {
            time++;
            continue;
        }
        remaining_time[smallest]--;
        if (remaining_time[smallest] == 0) {
            count++;
            completion_time[smallest] = time + 1;
```

```
            wt[smallest] = completion_time[smallest] - at[smallest] - cput[smallest];
            tat[smallest] = completion_time[smallest] - at[smallest];
        }
        time++;
    }
    for(i=0;i<n;i++){
        awt+=wt[i];
        atat += tat[i];
    }
    awt = awt/n;
    atat =atat/n;

    printf("\nProcess\tArrival Time\tCPU Time\tWaiting Time\tTurnaround Time\n");
    for (i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\t\t%d\t\t%d\n", i, at[i], cput[i], wt[i], tat[i]);
    }
    printf("\nAverage Waiting Time -- %f", awt);
    printf("\nAverage Turnaround Time -- %f\n", atat);



}

void sjf(int n){
    int cmpt[20],tat[20],wt[20],cput1[20];
    float awt=0, atat=0,sum_burst_time=0;
    int sum=0,i,j, smallest;
        printf("\t PROCESS \t TURNAROUND TIME\t WAITING TIME\n");
```

```
    for (i = 0; i < n; i++) {
            cput1[i]=cput[i];
    sum_burst_time += cput[i];
  }
    cput1[9]=9999;
    while(sum < sum_burst_time)
   {
    smallest = 9;
    for (i = 0; i < n; i++) {
      if (at[i] <= sum && cput1[i] > 0 && cput1[i] < cput1[smallest])
        smallest = i;
    }
    printf("\t P[%d] \t\t %d \t\t %d\n", smallest , sum + cput1[smallest] - at[smallest], sum -
at[smallest]);
    awt += sum - at[smallest];
    atat += sum + cput1[smallest] - at[smallest];
    sum += cput1[smallest];
    cput1[smallest] = 0;
  }
    awt = awt/n;
    atat =atat/n;

        printf("\nAverage Waiting Time -- %f", awt);
        printf("\nAverage Turnaround Time -- %f\n", atat);
}

void fcfs(int n){
    int cmpt[20],tat[20],wt[20],pname[20],temp;
```

```
float awt=0, atat=0;
int sum=0,i;
for(i=0;i<n;i++){
  pname[i]=i;
}
for(i=0;i<n;i++){
  if(at[i]==at[i+1] && cput[i]>cput[i+1]){
    temp = cput[i];
    cput[i]=cput[i+1];
    cput[i+1]=temp;
    temp = pname[i];
    pname[i]=pname[i+1];
    pname[i+1]=temp;
  }
}
for(i=0;i<n;i++){
  sum += cput[i];
  cmpt[i]=sum;
  tat[i]=cmpt[i]-at[i];
  wt[i]=tat[i]-cput[i];
}

for(i=0;i<n;i++){
    awt+=wt[i];
    atat += tat[i];
}
awt = awt/n;
atat =atat/n;
```

```
   printf("\t PROCESS \tARRIVAL TIME \tCPU TIME \t WAITING TIME\t TURNAROUND TIME\n");
   for(i=0;i<n;i++){
      printf("\n\t P%d \t\t %d \t\t %d \t\t %d \t\t %d", pname[i],at[i], cput[i], wt[i], tat[i]);
      }
      printf("\nAverage Waiting Time -- %f", awt);
      printf("\nAverage Turnaround Time -- %f\n", atat);
getch();
}
```

OUTPUT:

```
E:\Downloads\Lab2_OS.exe
Enter the number of processes
4
Enter arrival time and cpu time for each process respectively
0 3
1 6
4 4
6 2
Menu

1.FCFS
2.SJF(Non Preemptive)
3.SRTF(Preemptive)
4.Exit
1
        PROCESS        ARRIVAL TIME    CPU TIME        WAITING TIME    TURNAROUND TIME

        P0              0               3               0               3
        P1              1               6               2               8
        P2              4               4               5               9
        P3              6               2               7               9
Average Waiting Time -- 3.500000
Average Turnaround Time -- 7.250000
2
        PROCESS         TURNAROUND TIME         WAITING TIME
        P[0]            3               0
        P[1]            8               2
        P[3]            5               3
        P[2]            11              7

Average Waiting Time -- 3.000000
Average Turnaround Time -- 6.750000
3

Process Arrival Time    CPU Time        Waiting Time    Turnaround Time
0       0               3               0               3
1       1               6               8               14
2       4               4               0               4
3       6               2               2               4

Average Waiting Time -- 2.500000
Average Turnaround Time -- 6.250000
```

E:\Downloads\Lab2_OS.exe

```
Enter the number of processes
4
Enter arrival time and cpu time for each process respectively
0 10
3 2
5 1
10 5
Menu

1.FCFS
2.SJF(Non Preemptive)
3.SRTF(Preemptive)
4.Exit
1
        PROCESS        ARRIVAL TIME    CPU TIME         WAITING TIME    TURNAROUND TIME

        P0              0               10              0               10
        P1              3               2               7               9
        P2              5               1               7               8
        P3              10              5               3               8
Average Waiting Time -- 4.250000
Average Turnaround Time -- 8.750000
2
        PROCESS         TURNAROUND TIME         WAITING TIME
        P[0]            10                      0
        P[2]            6                       5
        P[1]            10                      8
        P[3]            8                       3

Average Waiting Time -- 4.000000
Average Turnaround Time -- 8.500000
3

Process Arrival Time    CPU Time        Waiting Time    Turnaround Time
0       0               10              3               13
1       3               2               0               2
2       5               1               0               1
3       10              5               3               8

Average Waiting Time -- 1.500000
Average Turnaround Time -- 6.000000
```

PROGRAM 2

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

(a) Priority (Non-pre-emptive)

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

Program:

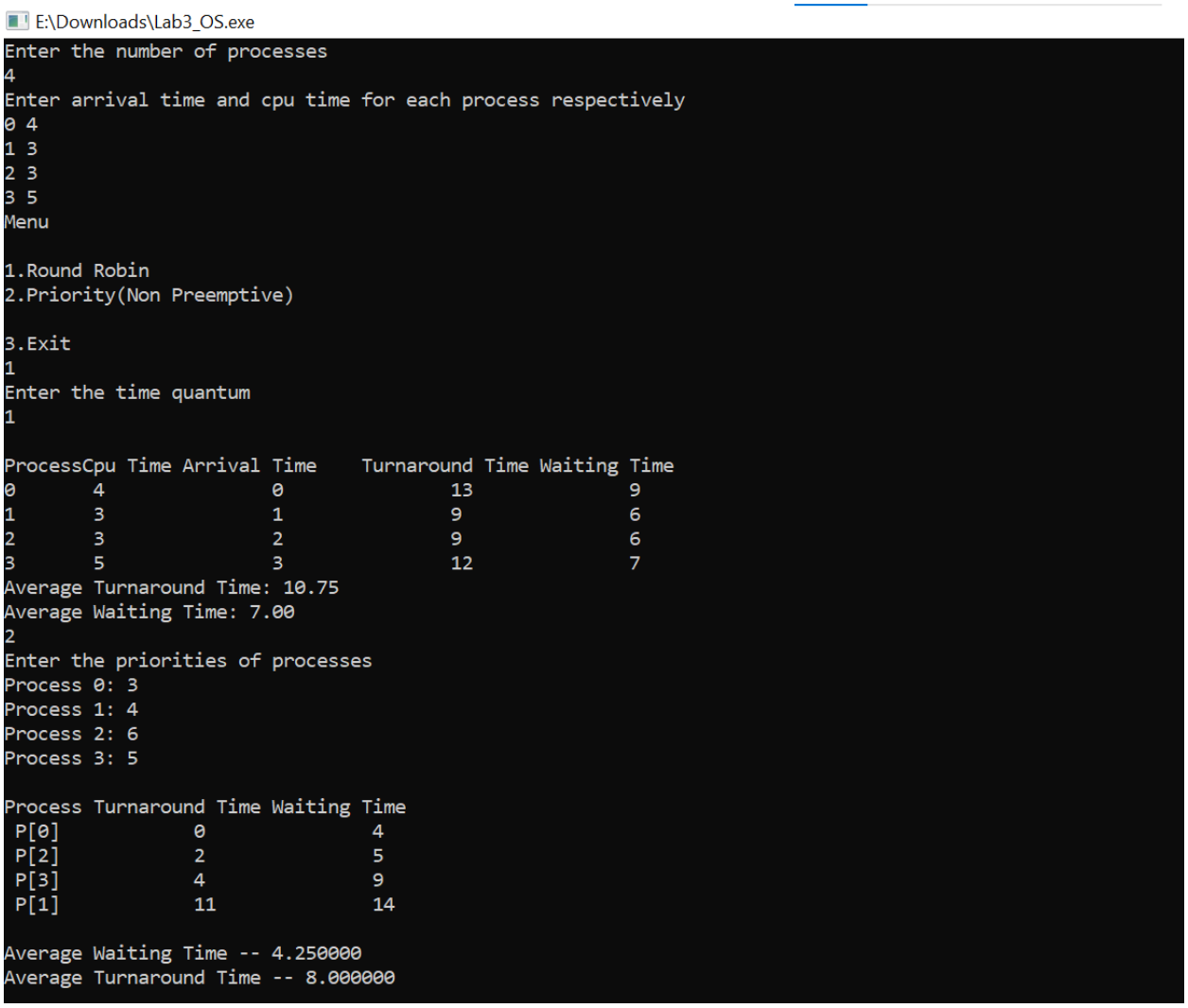
```
#include<stdio.h>
int at[20],cput[20];
void main()
{
   int n,i,choice,tq;
   printf("Enter the number of processes\n");
   scanf("%d",&n);
   printf("Enter arrival time and cpu time for each process respectively\n");
   for(i =0;i<n;i++){
      scanf("%d %d",&at[i],&cput[i]);
   }

   printf("Menu\n\n1.Round Robin\n2.Priority(Non Preemptive)\n\n3.Exit\n");
   while(1){
      scanf("%d",&choice);
      switch(choice){
      case 1: printf("Enter the time quantum \n");
      scanf("%d",&tq);
         roundRobin(n,tq);
      break;
      case 2: NonprePriority(n);
```

```
        break;
        case 3: exit(0);
        default:printf("Wring choice\n");
    }
    }
}

void roundRobin(int n, int tq){
    int i,remaining_time[20],wt[20],tat[20],completed = 0,time=0;
    float awt=0,atat=0;
    for(i=0;i<n;i++){
        remaining_time[i]=cput[i];
    }
    while (completed < n) {
        for (int i = 0; i < n; i++) {
            if (remaining_time[i] > 0 && at[i] <= time) {
                if (remaining_time[i] <= tq) {
                    time += remaining_time[i];
                    remaining_time[i] = 0;
                    completed++;

                    tat[i] = time - at[i];
                    wt[i] = tat[i] - cput[i];
                } else {
                    time += tq;
                    remaining_time[i] -= tq;
                }
            }
```

```
        }
    }
    for (int i = 0; i < n; i++) {
        atat += tat[i];
        awt += wt[i];
    }
    atat /= n;
    awt /= n;

    printf("\nProcess\Cpu Time\tArrival Time\tTurnaround Time\tWaiting Time\n");
    for (int i = 0; i < n; i++) {
        printf("%d\t%d\t\t%d\t\t%d\t\t%d\n", i , cput[i], at[i], tat[i], wt[i]);
    }
    printf("Average Turnaround Time: %.2f\n", atat);
    printf("Average Waiting Time: %.2f\n", awt);
}

void NonprePriority(int n){
    int priority[20],wt[20],tat[20],hp=0,cmpt[20],cput1[20],sum=0,i,sum_burst_time=0;
    float awt=0,atat=0;
    printf("Enter the priorities of processes\n");
     for (int i = 0; i < n; i++) {
        printf("Process %d: ", i);
        scanf("%d", &priority[i]);
    }
    for (i = 0; i < n; i++) {
            cput1[i]=cput[i];
    sum_burst_time += cput[i];
```

```
  }
   printf("\nProcess\tTurnaround Time\tWaiting Time\n");
  cput1[9]=-1;
   while(sum < sum_burst_time)
   {
   hp = 9;
   for (i = 0; i < n; i++) {
     if (at[i] <= sum && cput1[i]>0 && priority[i] > priority[hp])
       hp = i;
   }
   printf(" P[%d] \t\t %d \t\t %d\n", hp , sum - at[hp], sum + cput1[hp] - at[hp]);
   awt += sum - at[hp];
   atat += sum + cput1[hp] - at[hp];
   sum += cput1[hp];
   cput1[hp] = 0;
  }

  awt = awt/n;
   atat =atat/n;

      printf("\nAverage Waiting Time -- %f", awt);
      printf("\nAverage Turnaround Time -- %f\n", atat);
}
```

OUTPUT:



```
E:\Downloads\Lab3_OS.exe
Enter the number of processes
4
Enter arrival time and cpu time for each process respectively
0 4
1 3
2 3
3 5
Menu

1.Round Robin
2.Priority(Non Preemptive)

3.Exit
1
Enter the time quantum
1

ProcessCpu Time Arrival Time    Turnaround Time Waiting Time
0       4               0               13              9
1       3               1               9               6
2       3               2               9               6
3       5               3               12              7
Average Turnaround Time: 10.75
Average Waiting Time: 7.00
2
Enter the priorities of processes
Process 0: 3
Process 1: 4
Process 2: 6
Process 3: 5

Process Turnaround Time Waiting Time
 P[0]            0               4
 P[2]            2               5
 P[3]            4               9
 P[1]            11              14

Average Waiting Time -- 4.250000
Average Turnaround Time -- 8.000000
```

E:\Downloads\Lab3_OS.exe

```
Enter the number of processes
4
Enter arrival time and cpu time for each process respectively
0 5
1 3
2 1
3 2
Menu

1.Round Robin
2.Priority(Non Preemptive)

3.Exit
1
Enter the time quantum
2

ProcessCpu Time Arrival Time    Turnaround Time Waiting Time
0       5               0               11              6
1       3               1               9               6
2       1               2               3               2
3       2               3               4               2
Average Turnaround Time: 6.75
Average Waiting Time: 4.00
2
Enter the priorities of processes
Process 0: 3
Process 1: 2
Process 2: 1
Process 3: 4

Process Turnaround Time Waiting Time
 P[0]           0               5
 P[3]           2               4
 P[1]           6               9
 P[2]           8               9

Average Waiting Time -- 4.000000
Average Turnaround Time -- 6.750000
```

PROGRAM 3

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>
#define MAX 50
typedef struct
{
   int number;
   int p_id[MAX];
   int tat[MAX];
   int wt[MAX];
   int arrival_time[MAX];
   int cpu_time[MAX];
} Process;

void main()
{
   int n, i,j,pname[MAX],total_time=0,time=0;
   int totaltat[MAX], totalwt[MAX];
   float avgtat=0,avgwt=0;
   Process sp,up;
   printf("Enter the number of system processes: ");
   scanf("%d", &sp.number);

    printf("Enter the Arrival time and the Burst time for system processes:\n");
```

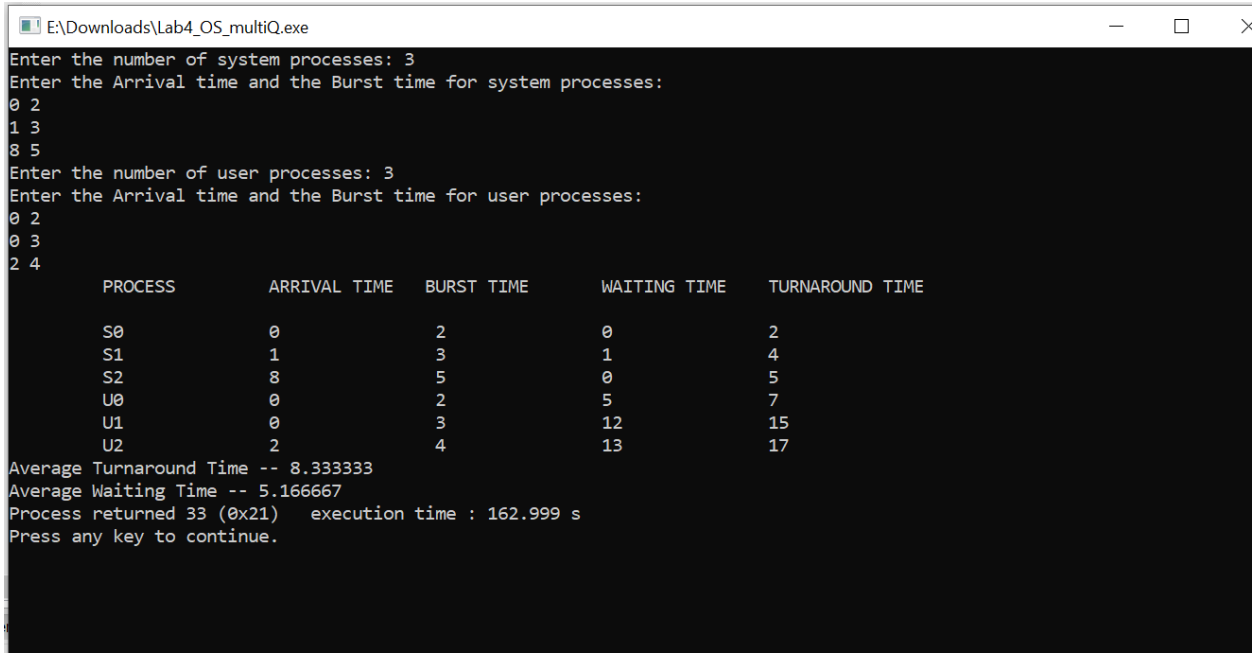
```
// Read process details
for (i = 0; i < sp.number; i++)
{
   //printf("Process %d\n", i + 1);
   scanf("%d", &sp.arrival_time[i]);
   scanf("%d", &sp.cpu_time[i]);

   sp.p_id[i] = 10+i + 1;
}
printf("Enter the number of user processes: ");
scanf("%d", &up.number);
printf("Enter the Arrival time and the Burst time for user processes:\n");
// Read process details
for (i = 0; i < up.number; i++)
{
   //printf("Process %d\n", i + 1);
   scanf("%d", &up.arrival_time[i]);
   scanf("%d", &up.cpu_time[i]);

   up.p_id[i] = 20+i + 1;
}

for(i=0;i<sp.number;i++)
   total_time+=sp.cpu_time[i];

for(i=0;i<up.number;i++)
   total_time+=up.cpu_time[i];
```

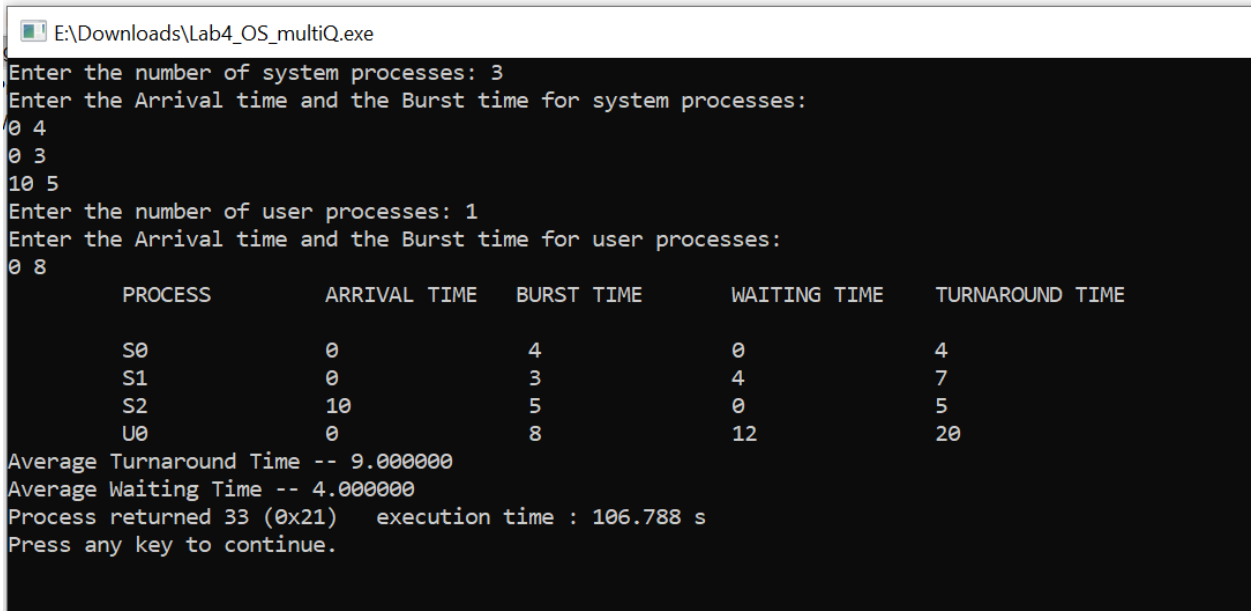
```
i=0,j=0;
while(time<total_time)
{
   if(sp.arrival_time[i]<=up.arrival_time[j])
   {
      time+=sp.cpu_time[i];
      sp.tat[i]=time-sp.arrival_time[i];
      sp.wt[i]=sp.tat[i]-sp.cpu_time[i];
      i++;
   }
   else if (up.arrival_time[j] < sp.arrival_time[i] && sp.arrival_time[i] > time)
{
   if ((time + up.cpu_time[j]) > sp.arrival_time[i])
{
   int ubt = up.cpu_time[j], sbt = sp.cpu_time[i];

   while (time < sp.arrival_time[i])
   {
      time++;
      ubt--;
   }

   time += sbt;
   sp.tat[i] = time - sp.arrival_time[i];
   sp.wt[i] = sp.tat[i] - sp.cpu_time[i];
   i++;
   time += ubt;
   up.tat[j] = time - up.arrival_time[j];
```

```
    up.wt[j] = up.tat[j] - up.cpu_time[j];
    j++;
  }
  else
  {
    time += up.cpu_time[j];
    up.tat[j] = time - up.arrival_time[j];
    up.wt[j] = up.tat[j] - up.cpu_time[j];
    j++;
  }
  }

    else if(up.arrival_time[j]<=sp.arrival_time[i]&&sp.arrival_time[i]<time)
    {
      time+=sp.cpu_time[i];
      sp.tat[i]=time-sp.arrival_time[i];
      sp.wt[i]=sp.tat[i]-sp.cpu_time[i];
      i++;
    }
    //printf("%d",sp.tat[0]);
  }
  printf("\t PROCESS \t ARRIVAL TIME \tBURST TIME \t WAITING TIME\t
TURNAROUND TIME\n");
  for(i=0;i<sp.number;i++)
  {
    printf("\n\t S%d \t\t %d \t\t %d \t\t %d \t\t %d", i,sp.arrival_time[i], sp.cpu_time[i], sp.wt[i],
sp.tat[i]);
    avgtat+=sp.tat[i];
```

```
        avgwt+=sp.wt[i];
    }
    for(i=0;i<up.number;i++)
    {
         printf("\n\t U%d \t\t %d \t\t %d \t\t %d \t\t %d", i,up.arrival_time[i], up.cpu_time[i],
up.wt[i], up.tat[i]);
        avgtat+=up.tat[i];
        avgwt+=up.wt[i];
    }
    avgtat/=(sp.number+up.number);
    avgwt/=(sp.number+up.number);
    printf("\nAverage Turnaround Time -- %f", avgtat);
    printf("\nAverage Waiting Time -- %f", avgwt);
}
```

OUTPUT:




E:\Downloads\Lab4_OS_multiQ.exe
Enter the number of system processes: 3
Enter the Arrival time and the Burst time for system processes:
0 4
0 3
10 5
Enter the number of user processes: 1
Enter the Arrival time and the Burst time for user processes:
0 8
PROCESS ARRIVAL TIME BURST TIME WAITING TIME TURNAROUND TIME
S0 0 4 0 4
S1 0 3 4 7
S2 10 5 0 5
U0 0 8 12 20
Average Turnaround Time -- 9.000000
Average Waiting Time -- 4.000000
Process returned 33 (0x21) execution time : 106.788 s
Press any key to continue.

PROGRAM 4

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

(a) Rate- Monotonic

(b) Earliest-deadline First

Program:

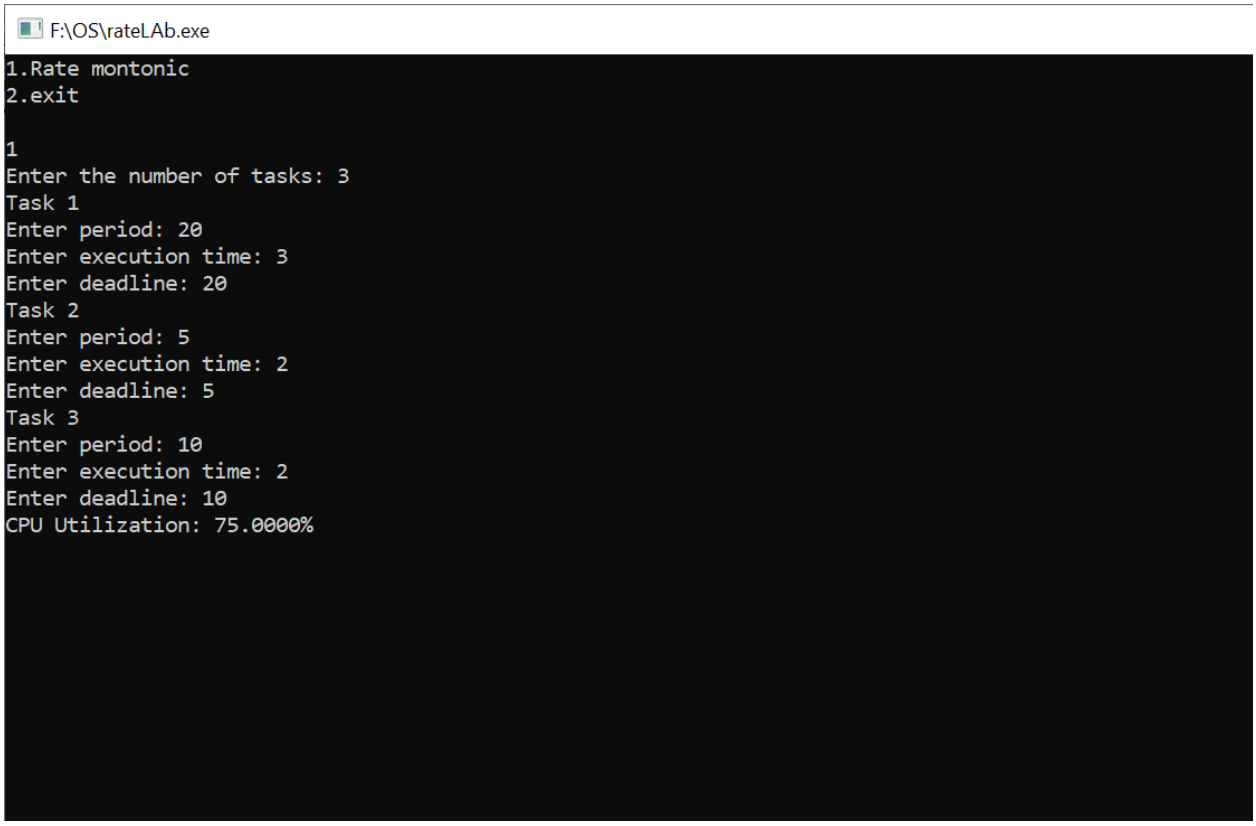
a) Rate- Monotonic:

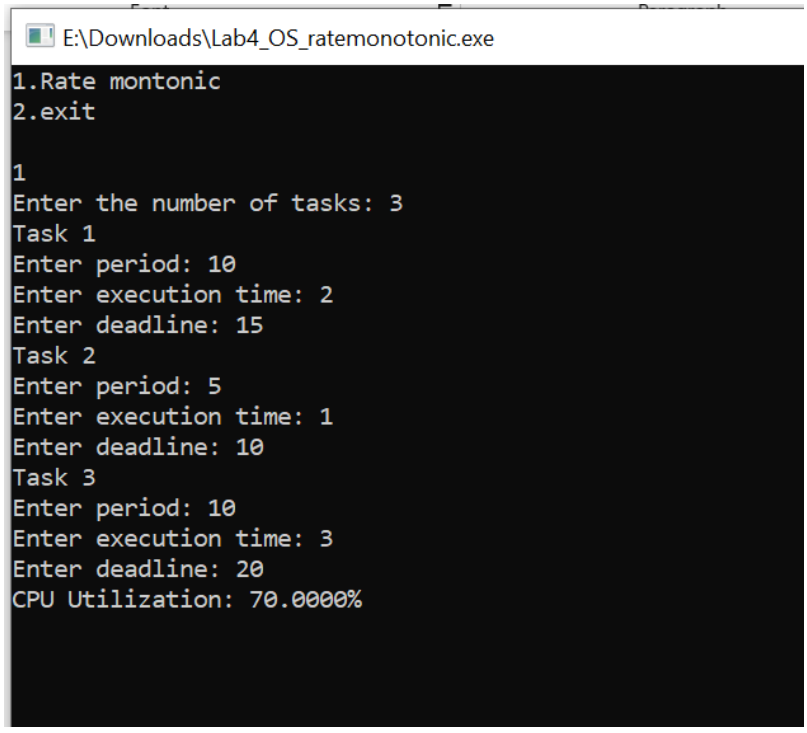
```
#include<stdio.h>
#define MAX_TASKS 100

typedef struct {
   int pid;
   int period;
   int exec_time;
   int deadline;
} Task;

float cpu_util(Task tasks[], int n) {
   float total_utilization = 0.0;

   for (int i = 0; i < n; i++) {
      float task_utilization = (float)tasks[i].exec_time / tasks[i].period;
      total_utilization += task_utilization;
   }

   float cpu_utilization = total_utilization * 100;
   return cpu_utilization;
```

```
}

rateMonotonic(){
    int n, i;

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

    Task tasks[MAX_TASKS];

    for (i = 0; i < n; i++) {
        printf("Task %d\n", i + 1);
        printf("Enter period: ");
        scanf("%d", &tasks[i].period);
        printf("Enter execution time: ");
        scanf("%d", &tasks[i].exec_time);
       /* printf("Enter execution time: ");
        scanf("%d", &tasks[i].exec_time;*/
        printf("Enter deadline: ");
        scanf("%d", &tasks[i].deadline);

        tasks[i].pid = i + 1;
    }

    float cpu_utilization = cpu_util(tasks, n);

    printf("CPU Utilization: %.4f%%\n", cpu_utilization);
}
```

```
void main(){
   int choice, n, i;
   printf("1.Rate montonic\n2.exit\n\n");
   while(1){
      scanf("%d",&choice);
      switch(choice){
         case 1: rateMonotonic();
         break;
         case 2:
            exit(0);
         default: printf("Wrong choice\n");
      }
   }
}
```

OUTPUT:


F:\OS\rateLAb.exe
1.Rate montonic
2.exit
1
Enter the number of tasks: 3
Task 1
Enter period: 20
Enter execution time: 3
Enter deadline: 20
Task 2
Enter period: 5
Enter execution time: 2
Enter deadline: 5
Task 3
Enter period: 10
Enter execution time: 2
Enter deadline: 10
CPU Utilization: 75.0000%

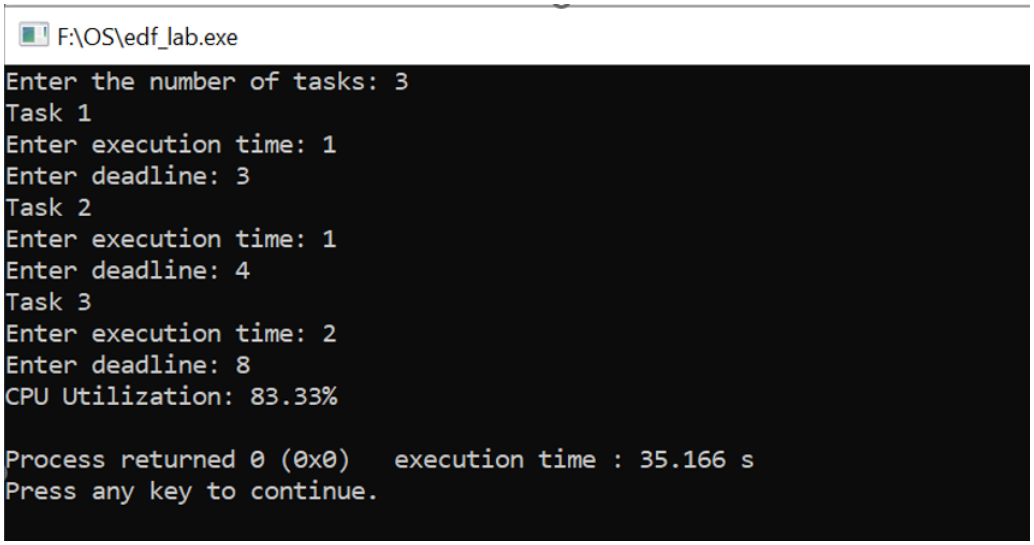

E:\Downloads\Lab4_OS_ratemonotonic.exe
1.Rate montonic
2.exit
1
Enter the number of tasks: 3
Task 1
Enter period: 10
Enter execution time: 2
Enter deadline: 15
Task 2
Enter period: 5
Enter execution time: 1
Enter deadline: 10
Task 3
Enter period: 10
Enter execution time: 3
Enter deadline: 20
CPU Utilization: 70.0000%

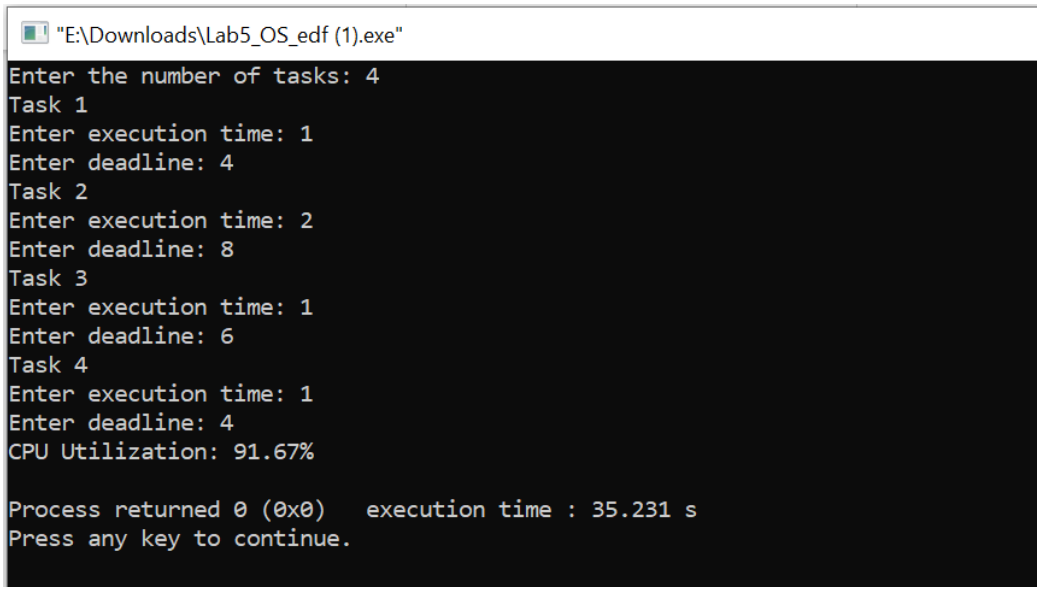
b) Earliest-deadline First:

```
#include <stdio.h>

#define MAX_TASKS 100

typedef struct {
    int task_id;
    int arrival_time;
    int execution_time;
    int deadline;
    int is_completed;
} Task;

float calc_cpu_util(Task tasks[], int n) {
    float total_util = 0.0;

    for (int i = 0; i < n; i++) {
        float task_util = (float)tasks[i].execution_time / tasks[i].deadline;
        total_util += task_util;
    }

    float cpu_util = total_util * 100;
    return cpu_util;
}

int main() {
    int n, i;
```

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

    Task tasks[MAX_TASKS];

    for (i = 0; i < n; i++) {
        printf("Task %d\n", i + 1);
        printf("Enter execution time: ");
        scanf("%d", &tasks[i].execution_time);
        printf("Enter deadline: ");
        scanf("%d", &tasks[i].deadline);

        tasks[i].task_id = i + 1;
        tasks[i].is_completed = 0;
    }

    float cpu_util = calc_cpu_util(tasks, n);

    printf("CPU Utilization: %.2f%%\n", cpu_util);

    return 0;
}
```

OUTPUT:


F:\OS\edf_lab.exe
Enter the number of tasks: 3
Task 1
Enter execution time: 1
Enter deadline: 3
Task 2
Enter execution time: 1
Enter deadline: 4
Task 3
Enter execution time: 2
Enter deadline: 8
CPU Utilization: 83.33%
Process returned 0 (0x0) execution time : 35.166 s
Press any key to continue.


"E:\Downloads\Lab5_OS_edf (1).exe"
Enter the number of tasks: 4
Task 1
Enter execution time: 1
Enter deadline: 4
Task 2
Enter execution time: 2
Enter deadline: 8
Task 3
Enter execution time: 1
Enter deadline: 6
Task 4
Enter execution time: 1
Enter deadline: 4
CPU Utilization: 91.67%
Process returned 0 (0x0) execution time : 35.231 s
Press any key to continue.

PROGRAM 5

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

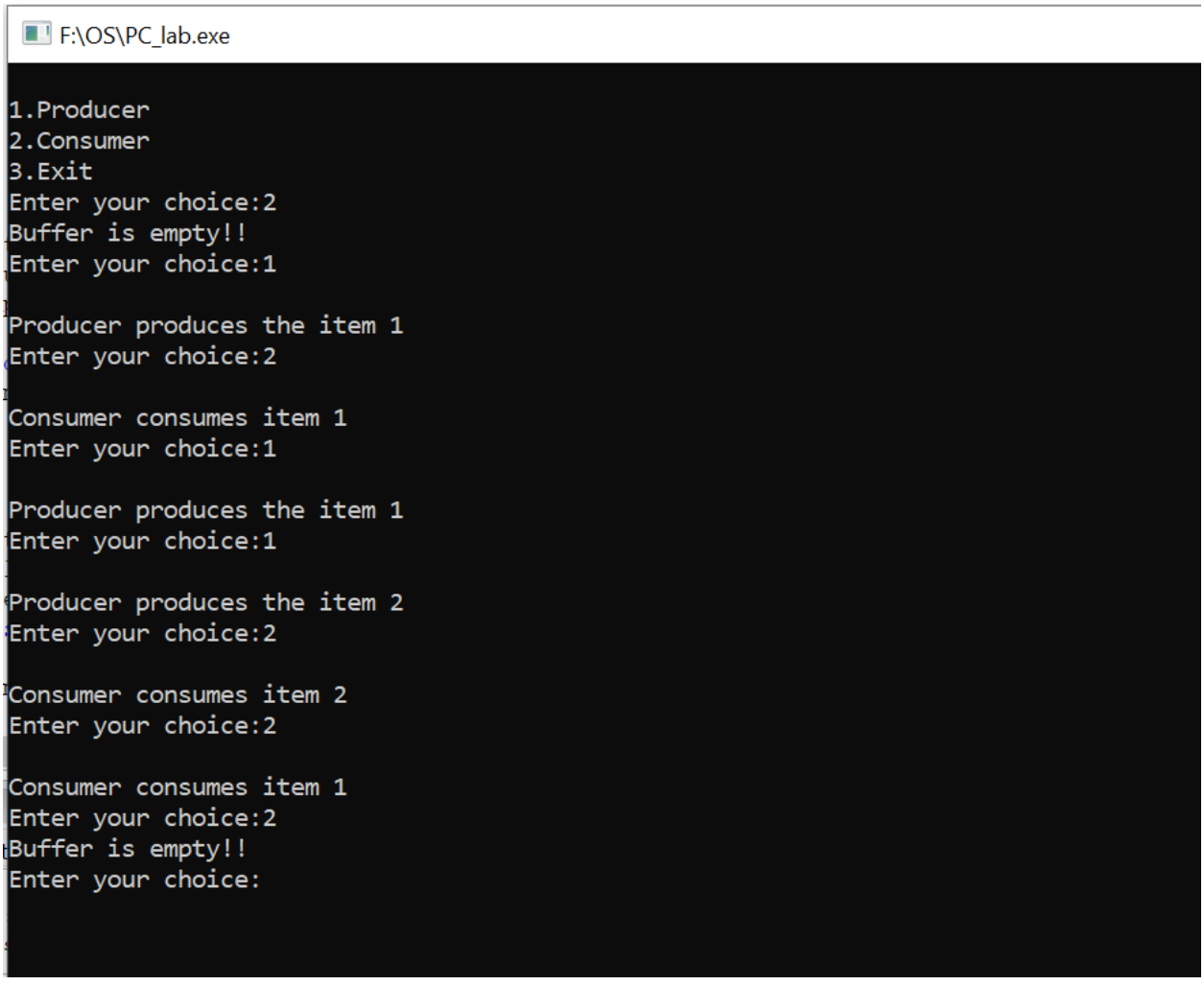
Program:

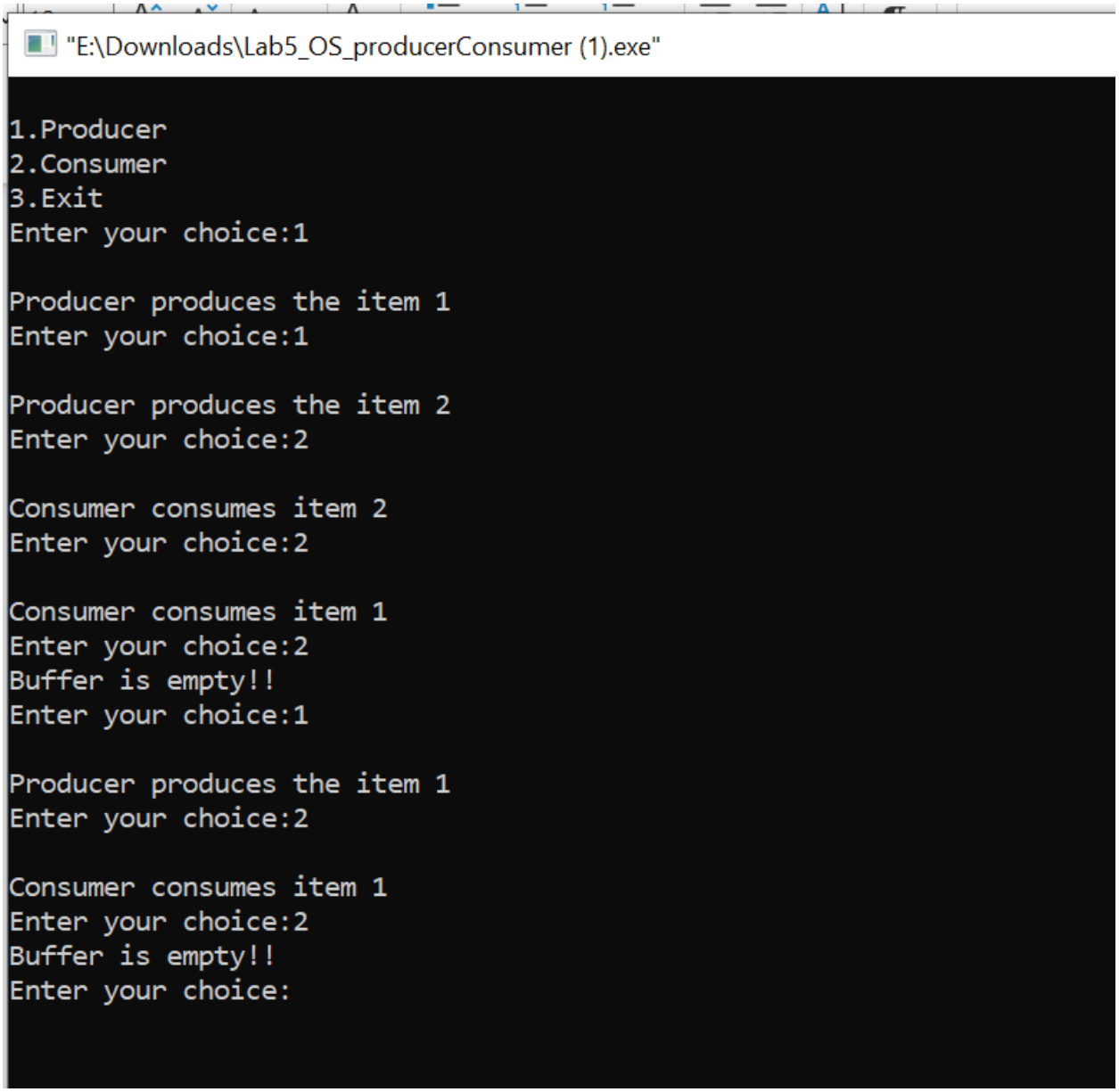
```
#include<stdio.h>
#include<stdlib.h>

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:




"E:\Downloads\Lab5_OS_producerConsumer (1).exe"
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:1
Producer produces the item 1
Enter your choice:2
Consumer consumes item 1
Enter your choice:2
Buffer is empty!!
Enter your choice:

PROGRAM 6

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;
```

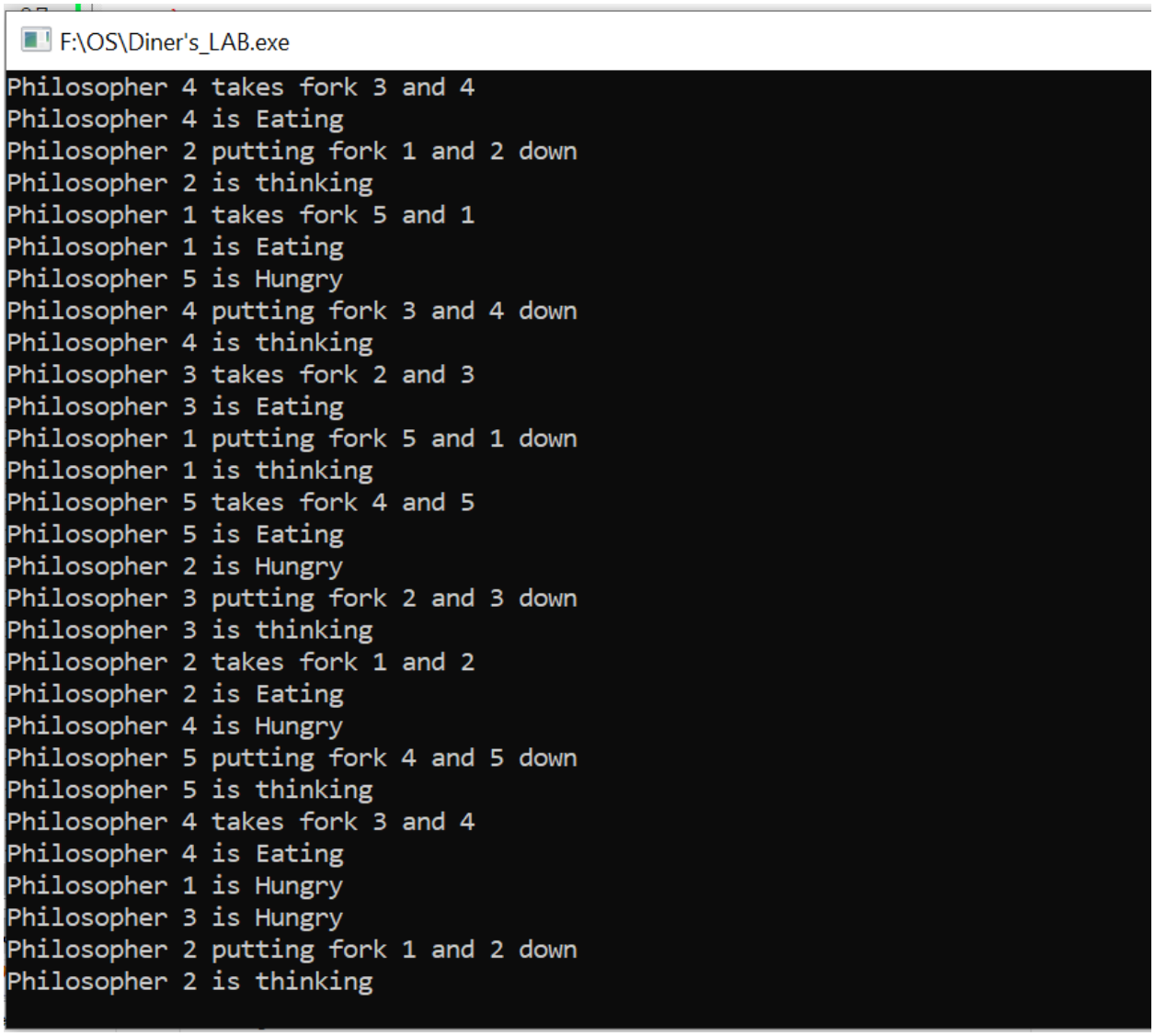
```
            sleep(2);

            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]);
        }
}

void take_fork(int phnum)
{

        sem_wait(&mutex);

        state[phnum] = HUNGRY;

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

        test(phnum);

        sem_post(&mutex);

        sem_wait(&S[phnum]);

        sleep(1);
```

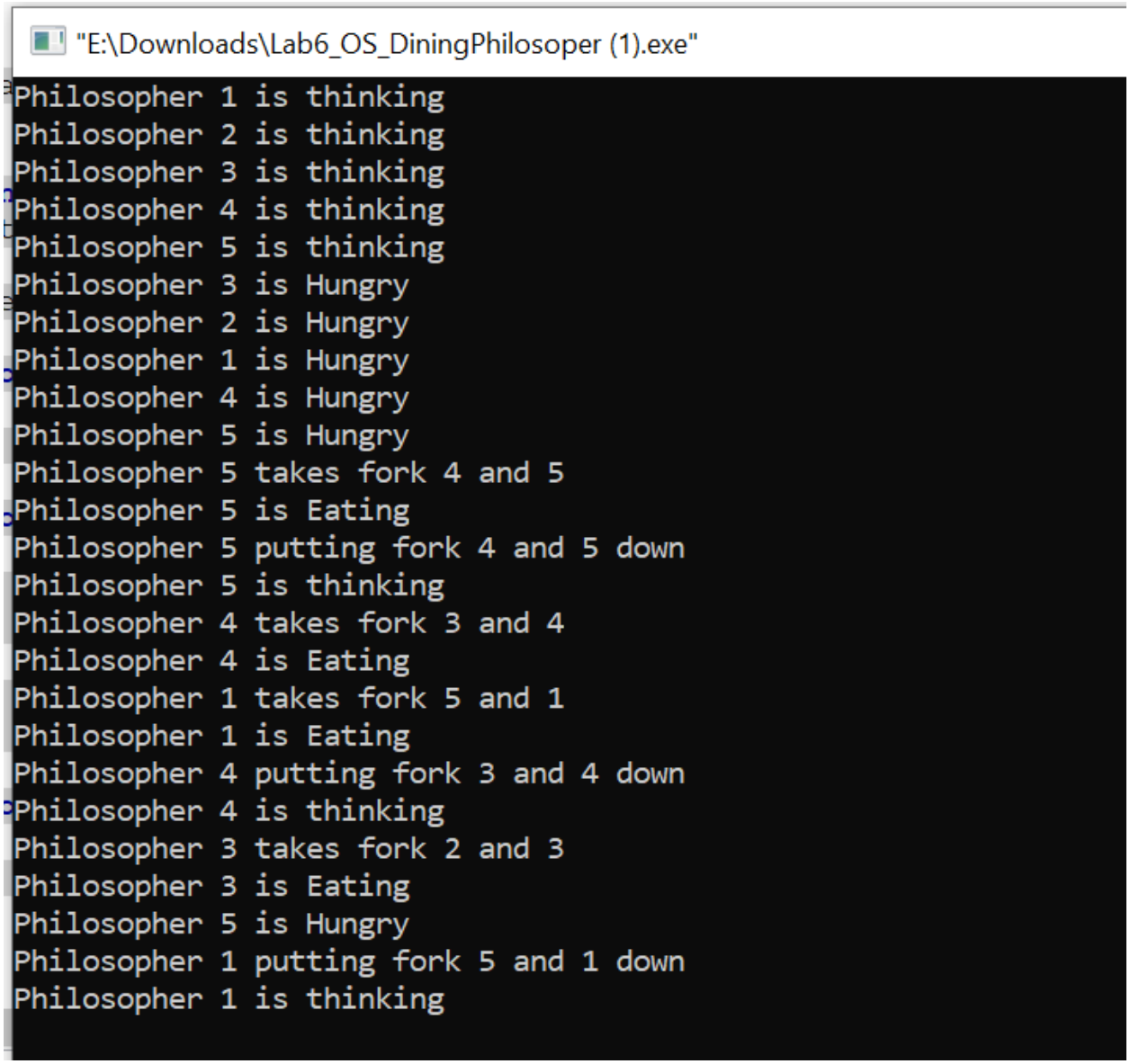
```
}

void put_fork(int phnum)
{

        sem_wait(&mutex);

        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];

        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);
}
```

OUTPUT:




"E:\Downloads\Lab6_OS_DiningPhilosoper (1).exe"
Philosopher 1 is thinking
Philosopher 2 is thinking
Philosopher 3 is thinking
Philosopher 4 is thinking
Philosopher 5 is thinking
Philosopher 3 is Hungry
Philosopher 2 is Hungry
Philosopher 1 is Hungry
Philosopher 4 is Hungry
Philosopher 5 is Hungry
Philosopher 5 takes fork 4 and 5
Philosopher 5 is Eating
Philosopher 5 putting fork 4 and 5 down
Philosopher 5 is thinking
Philosopher 4 takes fork 3 and 4
Philosopher 4 is Eating
Philosopher 1 takes fork 5 and 1
Philosopher 1 is Eating
Philosopher 4 putting fork 3 and 4 down
Philosopher 4 is thinking
Philosopher 3 takes fork 2 and 3
Philosopher 3 is Eating
Philosopher 5 is Hungry
Philosopher 1 putting fork 5 and 1 down
Philosopher 1 is thinking

PROGRAM 7

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

Program:

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

void main()
{
   int alloc[10][10],max[10][10];
   int avail[10],work[10],total[10],ans[10];
   int i,j,k,s,need[10][10];
   int m,n;
   int count=0,c=0;
   char finish[10];

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

   for(i=0;i<=n;i++)
      finish[i]='n';

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

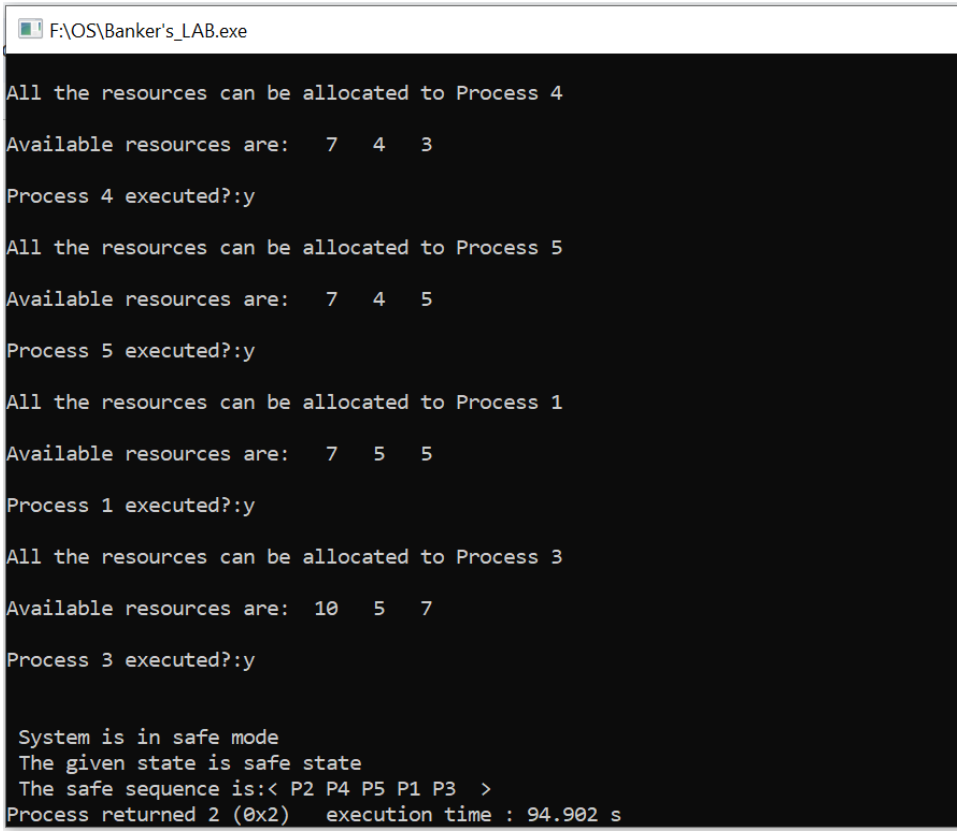
```
printf("Enter the allocation matrix:\n");
for(i=0;i<n;i++)
{
   for(j=0;j<m;j++)
      scanf("%d",&alloc[i][j]);
}
printf("Resource vector:");
for(i=0;i<m;i++)
   scanf("%d",&total[i]);

for(i=0;i<m;i++)
   avail[i]=0;

for(i=0;i<m;i++)
   work[i]=avail[i];
for(j=0;j<m;j++)
   work[j]=total[j]-work[j];

printf("\n\nNeed Matrix:\n");
for(i=0;i<n;i++)
{
    for(j=0;j<m;j++)
    {
       need[i][j]=max[i][j]-alloc[i][j];
       printf("%d ",need[i][j]);
    }
    printf("\n");
```

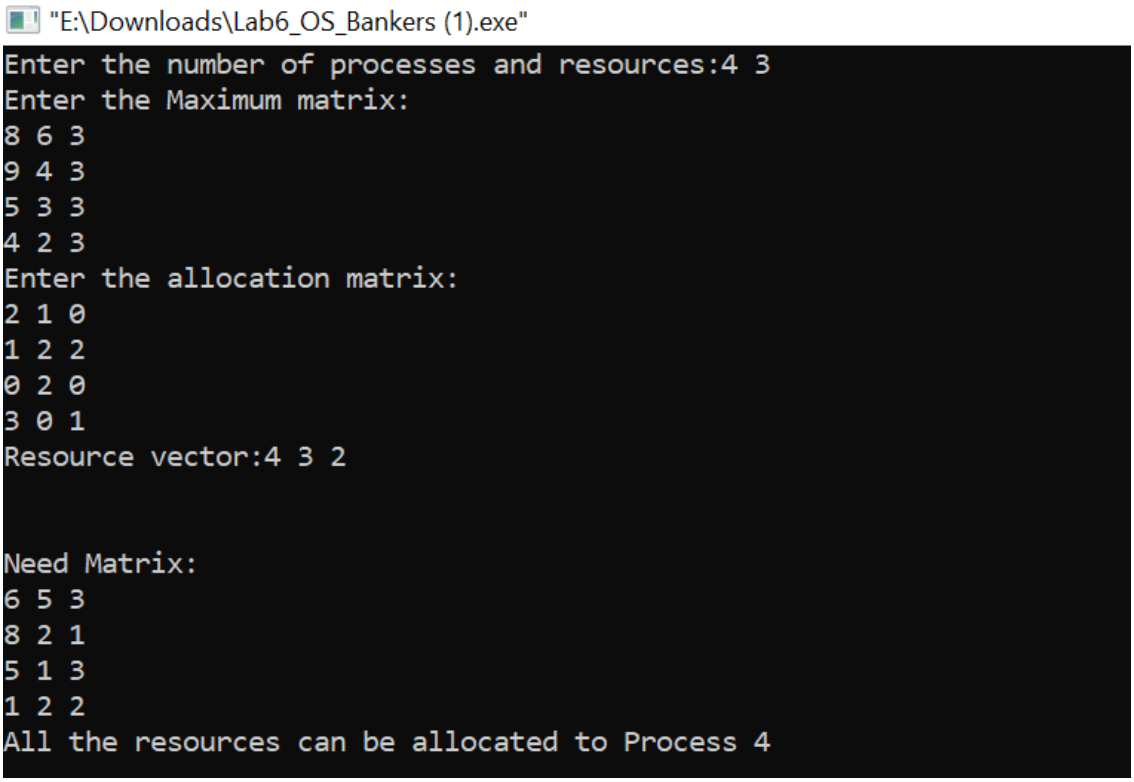
```
}
s=0;
A:
for(i=0;i<n;i++)
{
   c=0;
   for(j=0;j<m;j++)
      if((need[i][j]<=work[j])&&(finish[i]=='n'))
         c++;
   if(c==m)
   {
      printf("All the resources can be allocated to Process %d", i+1);
      printf("\n\nAvailable resources are:");
      for(k=0;k<m;k++)
      {
         work[k]+=alloc[i][k];
         printf("%4d",work[k]);
      }
      printf("\n");
      finish[i]='y';
      ans[s++]=i;
      printf("\nProcess %d executed?:%c \n\n",i+1,finish[i]); count++;
   }
}
if(count!=n)
   goto A;
else
{
```

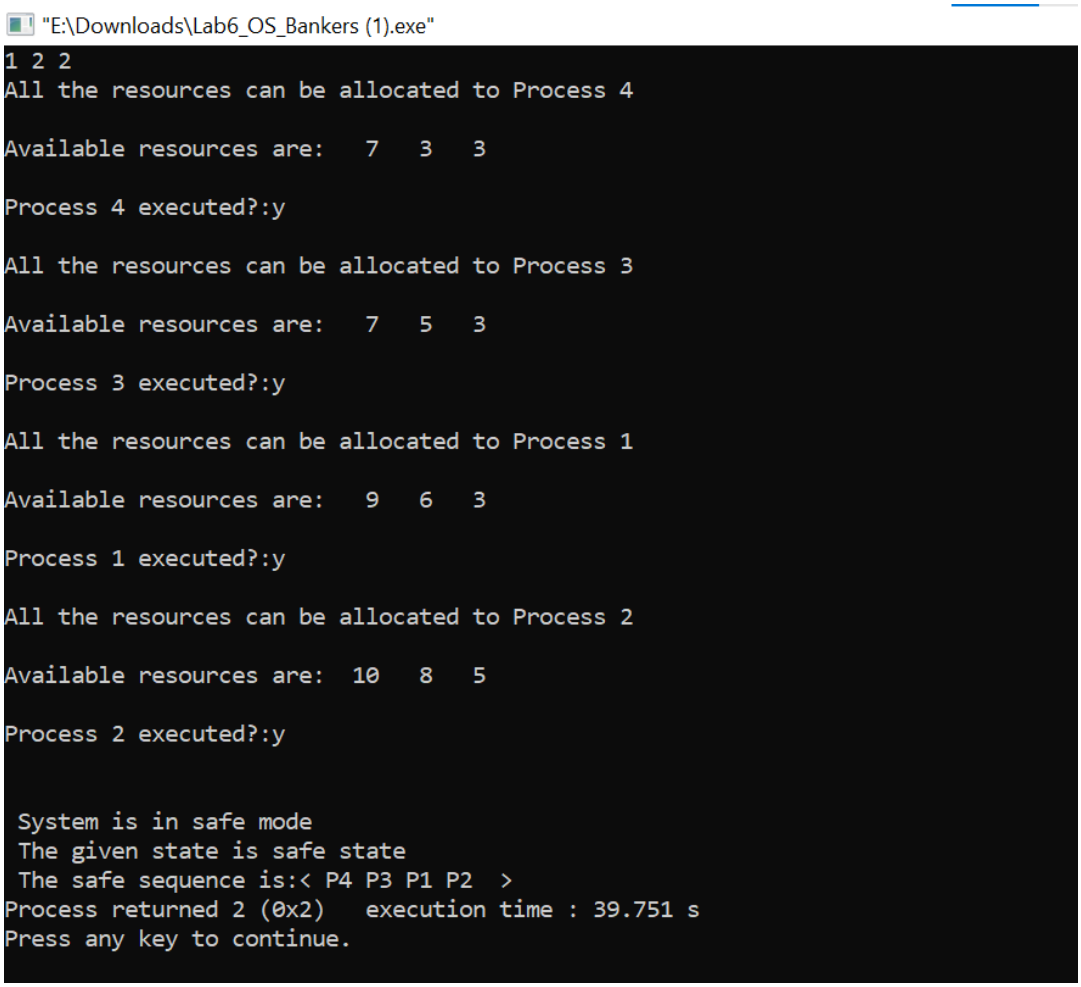
```
    printf("\n System is in safe mode");
    printf("\n The given state is safe state");
    printf("\n The safe sequence is:");
    printf("< ");
    for(i=0;i<n;i++)
      {
        printf("P%d ",ans[i]+1);
      }
    printf(" >");
  }

}
```

OUTPUT:

```
F:\OS\Banker's_LAB.exe
Enter the number of processes and resources:5 3
Enter the Maximum matrix:
7 5 3
3 2 2
9 0 2
2 2 2
4 3 3
Enter the allocation matrix:
0 1 0
2 0 0
3 0 2
2 1 1
0 0 2
Resource vector:3 3 2


Need Matrix:
7 4 3
1 2 2
6 0 0
0 1 1
4 3 1
All the resources can be allocated to Process 2

Available resources are:   5   3   2

Process 2 executed?:y

All the resources can be allocated to Process 4
```


F:\OS\Banker's_LAB.exe
All the resources can be allocated to Process 4
Available resources are: 7 4 3
Process 4 executed?:y
All the resources can be allocated to Process 5
Available resources are: 7 4 5
Process 5 executed?:y
All the resources can be allocated to Process 1
Available resources are: 7 5 5
Process 1 executed?:y
All the resources can be allocated to Process 3
Available resources are: 10 5 7
Process 3 executed?:y
System is in safe mode
The given state is safe state
The safe sequence is:< P2 P4 P5 P1 P3 >
Process returned 2 (0x2) execution time : 94.902 s


"E:\Downloads\Lab6_OS_Bankers (1).exe"
Enter the number of processes and resources:4 3
Enter the Maximum matrix:
8 6 3
9 4 3
5 3 3
4 2 3
Enter the allocation matrix:
2 1 0
1 2 2
0 2 0
3 0 1
Resource vector:4 3 2
Need Matrix:
6 5 3
8 2 1
5 1 3
1 2 2
All the resources can be allocated to Process 4


"E:\Downloads\Lab6_OS_Bankers (1).exe"
1 2 2
All the resources can be allocated to Process 4
Available resources are: 7 3 3
Process 4 executed?:y
All the resources can be allocated to Process 3
Available resources are: 7 5 3
Process 3 executed?:y
All the resources can be allocated to Process 1
Available resources are: 9 6 3
Process 1 executed?:y
All the resources can be allocated to Process 2
Available resources are: 10 8 5
Process 2 executed?:y
System is in safe mode
The given state is safe state
The safe sequence is:< P4 P3 P1 P2 >
Process returned 2 (0x2) execution time : 39.751 s
Press any key to continue.

PROGRAM 8

Write a C program to simulate deadlock detection

Program:

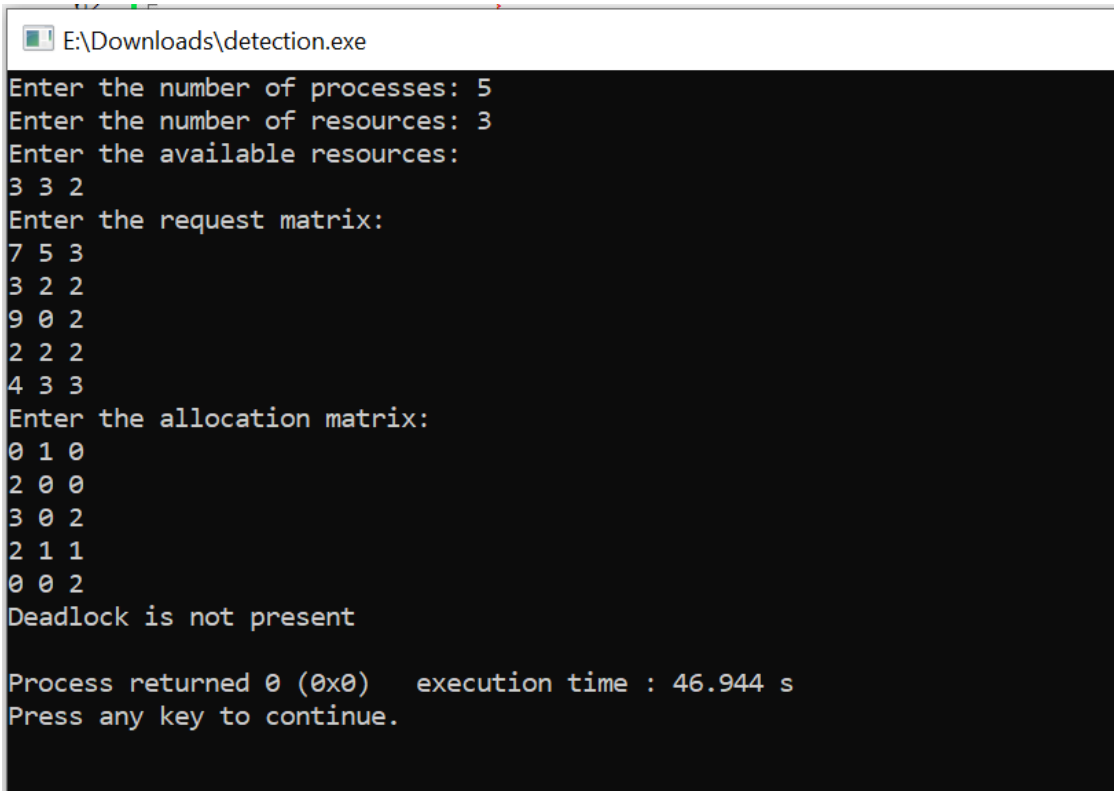
```
#include <stdio.h>

#define MAX_PROCESSES 10
#define MAX_RESOURCES 10

int available[MAX_RESOURCES];
int max[MAX_PROCESSES][MAX_RESOURCES];
int allocation[MAX_PROCESSES][MAX_RESOURCES];
int need[MAX_PROCESSES][MAX_RESOURCES];
int num_processes, num_resources;

void inputData() {
    printf("Enter the number of processes: ");
    scanf("%d", &num_processes);

    printf("Enter the number of resources: ");
    scanf("%d", &num_resources);

    printf("Enter the available resources:\n");
    for (int i = 0; i < num_resources; i++) {
        scanf("%d", &available[i]);
    }
    printf("Enter the maximum demand matrix:\n");
    for (int i = 0; i < num_processes; i++) {
```

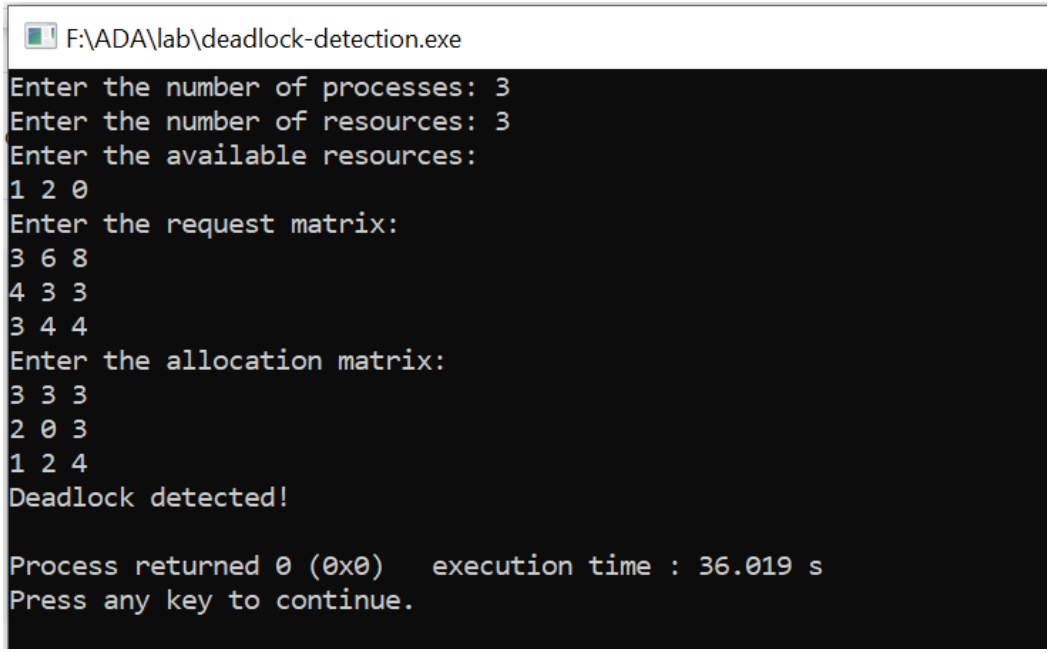
```
        for (int j = 0; j < num_resources; j++) {
            scanf("%d", &max[i][j]);
        }
    }
    printf("Enter the allocation matrix:\n");
    for (int i = 0; i < num_processes; i++) {
        for (int j = 0; j < num_resources; j++) {
            scanf("%d", &allocation[i][j]);
            need[i][j] = max[i][j] - allocation[i][j];
        }
    }
}
int checkSafety(int process_order[]) {
    int work[MAX_RESOURCES];
    int finish[MAX_PROCESSES] = {0};

    for (int i = 0; i < num_resources; i++) {
        work[i] = available[i];
    }
    int completed = 0;
    while (completed < num_processes) {
        int found = 0;
        for (int i = 0; i < num_processes; i++) {
            if (!finish[i]) {
                int j;
                for (j = 0; j < num_resources; j++) {
                    if (need[i][j] > work[j]) {
                        break;
```

```
                }
            }
            if (j == num_resources) {
                for (int k = 0; k < num_resources; k++) {
                    work[k] += allocation[i][k];
                }
                finish[i] = 1;
                process_order[completed] = i;
                completed++;
                found = 1;
            }
        }
    }
    if (!found) {
        return 0; // Deadlock detected
    }
  }
  return 1; // System is safe
}
int main() {
  int process_order[MAX_PROCESSES];
  inputData();
  int flag = checkSafety(process_order);
  if (flag == 1) {
    printf("Deadlock is not present \n");
  } else {
    printf("Deadlock detected!\n");
  }
```

```
    return 0;
}
```

OUTPUT:





PROGRAM 9

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

a) Worst-fit b) Best-fit c) First-fit

Program:

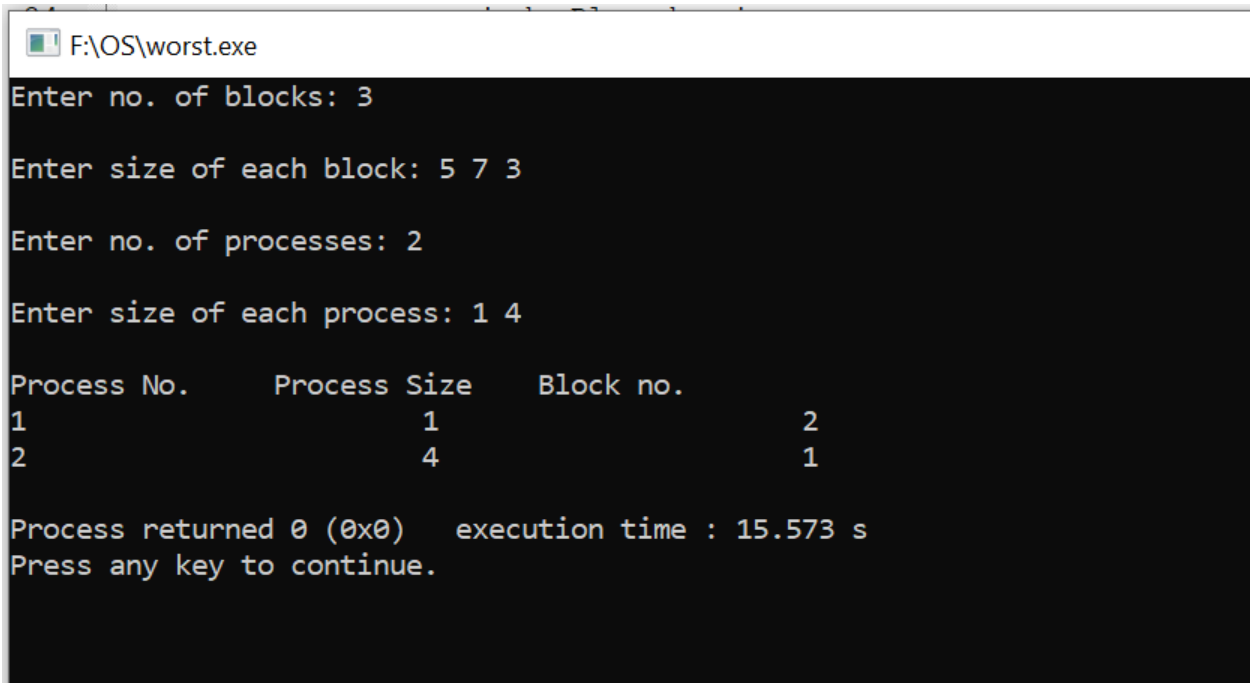
a) Worst-fit

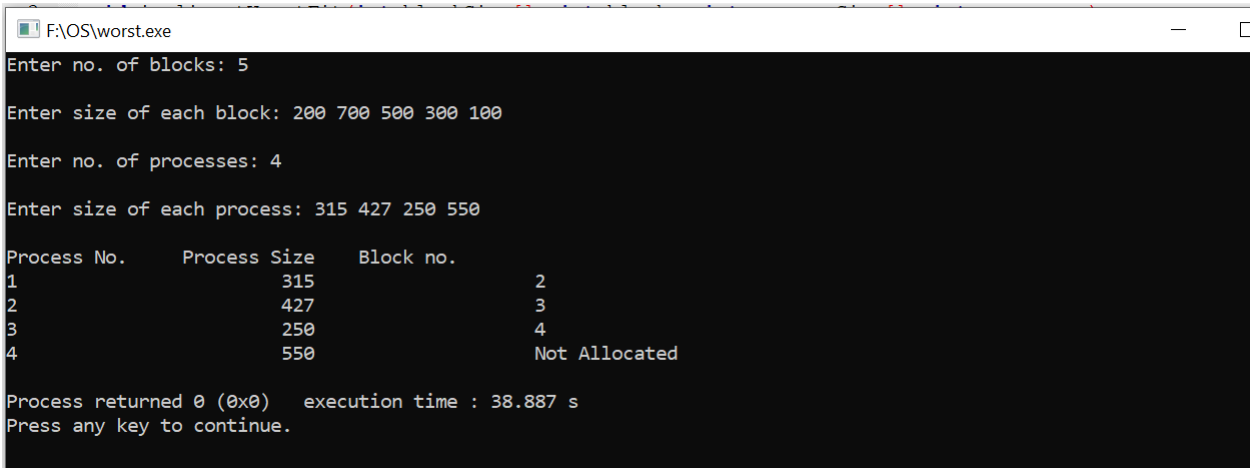
```
#include <stdio.h>


void implimentWorstFit(int blockSize[], int blocks, int processSize[], int processes)
{
   int allocation[processes];
   int occupied[blocks];
   for(int i = 0; i < processes; i++){
      allocation[i] = -1;
   }
   for(int i = 0; i < blocks; i++){
      occupied[i] = 0;
   }
   for (int i=0; i < processes; i++)
   {
int indexPlaced = -1;
for(int j = 0; j < blocks; j++)
{
  if(blockSize[j] >= processSize[i] && !occupied[j])
          {
             if (indexPlaced == -1)
                indexPlaced = j;
```

```
            else if (blockSize[indexPlaced] < blockSize[j])
                indexPlaced = j;
        }
      }

      if (indexPlaced != -1)
      {
          allocation[i] = indexPlaced;
          occupied[indexPlaced] = 1;
          blockSize[indexPlaced] -= processSize[i];
      }
   }
   printf("\nProcess No.\tProcess Size\tBlock no.\n");
   for (int i = 0; i < processes; i++)
   {
      printf("%d \t\t\t %d \t\t\t", i+1, processSize[i]);
      if (allocation[i] != -1)
          printf("%d\n",allocation[i] + 1);
      else
          printf("Not Allocated\n");
   }
}

int main()
{
   int i;
   int blocks;
   int processes;
```

```
    printf("Enter no. of blocks: ");
scanf("%d", &blocks);
int blockSize[blocks];
printf("\nEnter size of each block: ");
for(i = 0; i < blocks; i++)
scanf("%d", &blockSize[i]);
printf("\nEnter no. of processes: ");
scanf("%d", &processes);
   int processSize[processes];

printf("\nEnter size of each process: ");
for(i = 0; i < processes; i++)
scanf("%d", &processSize[i]);

    implimentWorstFit(blockSize, blocks, processSize, processes);

    return 0;
}
```

OUTPUT





b) Best-fit :

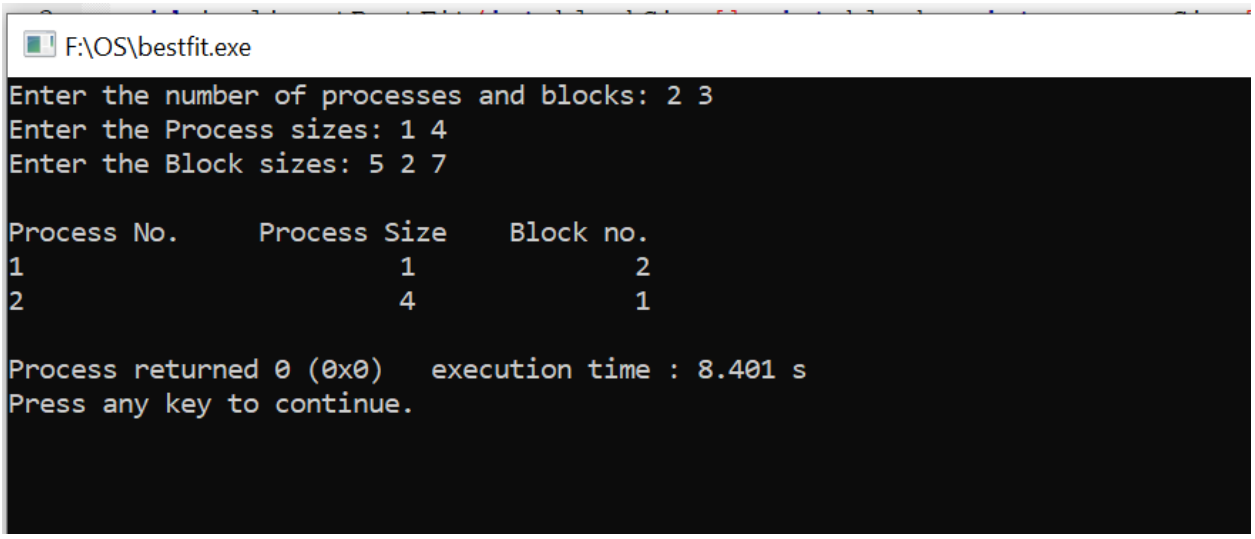
```
#include <stdio.h>
#define MAX 10
void implimentBestFit(int blockSize[], int blocks, int processSize[], int proccesses,int m)
{
   int allocation[proccesses];
   int occupied[blocks];
```

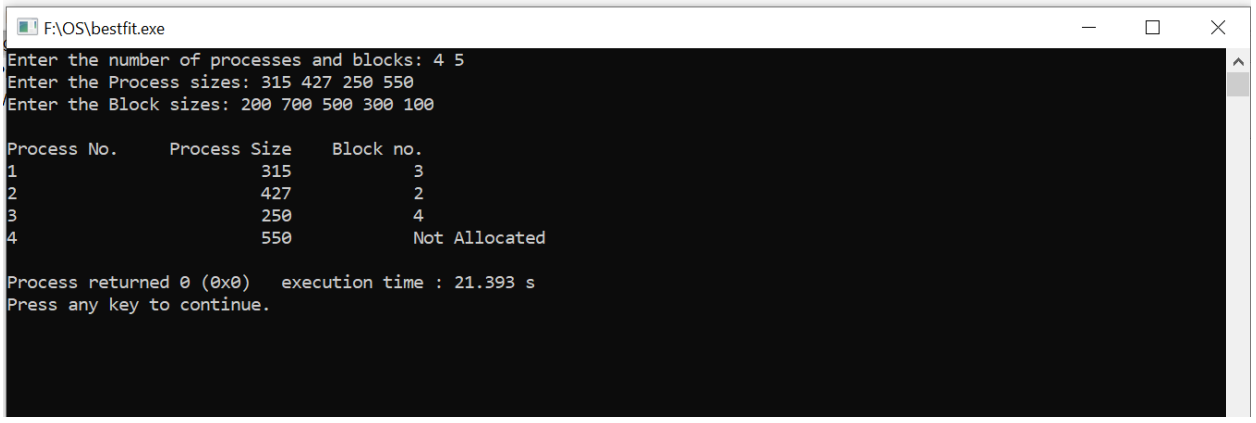
```
for(int i = 0; i < proccesses; i++){
   allocation[i] = -1;
}

for(int i = 0; i < blocks; i++){
   occupied[i] = 0;
}

for (int i = 0; i < proccesses; i++)
{

   int indexPlaced = -1;
   for (int j = 0; j < blocks; j++) {
      if (blockSize[j] >= processSize[i] && !occupied[j])
      {
         if (indexPlaced == -1)
            indexPlaced = j;
         else if (blockSize[j] < blockSize[indexPlaced])
            indexPlaced = j;
      }
   }

   if (indexPlaced != -1)
   {
      allocation[i] = indexPlaced;

      occupied[indexPlaced] = 1;
```

```
        }
    }

    printf("\nProcess No.\tProcess Size\tBlock no.\n");
    for (int i = 0; i < proccesses; i++)
    {
        printf("%d \t\t\t %d \t\t", i+1, processSize[i]);
        if (allocation[i] != -1)
            printf("%d\n",allocation[i] + 1);
        else
            printf("Not Allocated\n");
    }
}

int main()
{
    int p,m,j;
    printf("Enter the number of processes and blocks: ");
    scanf("%d%d",&p,&m);
    int processSize[p],blockSize[m];
    printf("Enter the Process sizes: ");
    for(j=0;j<p;j++)
            scanf("%d",&processSize[j]);

    printf("Enter the Block sizes: ");
    for(j=0;j<m;j++)
            scanf("%d",&blockSize[j]);
```

```
    int blocks = sizeof(blockSize)/sizeof(blockSize[0]);
    int proccesses = sizeof(processSize)/sizeof(processSize[0]);


    implimentBestFit(blockSize, blocks, processSize, proccesses,m);


    return 0 ;
}
```

OUTPUT:



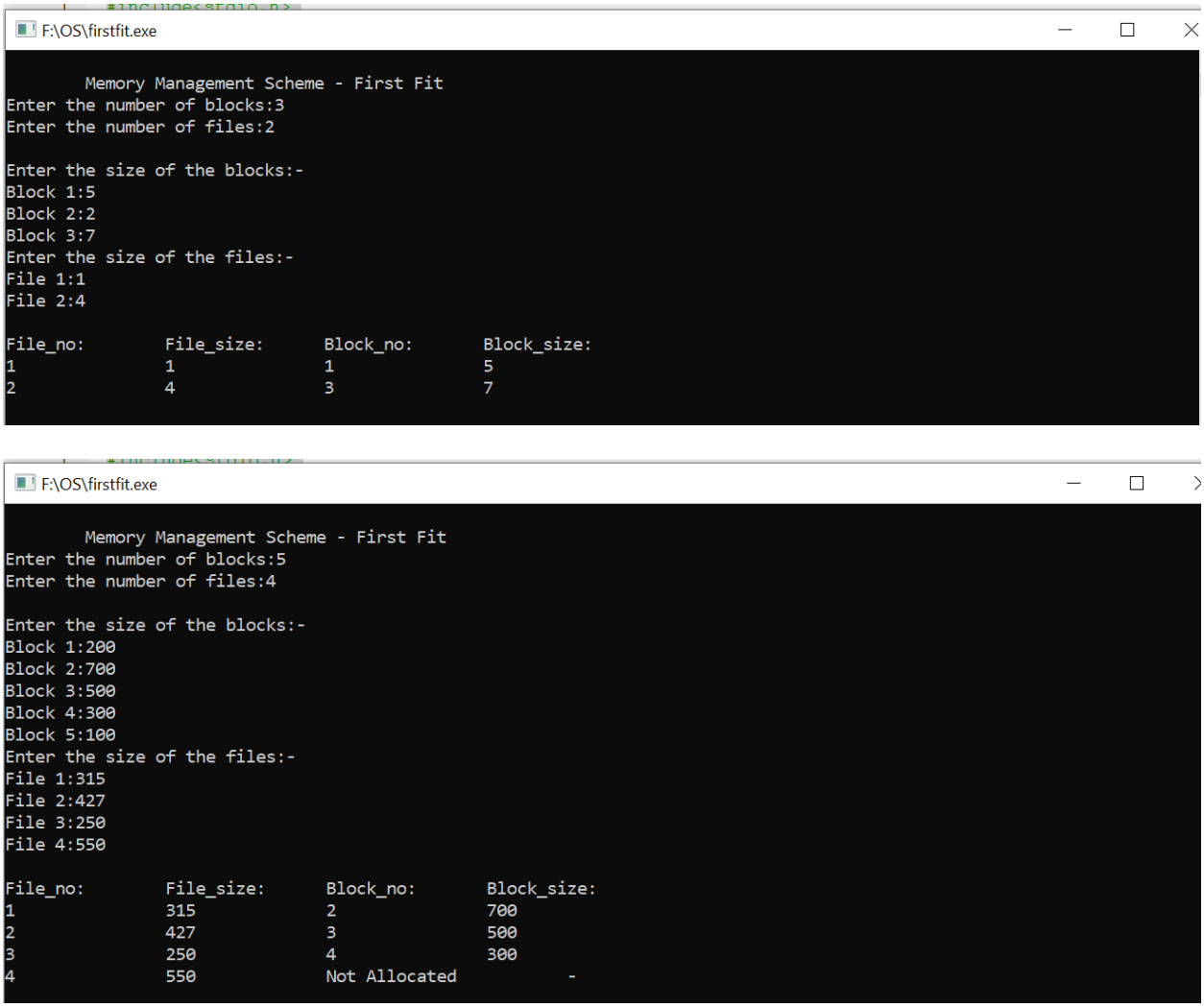


c) First-fit:

```
#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];

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

```
    for (i = 1; i <= nf; i++) {
        int allocated = 0;
        for (j = 1; j <= nb; j++) {
            if (bf[j] != 1) { // If bf[j] is not allocated
                temp = b[j] - f[i];
                if (temp >= 0) {
                    ff[i] = j;
                    bf[j] = 1; // Allocate block j to file i
                    frag[i] = b[j] - f[i]; // Remaining space in the block
                    allocated = 1;
                    printf("\n%d\t\t%d\t\t%d\t\t%d", i, f[i], ff[i], b[ff[i]]);
                    break; // Stop searching for blocks
                }
            }
        }
        if (!allocated) {
            printf("\n%d\t\t%d\t\tNot Allocated\t\t-", i, f[i]);
        }
    }
    getch();
}
```

OUTPUT:


F:\OS\firstfit.exe
Memory Management Scheme - First Fit
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:
1 1 1 5
2 4 3 7
F:\OS\firstfit.exe
Memory Management Scheme - First Fit
Enter the number of blocks:5
Enter the number of files:4
Enter the size of the blocks:-
Block 1:200
Block 2:700
Block 3:500
Block 4:300
Block 5:100
Enter the size of the files:-
File 1:315
File 2:427
File 3:250
File 4:550
File_no: File_size: Block_no: Block_size:
1 315 2 700
2 427 3 500
3 250 4 300
4 550 Not Allocated -

PROGRAM 10

Write a C program to simulate page replacement algorithms

a) FIFO b) LRU c) Optimal

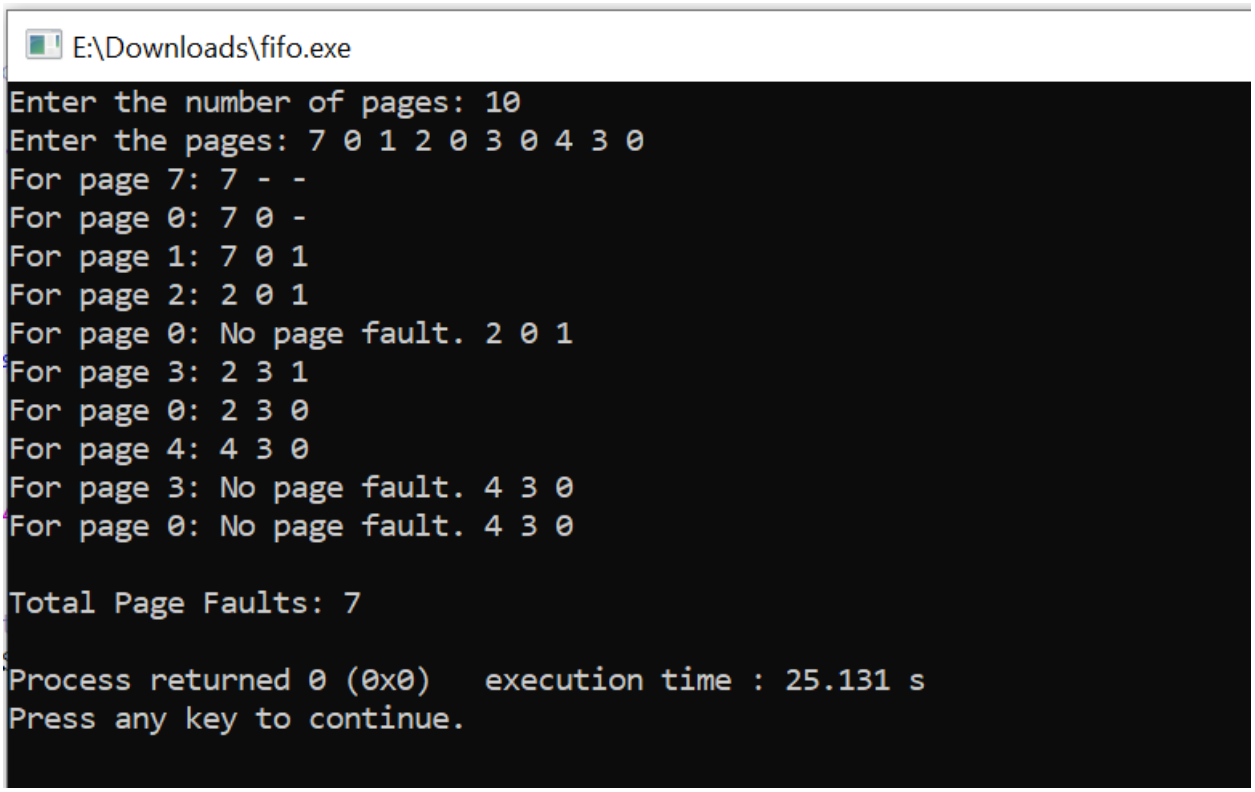
a) FIFO:

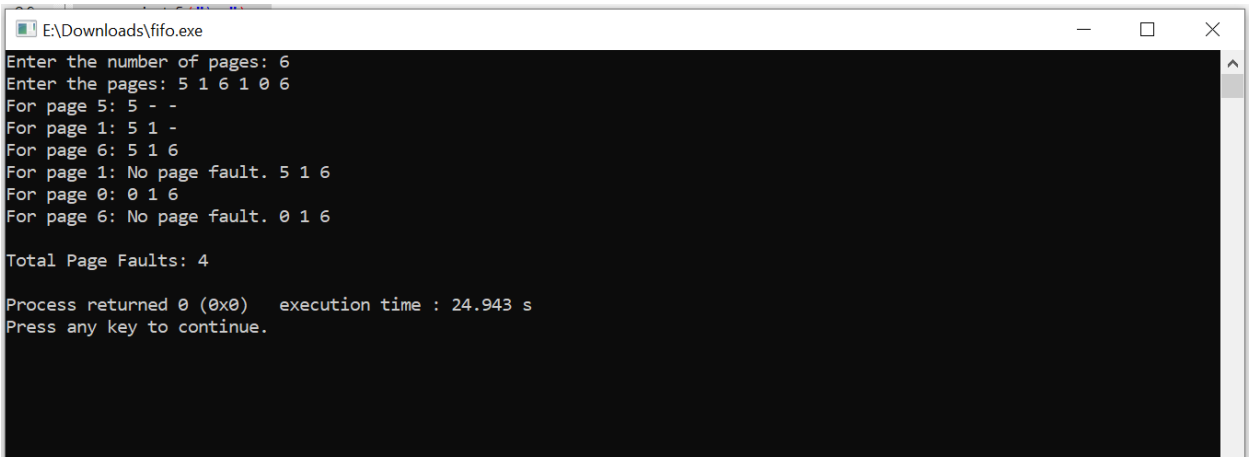
```
#include <stdio.h>
#define MAX_FRAMES 3 // Number of memory frames
int frames[MAX_FRAMES]; // Array to hold memory frames
int framePointer = 0;   // Pointer to the current frame being replaced
int pageFaultCount = 0; // Counter for page faults

int isPageInMemory(int page) {
    for (int i = 0; i < MAX_FRAMES; i++) {
        if (frames[i] == page) {
            return 1; // Page is in memory
        }
    }
    return 0; // Page is not in memory
}

void displayFrames() {
    //printf("Memory frames: ");
    for (int i = 0; i < MAX_FRAMES; i++) {
        if (frames[i] != -1) {
            printf("%d ", frames[i]);
        } else {
            printf("- ");
        }
```

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

// Function to simulate page replacement using FIFO algorithm
void fifo(int pages[], int pageCount) {
    for (int i = 0; i < pageCount; i++) {
        printf("For page %d: ", pages[i]);

        if (!isPageInMemory(pages[i])) {
            frames[framePointer] = pages[i];
            framePointer = (framePointer + 1) % MAX_FRAMES;
            pageFaultCount++;
        } else {
            printf("No page fault. ");
        }

        displayFrames();
    }

    printf("\nTotal Page Faults: %d\n", pageFaultCount);
}

int main() {
    int pageCount;
    printf("Enter the number of pages: ");
    scanf("%d",&pageCount);
    int pages[pageCount];
```

```
    printf("Enter the pages: ");
    for(int i=0;i<pageCount;i++){
        scanf("%d",&pages[i]);
    }

    for (int i = 0; i < MAX_FRAMES; i++) {
        frames[i] = -1;
    }

    fifo(pages, pageCount);

    return 0;
}
```

OUTPUT:





b) LRU:

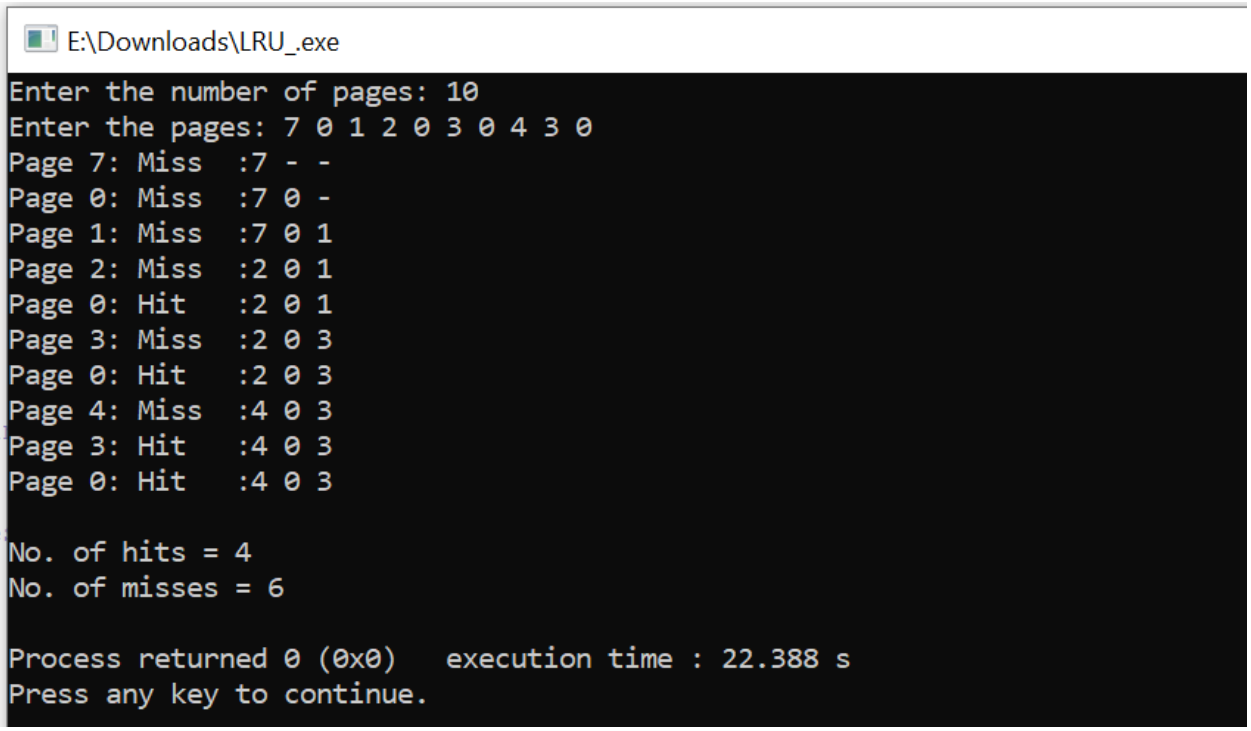
```
#include <stdio.h>
void displayFrames(int fr[], int fn) {
    for (int i = 0; i < fn; i++) {
        if (fr[i] != -1) {
            printf("%d ", fr[i]);
        } else {
            printf("- ");
        }
    }
    printf("\n");
}
int isPageInMemory(int page,int fn,int frames[fn])
{
    for (int i = 0; i < fn; i++) {
        if (frames[i] == page) {
            return 1;
        }
    }
```

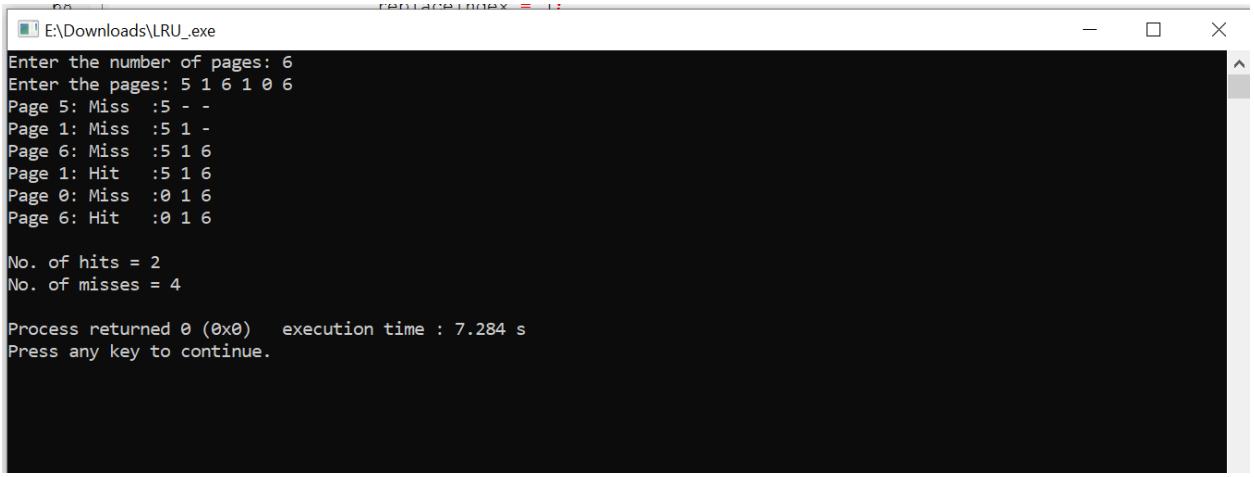
```
    return 0;
}
void lruPage(int pg[], int pn, int fn)
{
    int fr[fn];
    for (int i = 0; i < fn; i++)
        fr[i] = -1;

    int hit = 0;

    for (int i = 0; i < pn; i++)
    {

        if (isPageInMemory(pg[i],fn,fr))
        {
            hit++;
            printf("Page %d: Hit   :", pg[i]);
        }
        else
        {
            int emptyFrame = -1;
            for (int j = 0; j < fn; j++)
            {
                if (fr[j] == -1) {
                    fr[j] = pg[i];
                    emptyFrame = j;
                    break;
                }
```

```
    }

    if (emptyFrame != -1)
        printf("Page %d: Miss  :", pg[i]);
    else {
        int minCounter = pn + 1, replaceIndex = -1;
        for (int j = 0; j < fn; j++)
        {
            int k;
            for (k = i - 1; k >= 0; k--) {
                if (fr[j] == pg[k]) {
                    if (k < minCounter) {
                        minCounter = k;
                        replaceIndex = j;
                    }
                    break;
                }
            }
            if (k == -1) {
                replaceIndex = j;
                break;
            }
        }
        fr[replaceIndex] = pg[i];
        printf("Page %d: Miss  :", pg[i]);
    }
}
```

```
        displayFrames(fr, fn);
    }

    printf("\nNo. of hits = %d\n", hit);
    printf("No. of misses = %d\n", pn - hit);
}

int main() {
    int pn;
    printf("Enter the number of pages: ");
    scanf("%d", &pn);
    int pg[pn];
    printf("Enter the pages: ");
    for (int i = 0; i < pn; i++) {
        scanf("%d", &pg[i]);
    }
    int fn = 3;
    lruPage(pg, pn, fn);
    return 0;
}
```

OUTPUT:





c) OPTIMAL:

```
#include <stdio.h>

void displayFrames(int fr[], int fn) {
   //printf("Memory frames: ");
   for (int i = 0; i < fn; i++) {
      if (fr[i] != -1) {
```

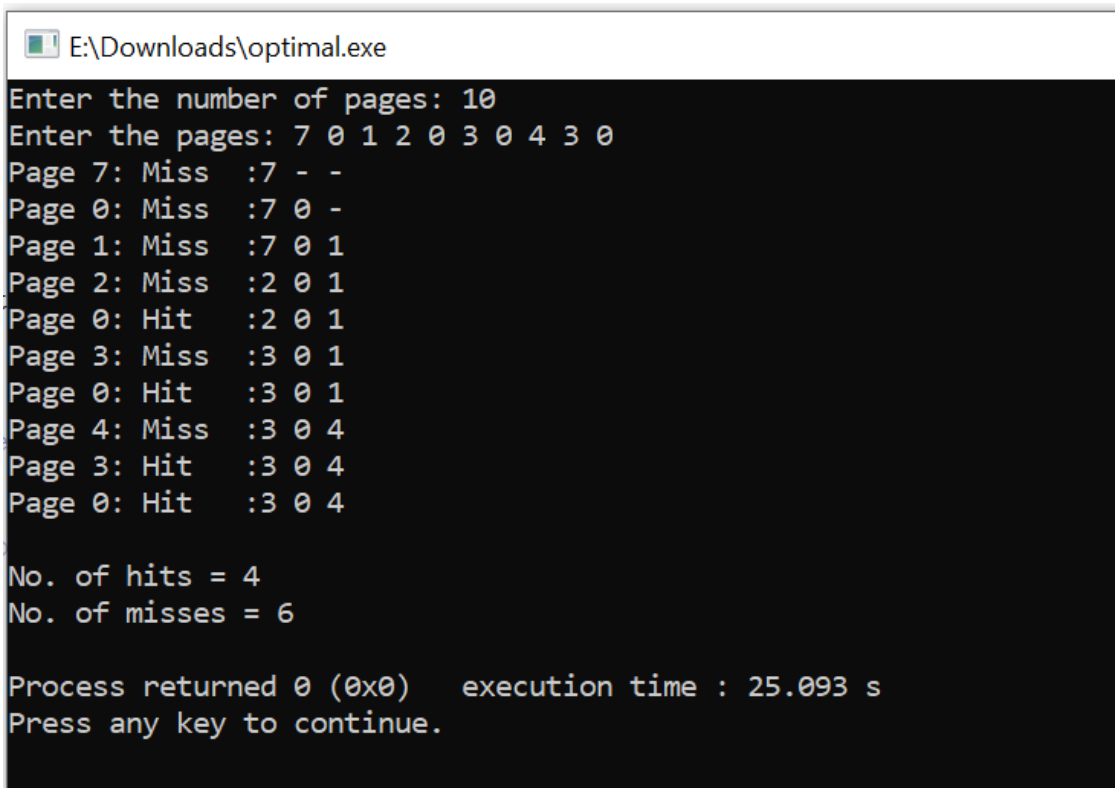
```
            printf("%d ", fr[i]);
        } else {
            printf("- ");
        }
    }
    printf("\n");
}

void optimalPage(int pg[], int pn, int fn) {
    // Create an array for given number of frames and initialize it as empty.
    int fr[fn];
    for (int i = 0; i < fn; i++) {
        fr[i] = -1;
    }

    // Traverse through page reference array and check for miss and hit.
    int hit = 0;
    for (int i = 0; i < pn; i++) {
        // Page found in a frame: HIT
        int found = 0;
        for (int j = 0; j < fn; j++) {
            if (fr[j] == pg[i]) {
                hit++;
                found = 1;
                break;
            }
        }
```

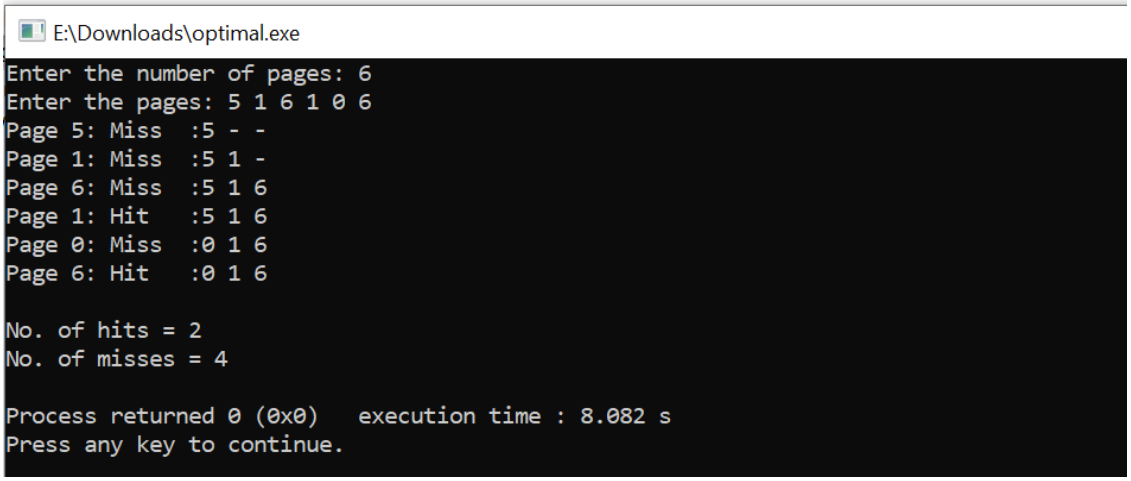
```
if (found) {
    printf("Page %d: Hit   :", pg[i]);
} else {
    // If there is space available in frames.
    int emptyFrame = -1;
    for (int j = 0; j < fn; j++) {
        if (fr[j] == -1) {
            fr[j] = pg[i];
            emptyFrame = j;
            break;
        }
    }

    if (emptyFrame != -1) {
        printf("Page %d: Miss  :", pg[i], pg[i]);
    } else {
        // Find the page to be replaced.
        int farthest = -1, replaceIndex = -1;
        for (int j = 0; j < fn; j++) {
            int k;
            for (k = i + 1; k < pn; k++) {
                if (fr[j] == pg[k]) {
                    if (k > farthest) {
                        farthest = k;
                        replaceIndex = j;
                    }
                    break;
                }
```

```
                }
                if (k == pn) {
                    replaceIndex = j;
                    break;
                }
            }
            fr[replaceIndex] = pg[i];
            printf("Page %d: Miss  :", pg[i], fr[replaceIndex]);
        }
    }

    // Display the contents of memory frames after each iteration.
    displayFrames(fr, fn);
  }

  printf("\nNo. of hits = %d\n", hit);
  printf("No. of misses = %d\n", pn - hit);
}

int main() {
  int pn;
  printf("Enter the number of pages: ");
  scanf("%d",&pn);
  int pg[pn];
  printf("Enter the pages: ");
  for(int i=0;i<pn;i++){
    scanf("%d",&pg[i]);
  }
```

```
    int fn = 3;
    optimalPage(pg, pn, fn);
    return 0;
}
```

OUTPUT:





PROGRAM 11

Write a C program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN

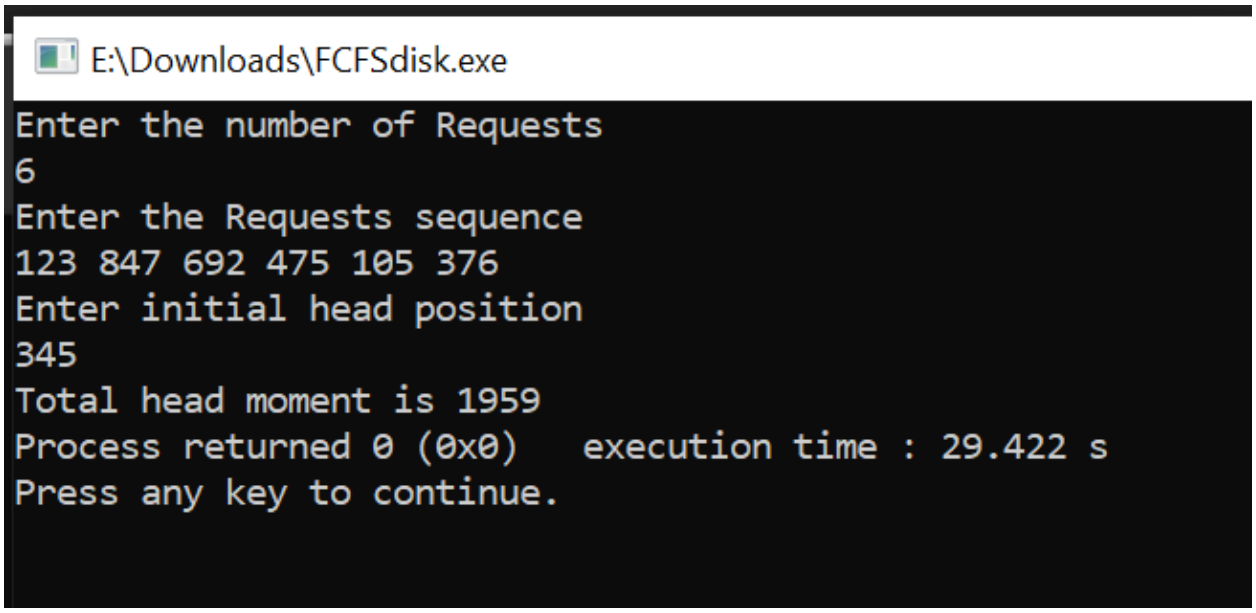
Programs:

a) FCFS:

```
/*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;
}
```

OUTPUT:



b) SCAN:

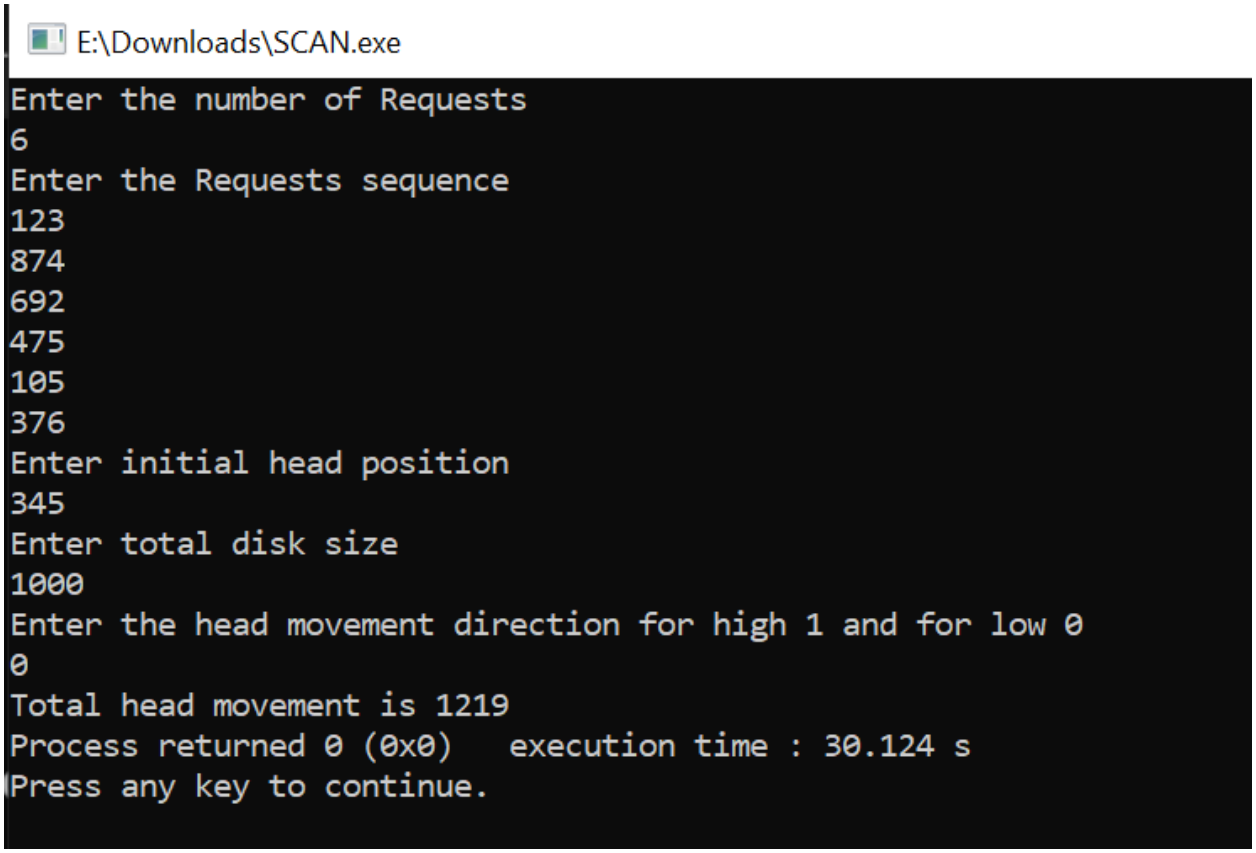
```
#include <stdio.h>
#include <stdlib.h>
int main()
{
    int RQ[100], i, j, n, TotalHeadMoment = 0, initial, size, move;
    printf("Enter the number of Requests\n");
    scanf("%d", &n);
    printf("Enter the Requests sequence\n");
    for (i = 0; i < n; i++)
        scanf("%d", &RQ[i]);
    printf("Enter 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);
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 (move == 1)
{
   for (i = index; i < n; i++)
   {
      TotalHeadMoment = TotalHeadMoment + abs(RQ[i] - initial);
      initial = RQ[i];
   }
   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];
   }
}
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:



c) CSCAN:

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

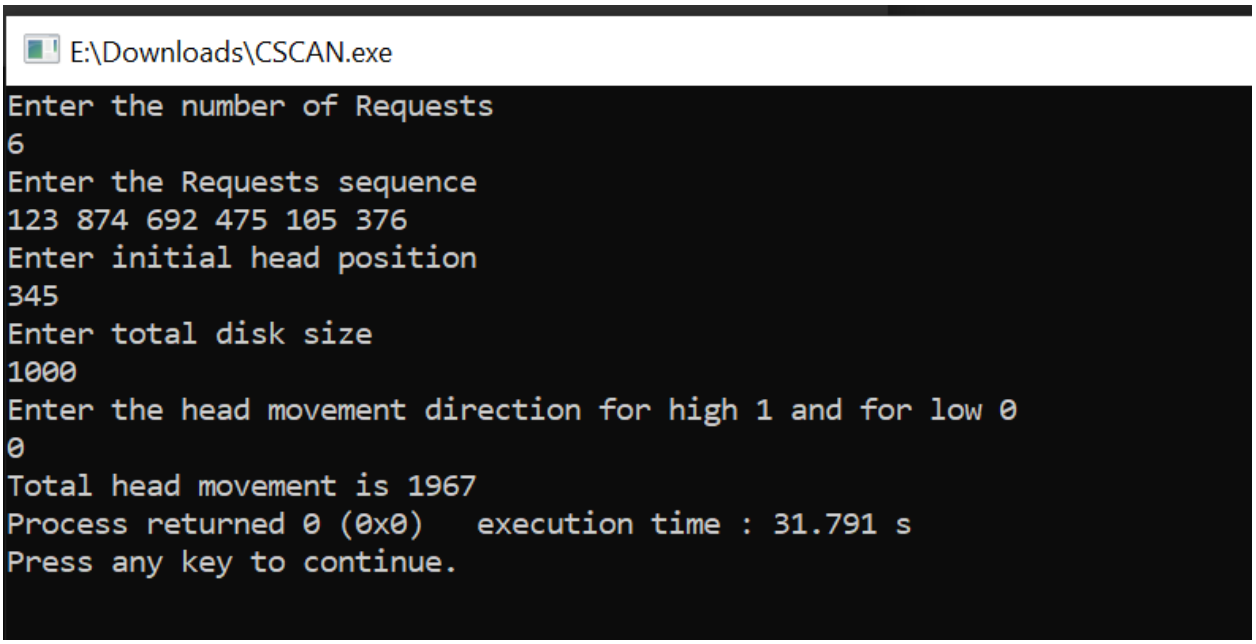
```
int main()
{
   int RQ[100], i, j, n, TotalHeadMoment = 0, initial, size, move;
   printf("Enter the number of Requests\n");
   scanf("%d", &n);
   printf("Enter the Requests sequence\n");
   for (i = 0; i < n; i++)
      scanf("%d", &RQ[i]);
   printf("Enter initial head position\n");
   scanf("%d", &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:


E:\Downloads\CSCAN.exe
Enter the number of Requests
6
Enter the Requests sequence
123 874 692 475 105 376
Enter initial head position
345
Enter total disk size
1000
Enter the head movement direction for high 1 and for low 0
0
Total head movement is 1967
Process returned 0 (0x0)   execution time : 31.791 s
Press any key to continue.