GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

OPERATING SYSTEMS LAB

Course Code: GR22A2079 **L/T/P/C: 0/0/3/1.5**

II Year II Semester

Course Objectives: The Objectives of this course is to provide the student to:

- Learn different types of CPU scheduling algorithms
- Demonstrate the usage of semaphores for solving synchronization problem
- Understand Banker's algorithm used for deadlock avoidance
- Implement paging techniques and page replacement policies, memory allocation techniques in memory management.
- Implement disk scheduling techniques and file allocation strategies.

Course Outcomes: At the end of the course, the student will be able to

- Evaluate the performance of different types of CPU scheduling algorithms
- Implement producer-consumer problem, reader-writers problem, Dining philosophers problem using semaphore
- Simulate Banker's algorithm for deadlock avoidance
- Implement paging techniques and page replacement policies, memory allocation techniques in memory management
- Implement disk scheduling techniques and file allocation strategies

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Syllabus

Task 1:

Practice the following commands in UNIX environment

a) cp b) rm c) mv d) chmod e) ps f) kill

Task 2:

Write a program that makes a copy of a file using standard I/O and system calls

Task 3:

Simulate the following CPU scheduling algorithms

a) FCFS b)SJF c) Priority d)Round Robin

Task 4:

Simulate the Producer-Consumer Problem

Task 5:

Simulate the Readers-Writers Problem using Semaphores.

Task 6:

Simulate the Dinning Philosophers Problem using Semaphores.

Task 7:

Simulate Bankers Algorithm for Dead Lock Avoidance.

Task 8:

Simulate First Fit and Best Fit algorithms for Memory Management.

Task 9:

Simulate Paging Technique of memory management.

Task 10:

Simulate all page replacement algorithms

a) FIFO b) LRU

Task 11:

Simulate the following Disk Scheduling Algorithms

a)FCFS b)SSTF c)SCAN d)C-SCAN e)LOOK f)CLOOK

Task 12:

Simulate all file allocation strategies

a) Sequential b) Indexed c) Linked

Text /Reference Books:

1. Operating System Concepts- Abraham Silberchatz , Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Operating Systems– Internal and Design Principles Stallings, Fifth Edition–2005, Pearson education/PHI

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TASK 1

Task: Practice the following commands in UNIX environment

a) cp b) rm c) mv d) chmod e) ps f) kill

$cp: used for copying files.

Syntax: $cp [options] source_file destination-file

Example: $cp f1 f2

OUTPUT:

$cat f1

This is GRIET

$cat f2

This is GRIET

It will copy the contents of f1 to f2

Options:

a)-**f**: Force copy by removing the destination file if needed.

Syntax: $cp -f source_file destination-file

Example:$cp -f f1 f2

OUTPUT: $cat f1

This is CSE

$cat f2

This is GRIET

b)-**i**: Ask the confirmation to overwrite.

Syntax: $cp -i source_file destination-file

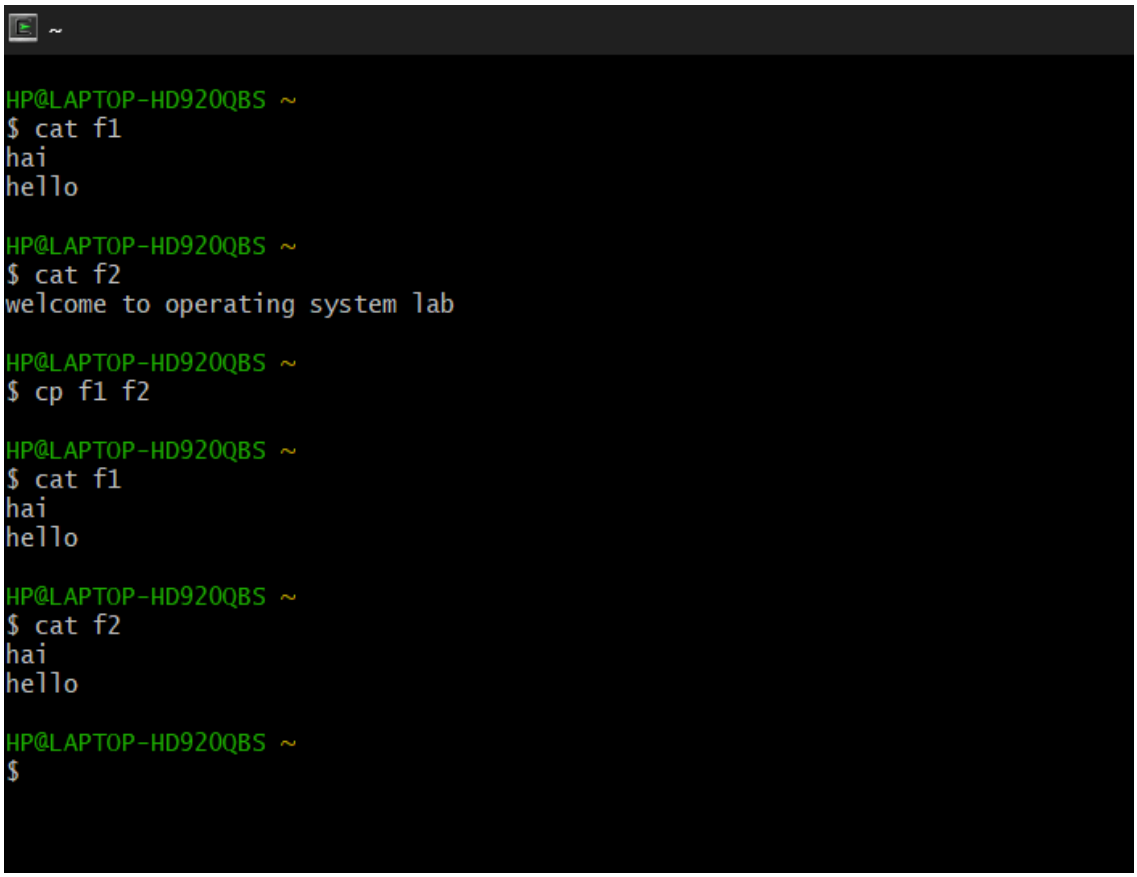
Example:$cp -i f1 f2

c)-**b**:It creates backup files before overriding.

Syntax: $cp -b source_file destination-file

Example:$cp -b f1 f2

OUTPUT:



$rm: Used to remove files (or) directories

Syntax: $rm [options] filename

Example:$rm f1

OUTPUT:

f1 is deleted

Options:

a)-**f**: ignores non existing files, never prompt

Syntax: $rm -f filename

Example: $rm -f myfile.txt

OUTPUT:Removes file myfile.txt

b)-**r**: Removes all files in directory and directory itself

Syntax: $rm -r filename

Example: $rm -r mydirectory

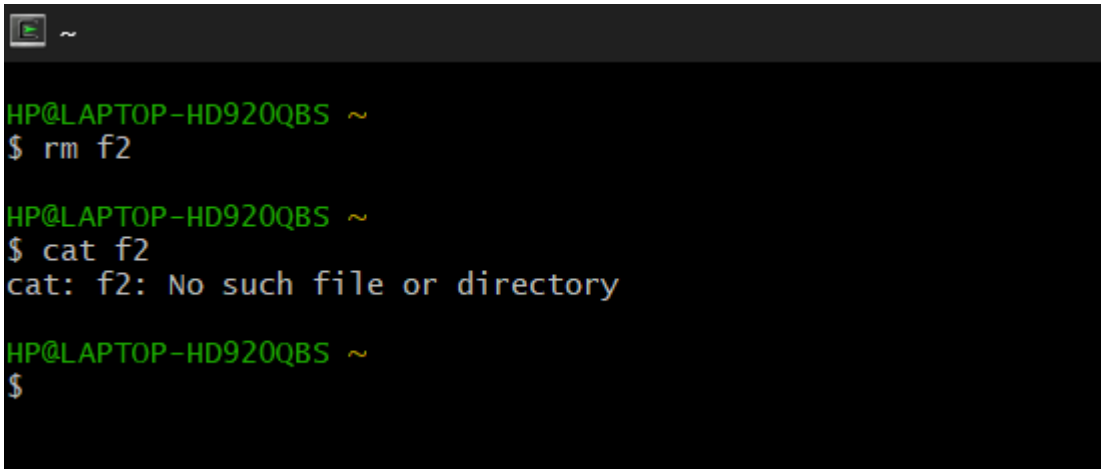
OUTPUT: Removes directory mydirectory and all files in it.

c)-**i**: prompts before every removal.

Syntax: $rm -i filename

Example: $rm -i bak.c

OUTPUT:



$mv: mv stands for move. mv is used to move one or more files or directories from one place to another in file system like UNIX. It has two distinct functions:

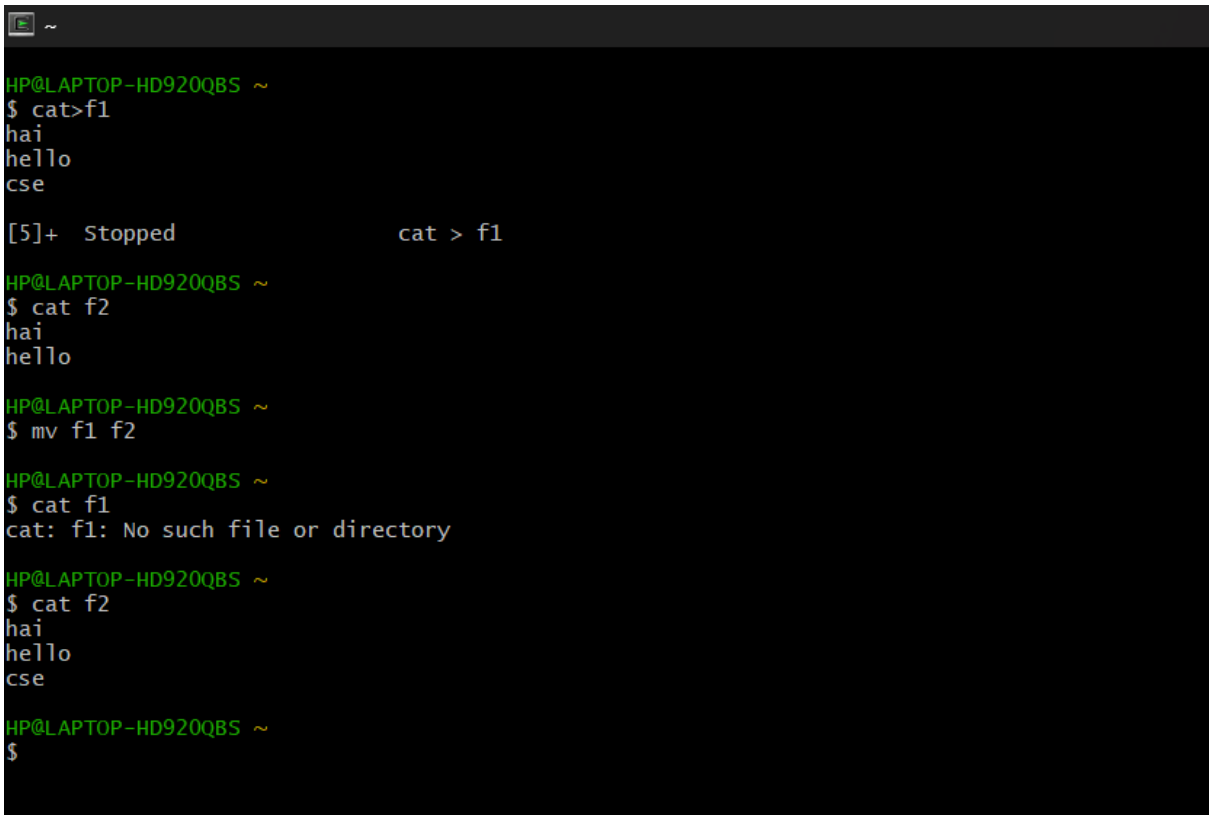
(i) It rename a file or folder.

(ii) It moves group of files to different directory.

No additional space is consumed on a disk during renaming. This command normally works silently means no prompt for confirmation.

Syntax:

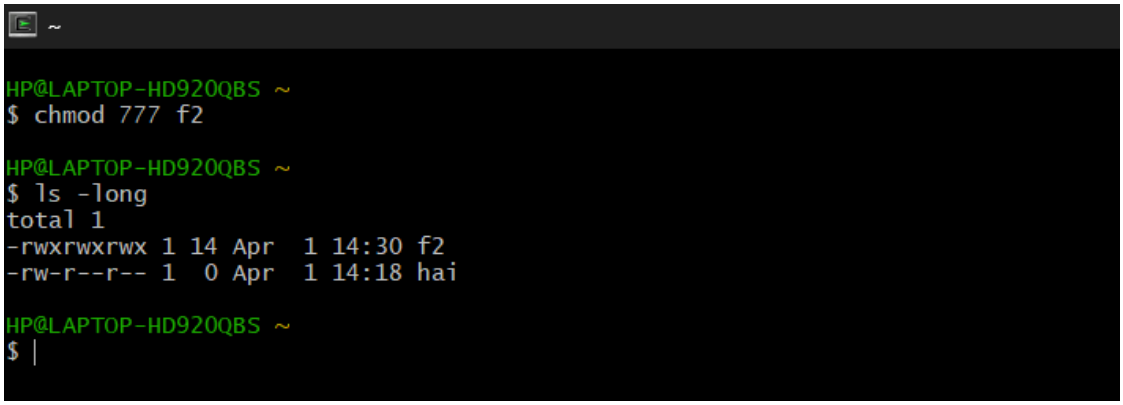
mv [Option] source destination



$chmod: To change directory permissions in Linux, use the following:

1. chmod +rwx filename to add permissions.
2. chmod -rwx directoryname to remove permissions.
3. chmod +x filename to allow executable permissions.
4. chmod -wx filename to take out write and executable permissions.

OUTPUT:



$ps(Process Status):

This command is used to display the attributes of a process.

Syntax: $ps

Example: $ps

OUTPUT: PID TTY TIME CMD

644 01 10:30:00 bash

643 02 10:31:00 ps

Options:

-f: detailed listing which shows parent of every process,use(-f)->(full) option.

Example: $ps –f

OUTPUT:

UID PID PPID C STIME TTY TIME CMD

Sumid 291 1 0 10:24:36 console 0:00 –bash

-u:it displays processes of a user.

Example: $ps –u sumit

OUTPUT: PID TTY TIME CMD

378 ? 00:05 xsun

403 ? 00:00 xsession

-a: displaying all user processes.

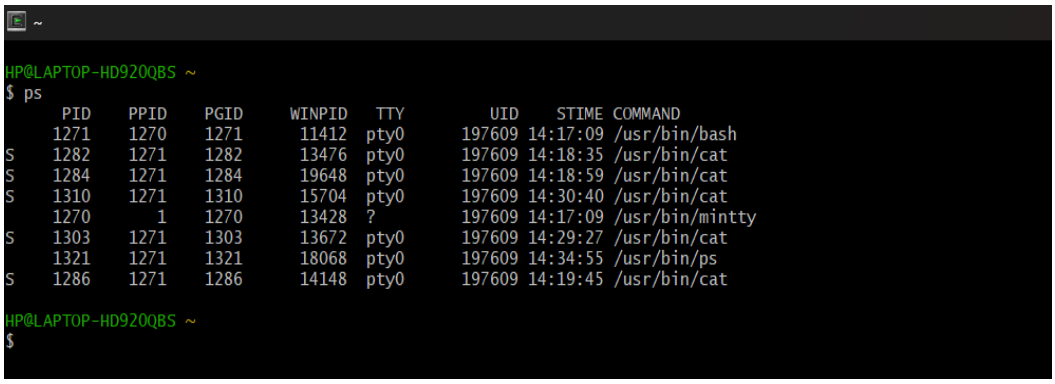
Example: $ps –a

OUTPUT: PID TTY TIME CMD

662 pts/01 00:00:00 ksh

705 pts/02 00:00:00 sh

OUTPUT:

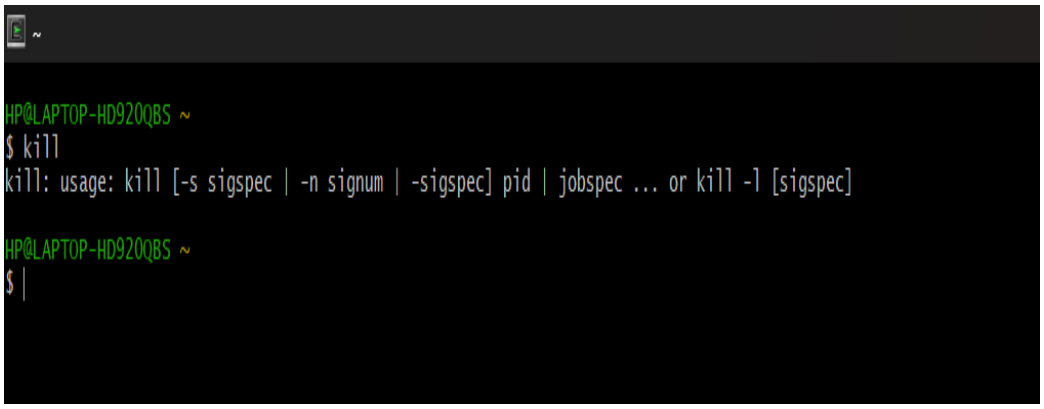


$kill: This command is used to kill the process i.e; stop or terminate a process.(by administrator)

Syntax: $kill <pid>

Example: $kill 644

OUTPUT: The process gets terminated.



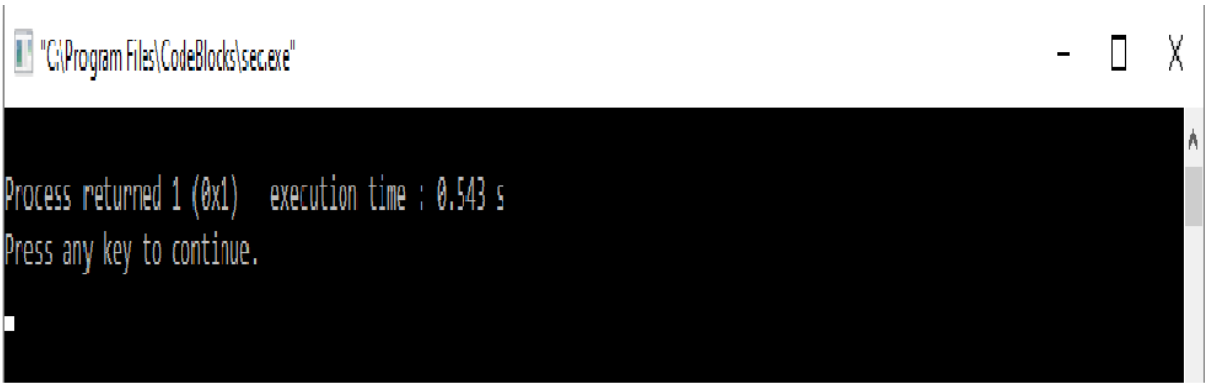
TASK 2

Task: Write a program that makes a copy of a file using standard I/O and system calls

Program:

```
#include<stdio.h>
#include<unistd.h>
#include<sys/types.h>
#include<sys/stat.h>
#include<fcntl.h>
void main()
{
 int fd1,fd2,n=1;
char *buf;
 fd1=open("f1",O_RDONLY);
fd2=open("f2",O_WRONLY|O_CREAT,S_IWUSR|S_IRUSR);
 if((fd1== -1) || (fd2== -1))
printf("error");
 else
 {
 while(n>0)
{
  n=read(fd1,&buf,1);
 write(fd2,&buf,1);
}
}
}
```

OUTPUT:



TASK 3

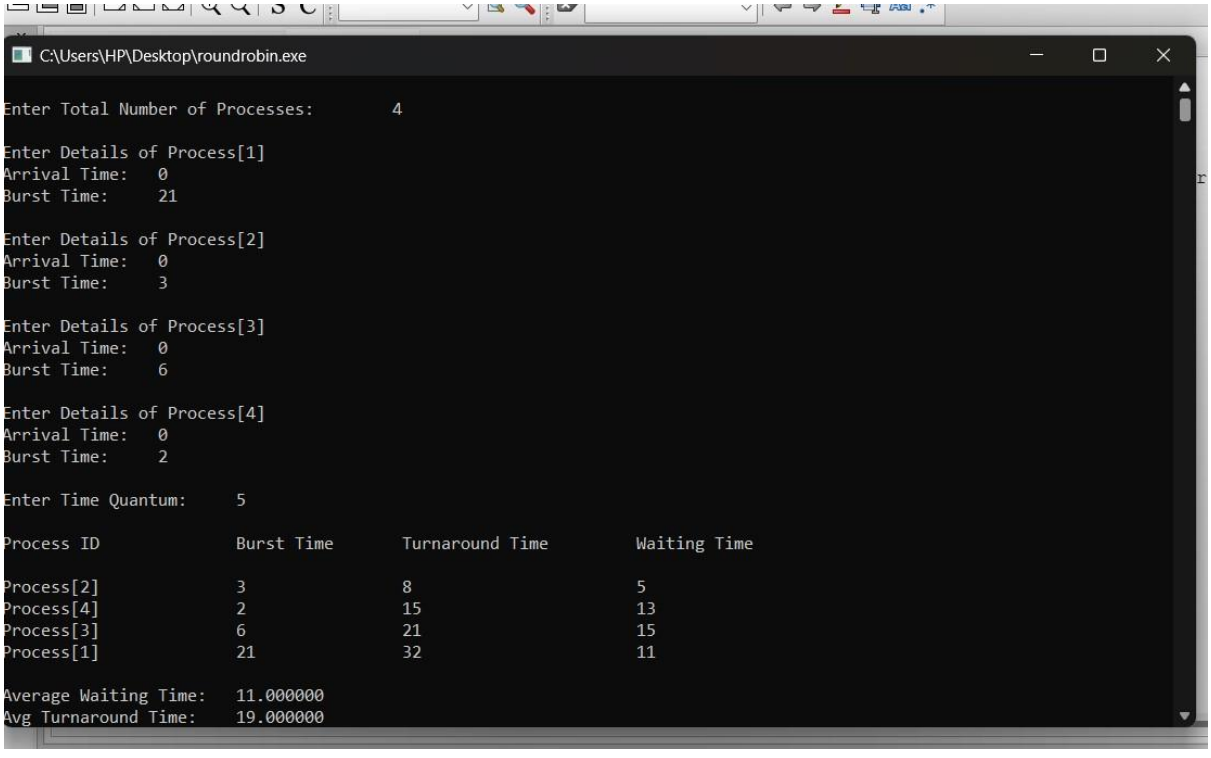
Task 3(a): To Simulate the Round Robin CPU Scheduling algorithm.

```
#include<stdio.h>

int main()

{

    int i, limit, total = 0, x, counter = 0, time_quantum;

    int wait_time = 0, turnaround_time = 0, arrival_time[10], burst_time[10], temp[10];

    float average_wait_time, average_turnaround_time;

    printf("\nEnter Total Number of Processes:\t");

    scanf("%d", &limit);

    x = limit;

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

    {

        printf("\nEnter Details of Process[%d]\n", i + 1);

        printf("Arrival Time:\t");

        scanf("%d", &arrival_time[i]);

        printf("Burst Time:\t");

        scanf("%d", &burst_time[i]);

        temp[i] = burst_time[i];

    }

    printf("\nEnter Time Quantum:\t");

    scanf("%d", &time_quantum);

    printf("\nProcess ID\t\tBurst Time\t Turnaround Time\t Waiting Time\n");

    for(total = 0, i = 0; x != 0;)

    {

        if(temp[i] <= time_quantum && temp[i] > 0)

        {
```

```
            total = total + temp[i];
            temp[i] = 0;
            counter = 1;
        }
        else if(temp[i] > 0)
        {
            temp[i] = temp[i] - time_quantum;
            total = total + time_quantum;
        }
        if(temp[i] == 0 && counter == 1)
        {
            x--;
            printf("\nProcess[%d]\t\t%d\t\t %d\t\t\t %d", i + 1, burst_time[i], total -
arrival_time[i], total - arrival_time[i] - burst_time[i]);
            wait_time = wait_time + total - arrival_time[i] - burst_time[i];
            turnaround_time = turnaround_time + total - arrival_time[i];
            counter = 0;
        }
        if(i == limit - 1)
        {
            i = 0;
        }
        else if(arrival_time[i + 1] <= total)
        {
            i++;
        }
        else
```

```
        {
            i = 0;
        }
    }
    average_wait_time = wait_time * 1.0 / limit;
    average_turnaround_time = turnaround_time * 1.0 / limit;
    printf("\n\nAverage Waiting Time:\t%f", average_wait_time);
    printf("\nAvg Turnaround Time:\t%f\n", average_turnaround_time);
    return 0;
}
```

OUTPUT:



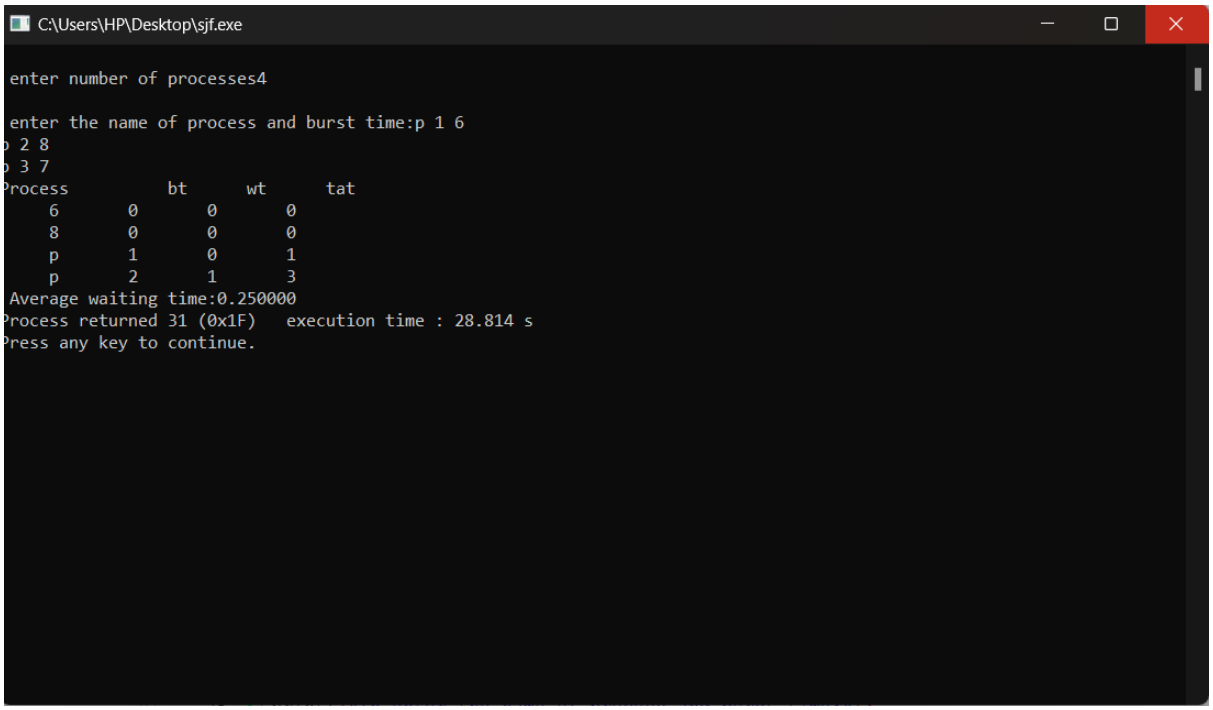
b)Aim:To Simulate the Shortest Job First(SJF) CPU Scheduling algorithm.

Program:

```
#include<stdio.h>

structsa

{

char pro[10];

int bt,wt,tat;

}p[10],temp[10];

void main()

{

int i,j,n,temp1=0;

float awt=0,atat=0;

printf("\n enter number of processes");

scanf("%d",&n);

printf("\n enter the name of process and burst time:");

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

{

scanf("%s %d",p[i].pro,&p[i].bt);

}

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

{

for(j=i+1;j<n;j++)

{

if(p[i].bt>p[j].bt)

{

temp[i]=p[i];
```

```
p[i]=p[j];

p[j]=temp[i];

}

}

}

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

{

p[i].wt=temp1;

p[i].tat=p[i].bt+p[i].wt;

temp1=p[i].bt+temp1;

}
```

OUTPUT:

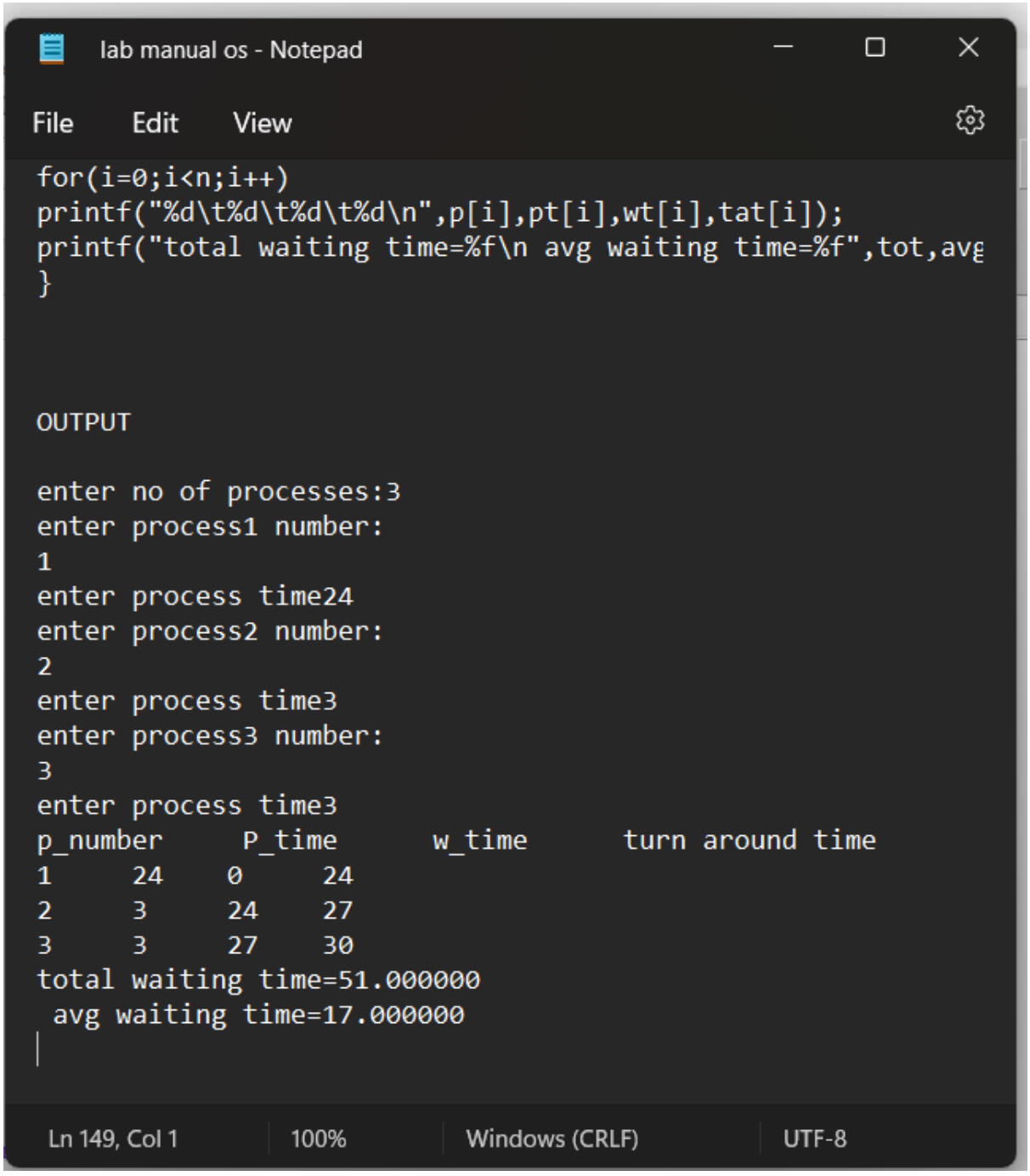


c)Aim: **To Simulate the First Come First Served CPU Scheduling algorithm**.

Program:

```
#include<stdio.h>
main()
{
int p[10];
int tat[10],wt[10],i,n,pt[10],bt[10];
float avg=0,tot=0;
printf("enter no of processes:");
scanf("%d",&n);
for(i=0;i<n;i++)
{
printf("enter process%d number:\n",i+1);
scanf("%d",&p[i]);
printf("enter process time");
scanf("%d",&pt[i]);
}
wt[0]=0;
for(i=1;i<n;i++)
{
wt[i]=pt[i-1]+wt[i-1];
tot=tot+wt[i];
}
avg=(float)tot/n;
for(i=0;i<n;i++)
tat[i]=pt[i]+wt[i];
printf("p_number\t P_time\t w_time\t turn around time\n");
for(i=0;i<n;i++)
printf("%d\t%d\t%d\t%d\n",p[i],pt[i],wt[i],tat[i]);
printf("total waiting time=%f\n avg waiting time=%f",tot,avg);
}
```

OUTPUT:


lab manual os - Notepad
File Edit View
for(i=0;i<n;i++)
printf("%d\t%d\t%d\t%d\n",p[i],pt[i],wt[i],tat[i]);
printf("total waiting time=%f\n avg waiting time=%f",tot,avg
}
OUTPUT
enter no of processes:3
enter process1 number:
1
enter process time24
enter process2 number:
2
enter process time3
enter process3 number:
3
enter process time3
p_number P_time w_time turn around time
1 24 0 24
2 3 24 27
3 3 27 30
total waiting time=51.000000
avg waiting time=17.000000
Ln 149, Col 1
100%
Windows (CRLF)
UTF-8

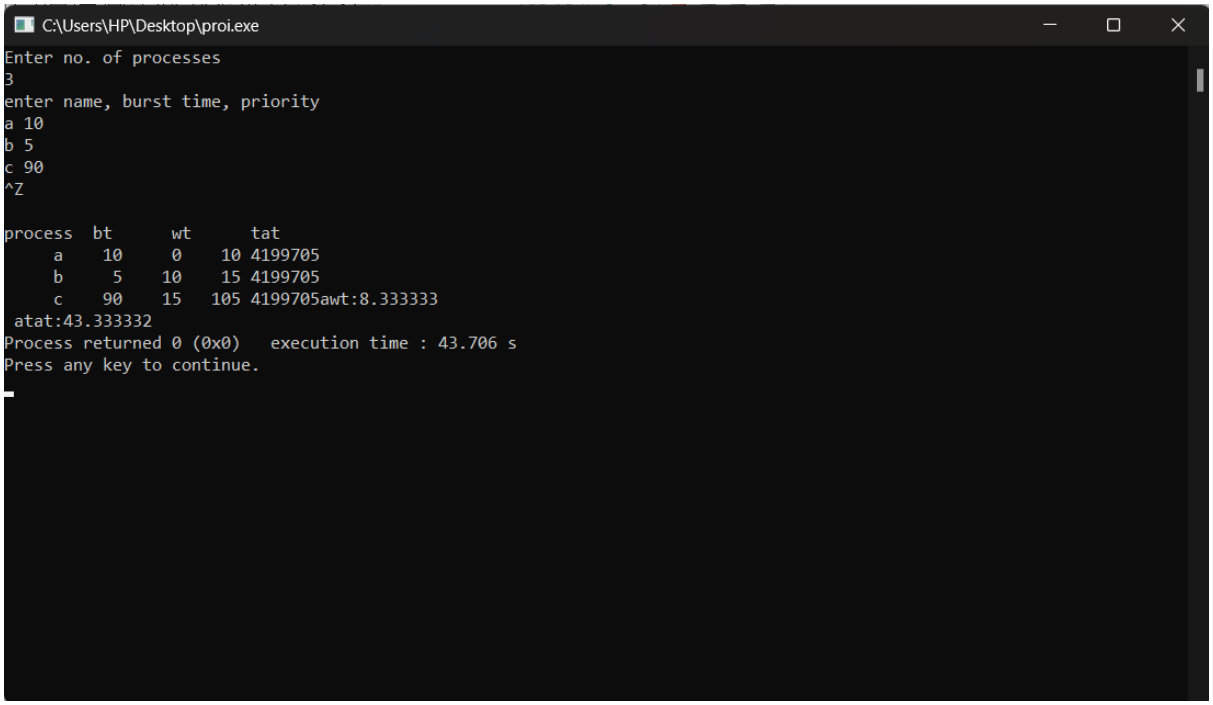
d)Aim: **To Simulate the Priority CPU Scheduling algorithm**.

Program:

```
#include<stdio.h>
struct sq
{
char pro[10];
int bt,wt,prior,tat;
}
P[10],temp;
main()
{
int i,j,n,temp1=0;
float awt=0,atat=0;
printf("Enter no. of processes\n");
scanf("%d",&n);
printf("enter name, burst time, priority\n");
for(i=0;i<n;i++)
{
scanf("%s%d%d",P[i].pro,&P[i].bt,&P[i].prior);
}
for(i=0;i<n;i++)
{
for(j=i+1;j<n;j++)
{
if(P[i].prior>P[j].prior)
{
temp=P[i];
P[i]=P[j];
P[j]=temp;
}
}
}
for(i=0;i<n;i++)
```

```
{
P[i].wt=temp1;
P[i].tat=P[i].wt+P[i].bt;
temp1+=P[i].bt;
}
for(i=0;i<n;i++)
{
awt+=P[i].wt;
atat+=P[i].tat;
}
printf("process\tbt\twt\ttat\n");
awt/=n;
atat/=n;
for(i=0;i<n;i++)
{
printf("%s\t%d\t%d\t%d\n",P[i].pro,P[i].bt,P[i].wt,P[i].tat);
}
printf("awt=%f\n,atat=%f\n",awt,atat);
}
```

OUTPUT:



TASK 4

Task: C Program to implement Producer-Consumer problem.

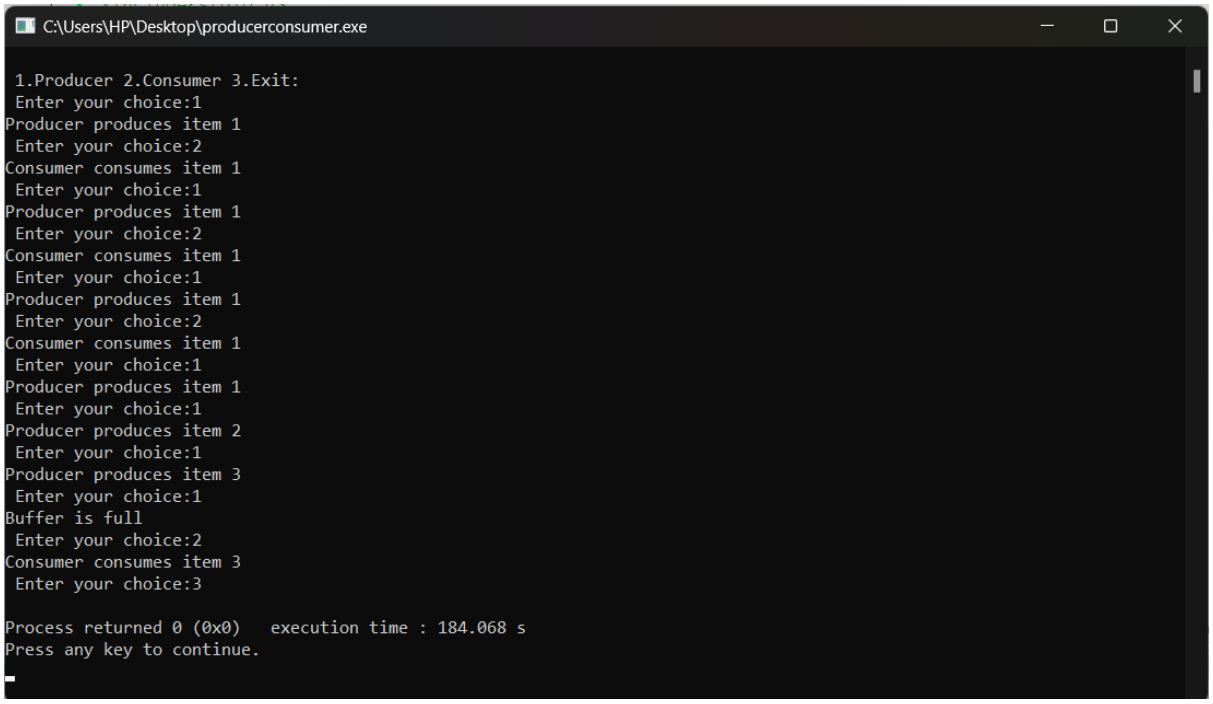
Program:

```
#include<stdio.h>

#include<stdlib.h>

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

void main()

{

        int n;

        void producer();

        void consumer();

        int wait(int);

        int signal(int);

        printf("\n 1.Producer 2.Consumer 3.Exit:");

        while(1)

        {

        printf("\n Enter 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;
        }
        }
}
int wait(int s)
{ while(s<=0);
        return(--s);
}
int signal(int s)
{
        return (++s);
}
void producer()
{
    empty=wait(empty);
        mutex=wait(mutex);



        x++;
        printf("Producer produces item %d",x);
        mutex=signal(mutex);
        full=signal(full);
}
```

```
void consumer()
{    full=wait(full);
        mutex=wait(mutex);

        printf("Consumer consumes item %d",x);
        x--;
        mutex=signal(mutex);
        empty=signal(empty);
}
```

OUTPUT:



TASK 5

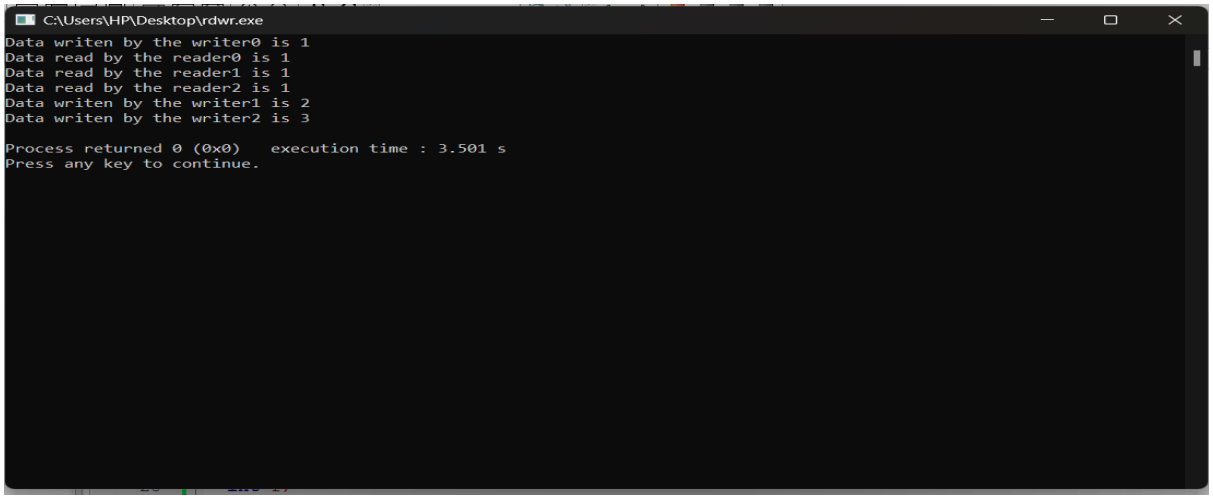
Task: Program to implement READERS-WRITERS concept.

Program:

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

sem_t mutex,wrt;
int data = 0,rcount = 0;

void *reader(void *arg)
{
  int f;
  f = ((int)arg);
  sem_wait(&mutex);
  rcount = rcount + 1;
  if(rcount==1)
   sem_wait(&wrt);
  sem_post(&mutex);
  printf("Data read by the reader%d is %d\n",f,data);
//  sleep(1);
  sem_wait(&mutex);
  rcount = rcount - 1;
  if(rcount==0)
   sem_post(&wrt);
  sem_post(&mutex);
}

void *writer(void *arg)
{
  int f;
  f = ((int) arg);
  sem_wait(&wrt);
```

```
  data++;
  printf("Data writen by the writer%d is %d\n",f,data);
  sleep(1);
  sem_post(&wrt);
}

main()
{
  int i,b;
  pthread_t rtid[5],wtid[5];
  sem_init(&mutex,0,1);
  sem_init(&wrt,0,1);
  for(i=0;i<=2;i++)
  {
    pthread_create(&wtid[i],NULL,writer,(void *)i);
    pthread_create(&rtid[i],NULL,reader,(void *)i);
  }
  for(i=0;i<=2;i++)
  {
    pthread_join(wtid[i],NULL);
    pthread_join(rtid[i],NULL);
  }
}
```

OUTPUT:



TASK 6:

Task: Program to implement Dining Philosopher problem using semaphores.

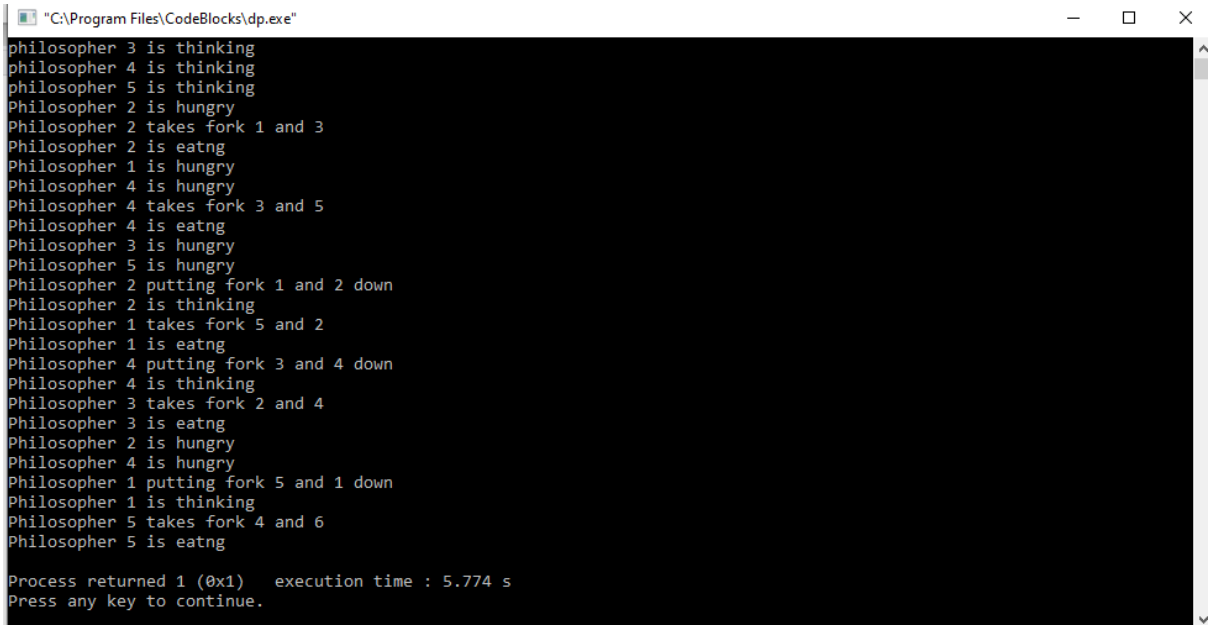
Program:

```
#include<stdio.h>
#include<pthread.h>
#include<stdlib.h>
#include<semaphore.h>
#define N 5
#define thinking 0
#define hungry 1
#define eating 2
#define left (ph_num+4)%N
#define right (ph_num+1)%N
sem_t mutex;
sem_t s[N];
void *philosopher(void *num);
void take_fork(int);
void put_fork(int);
void teet(int);
int state[N]={thinking,thinking,thinking,thinking,thinking};
int phil_num[N]={0,1,2,3,4};
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_num[i]);
```

```
printf("philosopher %d is thinking \n",i+1);
}
for(i=0;i<N;i++)
pthread_join(thread_id[i],NULL);
}
void *philosopher(void *num)
{
while(1)
{
int *i=num;
sleep(1);
take_fork(*i);
sleep(1);
put_fork(*i);
}
}
void take_fork(int ph_num)
{
sem_wait(&mutex);
state[ph_num]=hungry;
printf("Philosopher %d is hungry\n",ph_num+1);
teet(ph_num);
sem_post(&mutex);
sem_wait(&s[ph_num]);
sleep(1);
}
void teet(int ph_num)
{
static count=0;
if(state[ph_num]==hungry&& state[left]!=eating && state[right]!=eating)
{
state[ph_num]=eating;
printf("Philosopher %d takes fork %d and %d\n",ph_num+1,left+1,ph_num+2);
printf("Philosopher %d is eatng\n",ph_num+1);
```

```
sem_post(&s[ph_num]);
count++;
}
if(count==5)
exit(1);
}
void put_fork(int ph_num)
{
sem_wait(&mutex);
state[ph_num]=thinking;
printf("Philosopher %d putting fork %d and %d down \n",ph_num+1,left+1,ph_num+1);
printf("Philosopher %d is thinking\n",ph_num+1);
teet(left);
teet(right);
sem_post(&mutex);
}
```

OUTPUT:



TASK 7

Task : Simulate Bankers Algorithm for Deadlock Avoidance

Program:

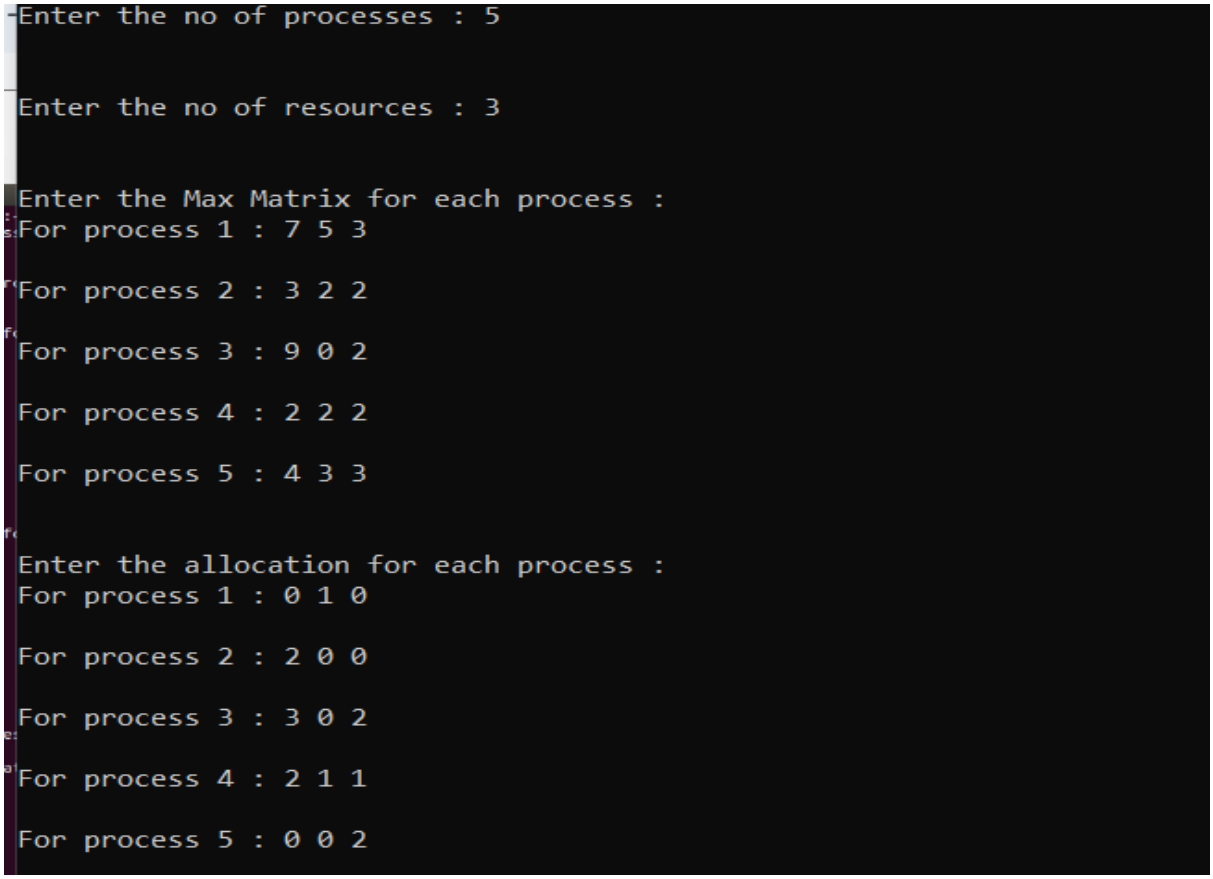
```
#include <stdio.h>
#include <stdlib.h>
int main()
{
int Max[10][10], need[10][10], alloc[10][10], avail[10], completed[10], safeSequence[10];
/*Max denotes max required resource
alloc denotes already allocated resouces for each process
avail denotes available resource of each kind
completed array indicates whether each process has met with its requirements and completed or not.
Safe sequence is an array which holds order of execution that can result in completion of all process*/

int p, r, i, j, process, count;
count = 0;

printf("Enter the no of processes : ");
scanf("%d", &p);

for(i = 0; i< p; i++)
completed[i] = 0; /*initially no process is completed*/

printf("\n\nEnter the no of resources : ");
scanf("%d", &r);
printf("\n\nEnter the Max Matrix for each process : ");
for(i = 0; i < p; i++)
{
printf("\nFor process %d : ", i + 1);
for(j = 0; j < r; j++)
scanf("%d", &Max[i][j]);
```

```
}

printf("\n\nEnter the allocation for each process : ");
for(i = 0; i < p; i++)
{
printf("\nFor process %d : ",i + 1);
for(j = 0; j < r; j++)
scanf("%d", &alloc[i][j]);
}

printf("\n\nEnter the Available Resources : ");
for(i = 0; i < r; i++)
scanf("%d", &avail[i]);

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

for(j = 0; j < r; j++)
need[i][j] = Max[i][j] - alloc[i][j]; // process still need these many resorces.

do
{
printf("\n Max matrix:\tAllocation matrix:\n");

for(i = 0; i < p; i++)
{
for( j = 0; j < r; j++)
printf("%d ", Max[i][j]);
printf("\t\t");
for( j = 0; j < r; j++)
printf("%d ", alloc[i][j]);
printf("\n");
}

process = -1; //indicates process can not completed.
```

```
        for(i = 0; i < p; i++)
        {
        if(completed[i] == 0)//if not completed.
        {
        process = i ; //ith process not yet completed.
        for(j = 0; j < r; j++)
           {
        if(avail[j] < need[i][j])
              {
        process = -1;  //excess required which is not possible
        break;
              }
           }
        }/*end if*/
if(process != -1)
break;   /* that means there exists a  process that can complete its requirement*/
        }/*for end*/
/* process holds i th process which is not yet completed*/
if(process != -1)
{
printf("\nProcess %d runs to completion!", process );
safeSequence[count] = process ; /*join it to safe sequence*/
count++;    //identifying number of completed processes
for(j = 0; j < r; j++)
{
avail[j] += alloc[process][j]; /*return back the resources*/
alloc[process][j] = 0;
Max[process][j] = 0;
completed[process] = 1;
}
}
}while(count != p && process != -1); /*for all process*/
```

```
if(count == p)
{
printf("\nThe system is in a safe state!!\n");
printf("Safe Sequence : < ");
for( i = 0; i < p; i++)
printf("%d ", safeSequence[i]);
printf(">\n");
}
else
printf("\nThe system is in an unsafe state!!");

}
```

OUTPUT:



```
For process 4 : 2 1 1

For process 5 : 0 0 2


Enter the Available Resources : 3 3 2

 Max matrix:     Allocation matrix:
7 5 3            0 1 0
3 2 2            2 0 0
9 0 2            3 0 2
2 2 2            2 1 1
4 3 3            0 0 2

Process 1 runs to completion!
 Max matrix:     Allocation matrix:
7 5 3            0 1 0
0 0 0            0 0 0
9 0 2            3 0 2
2 2 2            2 1 1
4 3 3            0 0 2

Process 3 runs to completion!
 Max matrix:     Allocation matrix:
7 5 3            0 1 0
0 0 0            0 0 0
9 0 2            3 0 2
0 0 0            0 0 0
4 3 3            0 0 2

Process 0 runs to completion!
 Max matrix:     Allocation matrix:
0 0 0            0 0 0
0 0 0            0 0 0
9 0 2            3 0 2
0 0 0            0 0 0
4 3 3            0 0 2

Process 2 runs to completion!
 Max matrix:     Allocation matrix:
0 0 0            0 0 0
0 0 0            0 0 0
0 0 0            0 0 0
0 0 0            0 0 0
4 3 3            0 0 2

Process 4 runs to completion!
The system is in a safe state!!
Safe Sequence : < 1 3 0 2 4 >
```

TASK 8

Task 8a: Simulate First fit algorithm for Memory Management.

Program:

```
#include<stdio.h>
#define max 25
void main()
{  int frag[max],b[max],f[max],i,j,nb,nf,temp,highest=0;
static int bf[max],ff[max];
printf("Memory management Scheme-first fit");
printf("\nenter number of blocks:");
scanf("%d",&nb);
printf("\n enter the number of files:");
scanf("%d",&nf);
printf("\n enter size of blocks:");
for(i=1;i<=nb;i++)
  {     printf("\nblock %d:",i);
scanf("%d",&b[i]);
  }
printf("\n enter size of files:");
for(i=1;i<=nf;i++)
  {
printf("\nfile %d:",i);
scanf("%d",&f[i]);
  }
for(i=1;i<=nf;i++)
  {
for(j=1;j<=nb;j++)
    {
if(bf[j]!=1)
      {
temp=b[j]-f[i];
if(temp>=0)
```

```
        {
ff[i]=j;
break;
        }
      }
    }
frag[i]=temp;
bf[ff[i]]=1;
  }
printf("\n file no\tfile size\tblock no\tblocksize\tfragment");
for(i=1;i<=nf;i++)
printf("\n %d  \t %d \t %d \t %d \t %d",i,f[i],ff[i],b[ff[i]],frag[i]);
}
```

OUTPUT:

```
C:\Users\HP\Documents\8a.exe
Memory management Scheme-first fit
enter number of blocks:5

 enter the number of files:3

 enter size of blocks:
block 1:10

block 2:20

block 3:30

block 4:40

block 5:50

 enter size of files:
file 1:2

file 2:5

file 3:4

 file no        file size       block no        blocksize       fragment
 1       2       1       10      8
 2       5       2       20      15
 3       4       3       30      26
Process returned 3 (0x3)   execution time : 34.679 s
Press any key to continue.
```

Task 8b:Simulate Best fit algorithm for Memory Management.

Program:

```
#include<stdio.h>
#define MAX 25
void main()
{
int frag[MAX],b[MAX],f[MAX],i,j,nb,nf,temp,lowest=10000;
static int bf[MAX],ff[MAX];
printf("\nEnter the number of blocks");
scanf("%d",&nb);
printf("\nEnter the number of files");
scanf("%d",&nf);
printf("\nEnter the size of the blocks");
for(i=1;i<=nb;i++)
{
printf("\nBlock %d",i);
scanf("%d",&b[i]);
}
printf("\nEnter the size of files");
for(i=1;i<=nf;i++)
{
printf("\nFile %d",i);
scanf("%d",&f[i]);
}
for(i=1;i<=nf;i++)
{
        for(j=1;j<=nb;j++)
                {
                        if(bf[j]!=1)
                        {
                                temp=b[j]-f[i];
                                if(temp>=0)
                                {
```

```
                                ff[i]=j;
                                lowest=temp;
                                }
                        }
                }
        frag[i]=lowest;
        bf[ff[i]]=1;
        lowest=10000;
}
printf("\nFile No \t File Size \t Block No \t Block Size \t fragment");
for(i=1;i<=nf&&ff[i]!=0;i++)
printf("\n %d \t %d \t %d \t %d \t %d",i,f[i],ff[i],b[ff[i]],frag[i]);
}
```

OUTPUT:

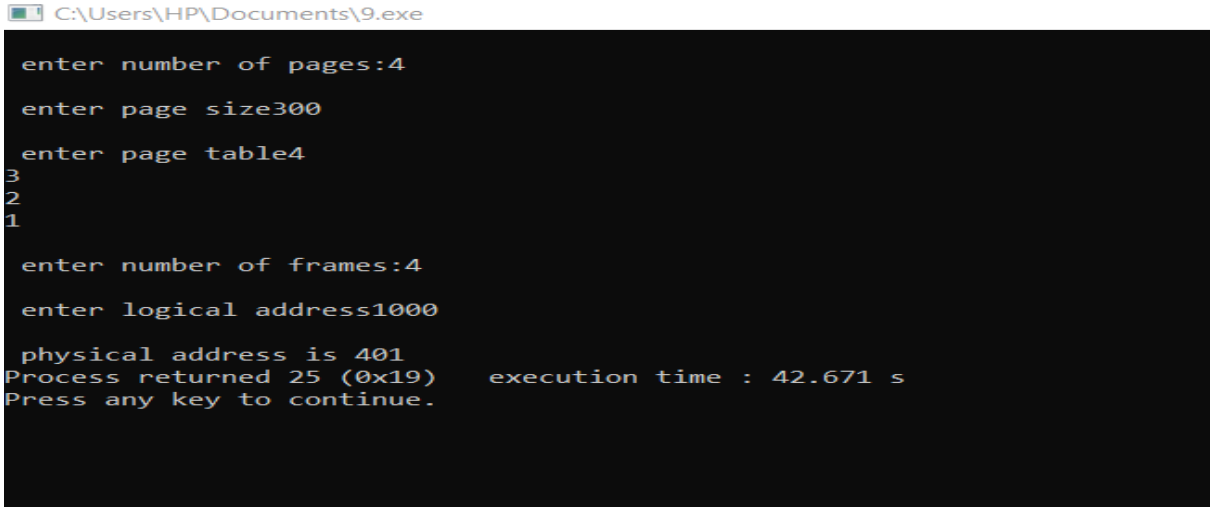
```
Enter the number of files4

Enter the size of the blocks
Block 110

Block 220

Block 330

Block 440

Block 550

Enter the size of files
File 14

File 25

File 36

File 47

File No          File Size       Block No        Block Size      fragment
 1       4       5       50      46
 2       5       4       40      35
 3       6       3       30      24
 4       7       2       20      13
Process returned 4 (0x4)   execution time : 40.701 s
Press any key to continue.
```

TASK 9

Task : To implement paging technique of memory management.

```
#include<stdio.h>
void main()
{
int np,ps,pt[20],nf,la,pn,index,pa,i,j;
printf("\n enter number of pages:");
scanf("%d",&np);
printf("\n enter page size");
scanf("%d",&ps);
printf("\n enter page table");
for(i=0;i<np;i++)
scanf("%d",&pt[i]);
printf("\n enter number of frames:");
scanf("%d",&nf);
printf("\n enter logical address");
scanf("%d",&la);
pn=la/ps;
index=la%ps;
pa=(pt[pn]+ps)+index;
printf("\n physical address is %d",pa);
}
```

OUTPUT:



TASK 10

Task 10a: Simulate first in first out Page Replacement Algorithm.

Program:

```
#include<stdio.h>
int main()
{
int i,j,n,a[50],frame[10],no,k,avail,count=0;
printf("\n ENTER THE NUMBER OF PAGES:\n");
scanf("%d",&n);
printf("\n ENTER THE PAGE NUMBER :\n");
for(i=1;i<=n;i++)
scanf("%d",&a[i]);
printf("\n ENTER THE NUMBER OF FRAMES :");
scanf("%d",&no);
for(i=0;i<no;i++)
frame[i]= -1;
j=0;
printf("\tref string\t page frames\n");
for(i=1;i<=n;i++)
{
printf("%d\t\t",a[i]);
avail=0;
for(k=0;k<no;k++)
if(frame[k]==a[i])
avail=1;
if (avail==0)
{
frame[j]=a[i];
j=(j+1)%no;
count++;
for(k=0;k<no;k++)
printf("%d\t",frame[k]);
}
printf("\n");
}
printf("Page Fault Is %d",count);
return 0;
}
```

OUTPUT:

```
 ENTER THE NUMBER OF PAGES:
3

 ENTER THE PAGE NUMBER :
4
8
2

 ENTER THE NUMBER OF FRAMES :3
        ref string       page frames
4               4       -1      -1
8               4       8       -1
2               4       8       2
Page Fault Is 3
Process returned 0 (0x0)   execution time : 24.724 s
Press any key to continue.
```

Task 10b: To simulate least recently used page replacement algorithm.

```
#include<stdio.h>
int main()
{
int frames[10], temp[10], pages[10];
int total_pages, m, n, position, k, l, total_frames;
int a = 0, b = 0, page_fault = 0;
printf("\nEnter Total Number of Frames:\t");
scanf("%d", &total_frames);
for(m = 0; m < total_frames; m++)
{
frames[m] = -1;
}
printf("Enter Total Number of Pages:\t");
scanf("%d", &total_pages);
printf("Enter Values for Reference String:\n");
for(m = 0; m < total_pages; m++)
{
printf("Value No.[%d]:\t", m + 1);
scanf("%d", &pages[m]);
}
for(n = 0; n < total_pages; n++)
{
a = 0, b = 0;
for(m = 0; m < total_frames; m++)
```

```
{
if(frames[m] == pages[n])
{
a = 1;
b = 1;
break;
}
}
if(a == 0)
{
for(m = 0; m < total_frames; m++)
{
if(frames[m] == -1)
{
frames[m] = pages[n];
b = 1;
break;
}
}
}
if(b == 0)
{
for(m = 0; m < total_frames; m++)
{
temp[m] = 0;
```

```
}
for(k = n - 1, l = 1; l <= total_frames - 1; l++, k--)
{
for(m = 0; m < total_frames; m++)
{
if(frames[m] == pages[k])
{
temp[m] = 1;
}
}
}
for(m = 0; m < total_frames; m++)
{
if(temp[m] == 0)
position = m;
}
frames[position] = pages[n];
page_fault++;
}
printf("\n");
for(m = 0; m < total_frames; m++)
{
printf("%d\t", frames[m]);
}
}
```

```
printf("\nTotal Number of Page Faults:\t%d\n", page_fault);

return 0;

}
```

OUTPUT :

```
Enter Total Number of Frames:   3
Enter Total Number of Pages:    5
Enter Values for Reference String:
Value No.[1]:   8
Value No.[2]:   75
Value No.[3]:   2
Value No.[4]:   36
Value No.[5]:   4

8       -1      -1
8       75      -1
8       75      2
36      75      2
36      4       2
Total Number of Page Faults:    2

Process returned 0 (0x0)   execution time : 25.979 s
Press any key to continue.
```

TASK 11

Task :Simulate the following Disc Scheduling Algorithms

Program:

```
#include<stdio.h>
int absolute(int a,int b)
{int c;
c=a-b;
if(c<0)
return -c;
else
return c;
}
int main()
{int choice,m,n,x,start,i,j,pos,min,a[15],count;
count=0;
printf("\nEnter the number of cylinders :");
scanf("%d",&m);
printf("\nEnter the number of requests :");
scanf("%d",&n);
printf("\nEnter current position :");
scanf("%d",&start);
printf("\nEnter the request queue :");
for(i=0;i<n;i++)
{scanf("%d",&a[i]);
```

```
if(a[i]>=m)

{printf("\ninvalid input");

scanf("%d",&a[i]);

}

}

do

{printf("\n\nDISK SCHEDULING ALGORITHMS\n1. FCFS\n2. SSTF\n3. SCAN\n4. C-SCAN\n5. LOOK\n6. C-LOOK");

printf("\nEnter choice :");

scanf("%d",&choice);

count=0;

x=start;

switch(choice)

{case 1:printf("\nFCFS :\n");

printf("Scheduling services the request in the order that follows:\n%d\t",start);

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

{x-=a[i];

if(x<0)

x=-x;

count+=x;

x=a[i];

printf("%d\t",x);

}

printf("\nTotal Head Movement :%d Cylinders",count);

break;
```

```
case 2:printf("\nSSTF :\n");
printf("Scheduling services the request in the order that follows:\n%d\t",start);
for(i=0;i<n;i++)
{min=absolute(a[i],x);
pos=i;
for(j=i;j<n;j++)
if(min>absolute(x,a[j]))
{pos=j;
min=absolute(x,a[j]);
}
count+=absolute(x,a[pos]);
x=a[pos];
a[pos]=a[i];
a[i]=x;
printf("%d\t",x);
}
printf("\nTotal Head Movement: %d Cylinders",count);
break;
case 3:printf("\nSCAN :\n");
printf("Scheduling services the request in the order that follows:\n");
count=0;
pos=0;
for(i=0;i<n;i++)
for(j=0;j<n-i-1;j++)
if(a[j]>a[j+1])
```

```
{x=a[j];
a[j]=a[j+1];
a[j+1]=x;
}
for(i=0;i<n;i++)
if(a[i]<start)
pos++;
for(i=0;i<pos;i++)
for(j=0;j<pos-i-1;j++)
if(a[j]<a[j+1])
{x=a[j];
a[j]=a[j+1];
a[j+1]=x;
}
x=start;
printf("%d\t",x);
for(i=0;i<pos;i++)
{count+=absolute(a[i],x);
x=a[i];
printf("%d\t",x);
}
count+=absolute(x,0);
x=0;
printf("%d\t",x);
for(i=pos;i<n;i++)
```

```
{count+=absolute(a[i],x);
x=a[i];
printf("%d\t",x);
}
/*for(i=0;i<n;i++)
printf("%d\t",a[i]);*/
printf("\nTotal Head Movement: %d Cylinders",count);
break;
case 4:printf("\nC-SCAN :\n");
printf("Scheduling Services the request in the order that follows:\n%d\t",start);
count=0;
pos=0;
for(i=0;i<n;i++)
for(j=0;j<n-i-1;j++)
if(a[j]>a[j+1])
{x=a[j];
a[j]=a[j+1];
a[j+1]=x;
}
for(i=0;i<n;i++)
if(a[i]<start)
pos++;
x=start;
for(i=pos;i<n;i++)
{count+=absolute(x,a[i]);
```

```
x=a[i];
printf("%d\t",x);
}
count+=absolute(m-1,x);
x=0;
printf("%d\t%d\t",m-1,0);
for(i=0;i<pos;i++)
{count+=absolute(x,a[i]);
x=a[i];
printf("%d\t",x);
}
/*for(i=0;i<n;i++)
printf("%d\t",a[i]);*/
printf("\nTotal Head movement: %d Cylinders",count);
break;
case 5:printf("\nLOOK :\n");
printf("\nScheduling services the request in the order as follows :\n%d\t",start);
count=0;
pos=0;
for(i=0;i<n;i++)
for(j=0;j<n-i-1;j++)
if(a[j]>a[j+1])
{x=a[j];
a[j]=a[j+1];
a[j+1]=x;
```

```
}
for(i=0;i<n;i++)
if(a[i]<start)
pos++;
for(i=0;i<pos;i++)
for(j=0;j<pos-i-1;j++)
if(a[j]<a[j+1])
{x=a[j];
a[j]=a[j+1];
a[j+1]=x;
}
x=start;
for(i=0;i<pos;i++)
{count+=absolute(a[i],x);
x=a[i];
printf("%d\t",x);
}
for(i=pos;i<n;i++)
{count+=absolute(a[i],x);
x=a[i];
printf("%d\t",x);
}
printf("\nToal Head Movement: %d Cylinders",count);
break;
case 6:printf("\nC-LOOK :\n");
```

```
printf("Scheduling Services the request in the order that follows:\n%d\t",start);
count=0;
pos=0;
for(i=0;i<n;i++)
for(j=0;j<n-i-1;j++)
if(a[j]>a[j+1])
{x=a[j];
a[j]=a[j+1];
a[j+1]=x;
}
for(i=0;i<n;i++)
if(a[i]<start)
pos++;
x=start;
for(i=pos;i<n;i++)
{count+=absolute(x,a[i]);
x=a[i];
printf("%d\t",x);
}
for(i=0;i<pos;i++)
{count+=absolute(x,a[i]);
x=a[i];
printf("%d\t",x);
}
/*for(i=0;i<n;i++)
```

```
printf("%d\t",a[i]);*/

printf("\nTotal Head movement: %d Cylinders",count);

break;

}

printf("\nDo you want to continue(1 to continue) :");

scanf("%d",&choice);

}while(choice==1);

}
```

OUTPUT:

```
Enter the number of cylinders :200

Enter the number of requests :5

Enter current position :1

Enter the request queue :2
3
5
8
9


DISK SCHEDULING ALGORITHMS
1. FCFS
2. SSTF
3. SCAN
4. C-SCAN
5. LOOK
6. C-LOOK
Enter choice :1

FCFS :
Scheduling services the request in the order that follows:
1       2       3       5       8       9
Total Head Movement :8 Cylinders
Do you want to continue(1 to continue) :1


DISK SCHEDULING ALGORITHMS
1. FCFS
2. SSTF
3. SCAN
4. C-SCAN
5. LOOK
6. C-LOOK
Enter choice :
```

TASK 12

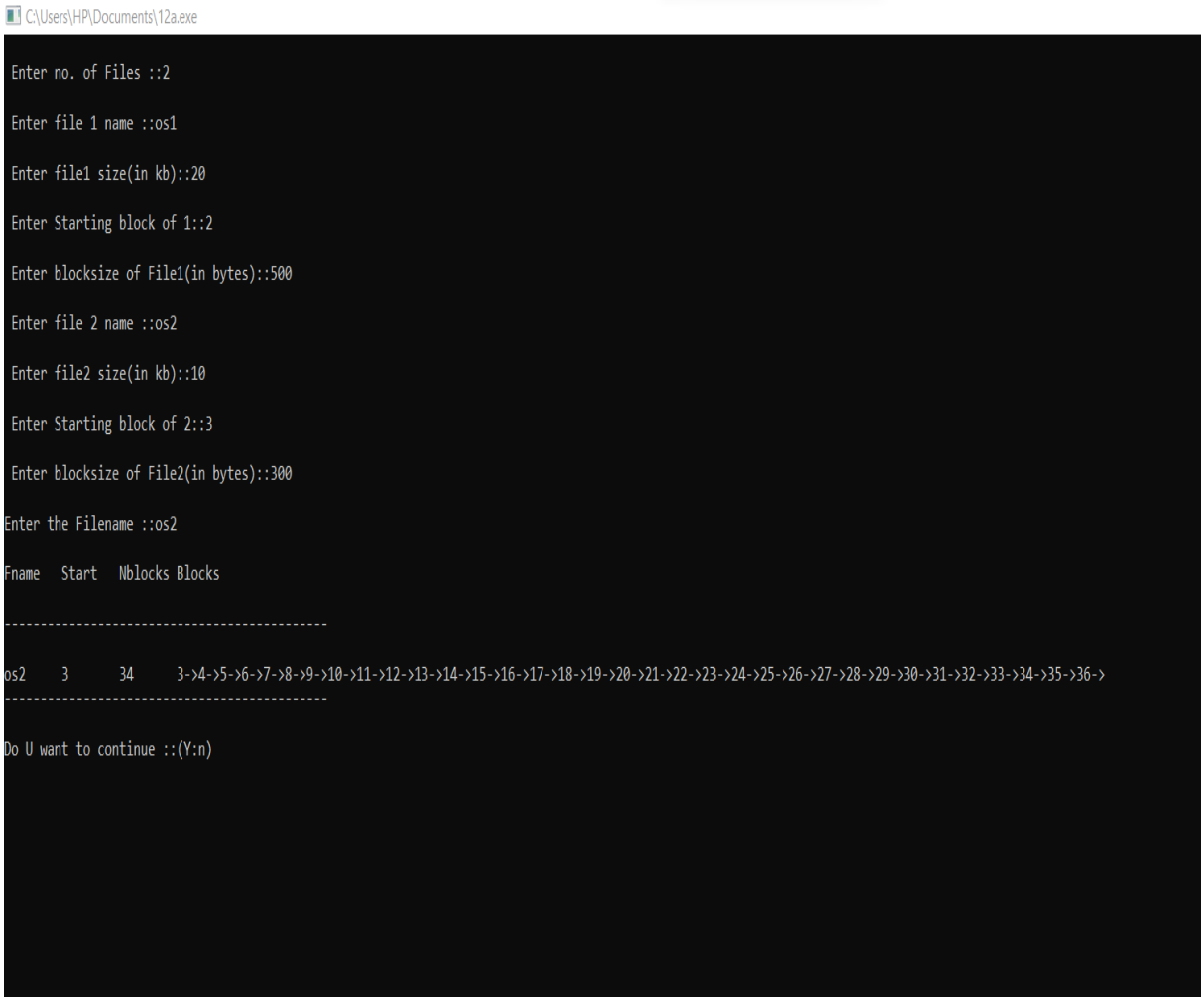
Task : To Simulate Sequential file allocation Strategy

Program:

```
#include<stdio.h>
#include<string.h>
void main()
{
 int st[20],b[20],b1[20],ch,i,j,n,blocks[20][20],sz[20];
char F[20][20],S[20];
printf("\n Enter no. of Files ::");
scanf("%d",&n);
for(i=0;i<n;i++)
   {
printf("\n Enter file %d name ::",i+1);

scanf("%s",&F[i]);
printf("\n Enter file%d size(in kb)::",i+1);
scanf("%d",&sz[i]);
printf("\n Enter Starting block of %d::",i+1);
scanf("%d",&st[i]);
printf("\n Enter blocksize of File%d(in bytes)::",i+1);
scanf("%d",&b[i]);
   }
for(i=0;i<n;i++)
b1[i]=(sz[i]*1024)/b[i];
for(i=0;i<n;i++)
   {
for(j=0;j<b1[i];j++)
blocks[i][j]=st[i]+j;
   }
do
   {
```

```
printf("\nEnter the Filename ::");
scanf("%s",S);
for(i=0;i<n;i++)
        {
if(strcmp(S,F[i])==0)
            {
printf("\nFname\tStart\tNblocks\tBlocks\n");
printf("\n---------------------------------------------\n");
printf("\n%s\t%d\t%d\t",F[i],st[i],b1[i]);
for(j=0;j<b1[i];j++)
printf("%d->",blocks[i][j]);
            }

        }
printf("\n---------------------------------------------\n");
printf("\nDo U want to continue ::(Y:n)");
scanf("%d",&ch);
if(ch!=1)
break;
}while(1);
}
```

OUTPUT:

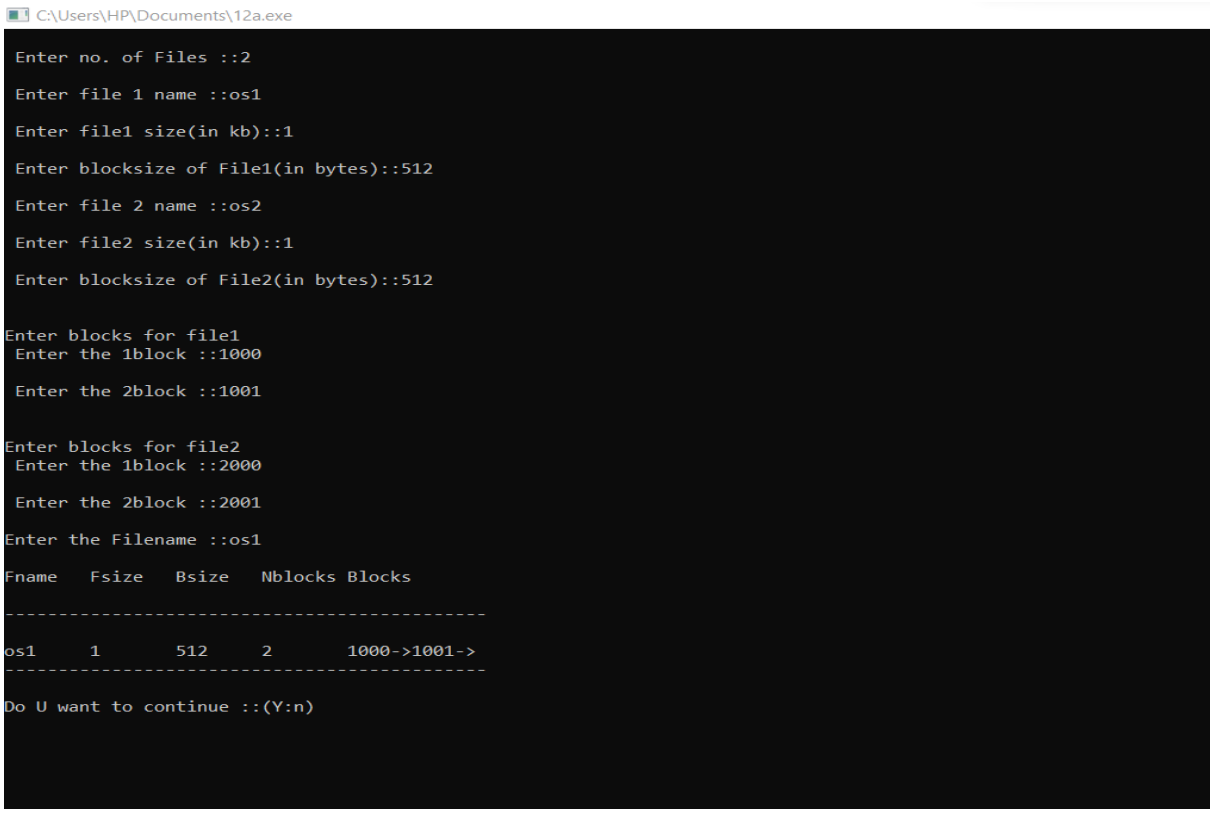

C:\Users\HP\Documents\12a.exe
Enter no. of Files ::2
Enter file 1 name ::os1
Enter file1 size(in kb)::20
Enter Starting block of 1::2
Enter blocksize of File1(in bytes)::500
Enter file 2 name ::os2
Enter file2 size(in kb)::10
Enter Starting block of 2::3
Enter blocksize of File2(in bytes)::300
Enter the Filename ::os2
Fname Start Nblocks Blocks
os2 3 34 3->4->5->6->7->8->9->10->11->12->13->14->15->16->17->18->19->20->21->22->23->24->25->26->27->28->29->30->31->32->33->34->35->36->
Do U want to continue ::(Y:n)

Task 12b: To implement indexed file allocation method.

```
#include<stdio.h>
#include<string.h>
int n;
void main()
{
   int b[20],b1[20],i,j,blocks[20][20],sz[20];
char F[20][20],S[20],ch;
printf("\n Enter no. of Files ::");
scanf("%d",&n);
for(i=0;i<n;i++)
   {
printf("\n Enter file %d name ::",i+1);
scanf("%s",&F[i]);
printf("\n Enter file%d size(in kb)::",i+1);
scanf("%d",&sz[i]);
printf("\n Enter blocksize of File%d(in bytes)::",i+1);
scanf("%d",&b[i]);
   }
for(i=0;i<n;i++)
   {
b1[i]=(sz[i]*1024)/b[i];
printf("\n\nEnter blocks for file%d",i+1);
for(j=0;j<b1[i];j++)
      {
printf("\n Enter the %dblock ::",j+1);
scanf("%d",&blocks[i][j]);
      }
   }
do
   {
printf("\nEnter the Filename ::");
scanf("%s",&S);
```

```
for(i=0;i<n;i++)
        {
if(strcmp(F[i],S)==0)
            {
printf("\nFname\tFsize\tBsize\tNblocks\tBlocks\n");
printf("\n-----------------------------------------\n");
printf("\n%s\t%d\t%d\t%d\t",F[i],sz[i],b[i],b1[i]);
for(j=0;j<b1[i];j++)
printf("%d->",blocks[i][j]);
            }
        }
printf("\n-----------------------------------------\n");
printf("\nDo U want to continue ::(Y:n)");

scanf("%d",&ch);
}while(ch!=0);
}
```

OUTPUT:



Task 12c: To implement linked file allocation method.

```
#include<stdio.h>
#include<string.h>
int n;
void main()
{
int b[20],b1[20],i,j,blocks[20][20],sz[20];
char F[20][20],S[20],ch;
int sb[20],eb[20],x;
printf("\n Enter no. of Files ::");
scanf("%d",&n);
for(i=0;i<n;i++)
{
printf("\n Enter file %d name ::",i+1);
scanf("%s",&F[i]);
printf("\n Enter file%d size(in kb)::",i+1);
scanf("%d",&sz[i]);
printf("\n Enter blocksize of File%d(in bytes)::",i+1);
scanf("%d",&b[i]);
}
for(i=0;i<n;i++)
{
b1[i]=(sz[i]*1024)/b[i];
printf("\n Enter Starting block of file%d::",i+1);
scanf("%d",&sb[i]);
```

```
printf("\n Enter Ending block of file%d::",i+1);
scanf("%d",&eb[i]);
printf("\nEnter blocks for file%d::\n",i+1);
for(j=0;j<b1[i]-2;)
{
printf("\n Enter the %dblock ::",j+1);
scanf("%d",&x);
if(x>sb[i]&&x<eb[i])
{
blocks[i][j]=x;
j++;
}
else
printf("\n Invalid block::");
}
}
do
{
printf("\nEnter the Filename ::");
scanf("%s",&S);
for(i=0;i<n;i++)
{
if(strcmp(F[i],S)==0)
{
printf("\nFname\tFsize\tBsize\tNblocks\tBlocks\n");
```

```
printf("\n-----------------------------------------\n");
printf("\n%s\t%d\t%d\t%d\t",F[i],sz[i],b[i],b1[i]);
printf("%d->",sb[i]);
for(j=0;j<b1[i]-2;j++)
printf("%d->",blocks[i][j]);
printf("%d->",eb[i]);
}
}
printf("\n-----------------------------------------\n");
printf("\nDo U want to continue (Y:n)::");
scanf("%d",&ch);
}while(ch!=0);
}
```

OUTPUT:

C:\Users\HP\Documents\12a.exe

```
 Enter no. of Files ::2
 Enter file 1 name ::os1
 Enter file1 size(in kb)::1
 Enter blocksize of File1(in bytes)::512
 Enter file 2 name ::os2
 Enter file2 size(in kb)::1
 Enter blocksize of File2(in bytes)::1024
 Enter Starting block of file1::1100
 Enter Ending block of file1::1600
Enter blocks for file1::
 Enter Starting block of file2::2200
 Enter Ending block of file2::2500
Enter blocks for file2::
Enter the Filename ::os1
Fname   Fsize   Bsize   Nblocks Blocks
-----------------------------------------------
os1     1       512     2       1100->1600->
-----------------------------------------------
Do U want to continue (Y:n)::
```