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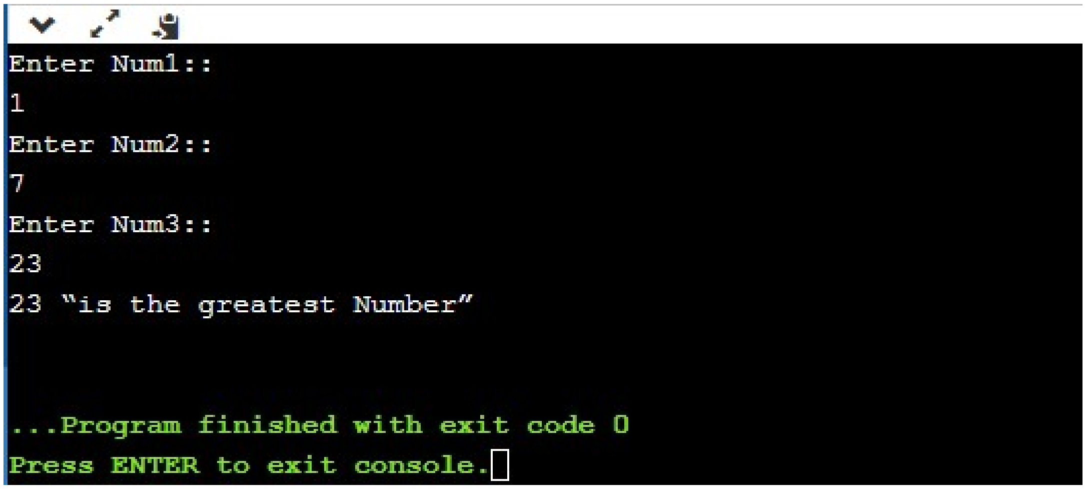
**AP18110010153**

**CSE-C**

# OS LAB

## 1.Write a script to find the greatest of three numbers (numbers passed as command line parameters)

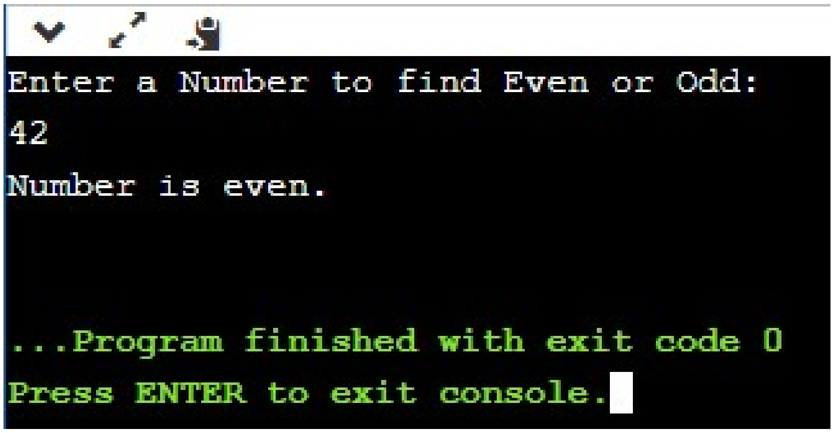
```
echo "Enter Num1::"

read num1

echo "Enter Num2::"

read num2

echo "Enter Num3::"

read num3

if [ $num1 -gt $num2 ] && [ $num1 -gt $num3 ]

then

echo $num1 “is the greatest Number”

elif [ $num2 -gt $num1 ] && [ $num2 -gt $num3 ]

then

echo $num2 “is the greatest Number”

else

echo $num3 “is the greatest Number”

fi
```



```
Enter Num1::
1
Enter Num2::
7
Enter Num3::
23
23 "is the greatest Number"


...Program finished with exit code 0
Press ENTER to exit console.
```

## 2. Write a script to check whether the given no. is even/odd

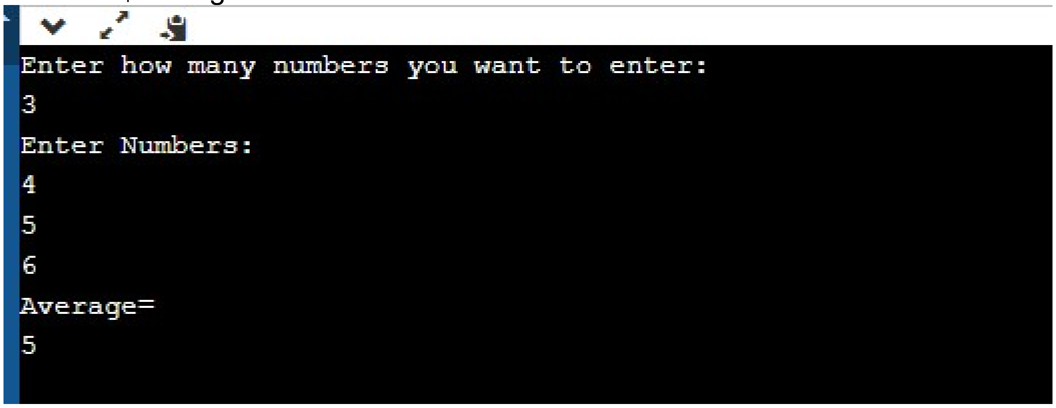
```
echo "Enter a Number to find Even or Odd: "
read num
if [ $((num%2)) -eq 0 ]
then
echo "Number is even."
else
echo "Number is odd."
fi
```



```
Enter a Number to find Even or Odd:
42
Number is even.


...Program finished with exit code 0
Press ENTER to exit console.
```

### 3. Write a script to calculate the average of n numbers.

```
echo "Enter Size:"
read N
i=1
sum=0
echo "Enter Numbers:"
while [ $i -le $N ]
do
  read num
  sum=$((sum + num))
  i=$((i + 1))
done
average= expr $sum / $N
echo $average
```

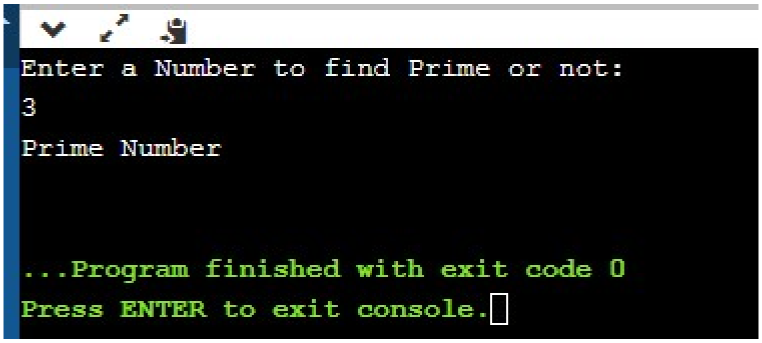


```
Enter how many numbers you want to enter:
3
Enter Numbers:
4
5
6
Average=
5
```

### 4. Write a script to check whether the given number is prime or not.

```
echo "Enter a Number to find Prime or not: "

read number

i=2

f=0

while test $i -le `expr $number / 2`

do

if test `expr $number % $i` -eq 0

then

f=1
```

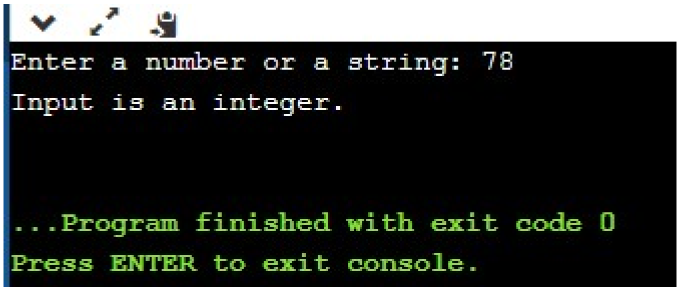
```
fi
i=`expr $i + 1`
done
if test $f -eq 1
then
echo "Not a Prime Number"
else
echo "Prime Number"
fi
```



```
Enter a Number to find Prime or not:
3
Prime Number


...Program finished with exit code 0
Press ENTER to exit console.
```

## 5. Write a script to check whether the given input is a number or a string.

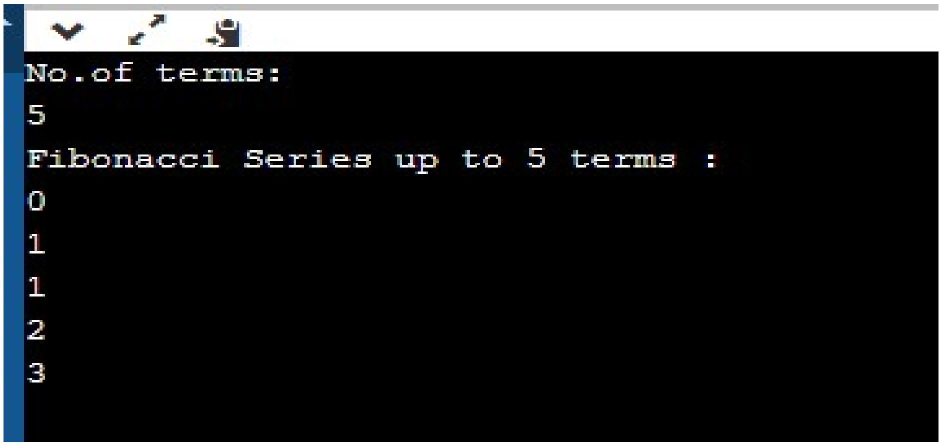
```
read -p "Enter a number or a string: " input
if [[ $input =~ ^[+-]?[0-9]+$ ]]; then
echo "Input is an integer."
elif [[ $input =~ ^[+-]?[0-9]+\.$ ]]; then
echo "Input is a string."
else
echo "Input is a string."
Fi
```



```
Enter a number or a string: 78
Input is an integer.


...Program finished with exit code 0
Press ENTER to exit console.
```

## 6. Write a script to print the Fibonacci series up to n terms

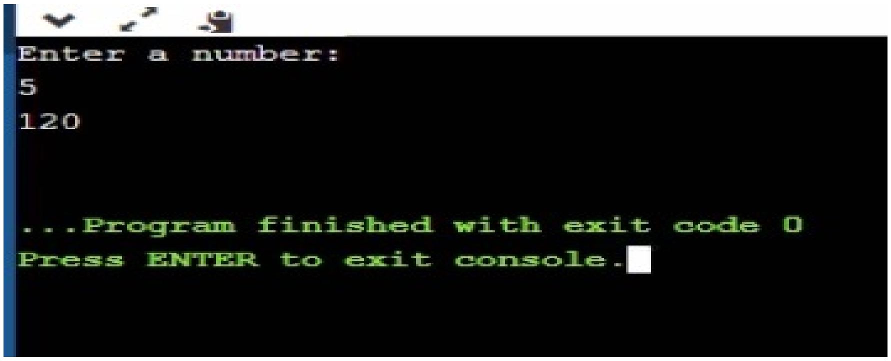
```
echo "No.of terms:"
read n
a=0
b=1
i=2
echo "Fibonacci Series up to $n terms :"
echo "$a"
echo "$b"
while [ $i -lt $n ]
do
i=`expr $i + 1 `
c=`expr $a + $b `
echo "$c"
a=$b
b=$c
done
```



```
No.of terms:
5
Fibonacci Series up to 5 terms :
0
1
1
2
3
```

## 7. Write a script to calculate the factorial of a given number

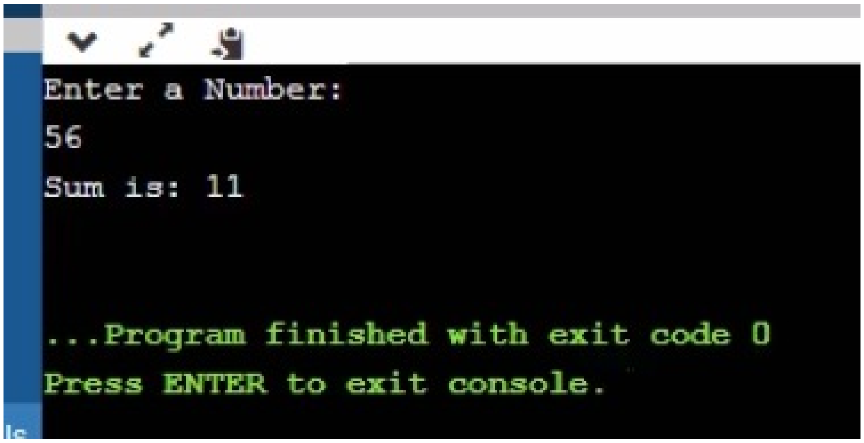
```
  echo "Enter a number:"

read number

factorial=1

while [ $number -gt 1 ]

do

factorial=$((factorial * number))

number=$((number - 1))

done

echo $factorial
```



```
Enter a number:
5
120


...Program finished with exit code 0
Press ENTER to exit console.
```

## 8. Write a script to calculate the sum of digits of the given number

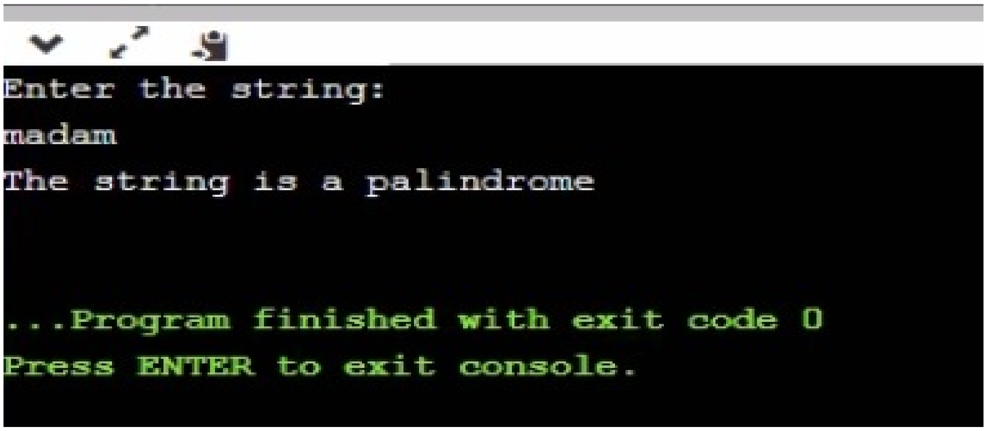
```
echo "Enter a Number:"
read n
temp=$n
s=0
sum=0
while [ $n -gt 0 ]
   do
      s=$(( $n % 10 ))
      n=$(( $n / 10 ))
      sum=$(( $sum + $s ))
   done
echo "Sum is: $sum"
```



```
Enter a Number:
56
Sum is: 11


...Program finished with exit code 0
Press ENTER to exit console.
```

## 9. Write a script to check whether the given string is a palindrome

```
echo "Enter the string:"
read str
len=$(echo "$str" | wc -c)
while [ $len -gt 0 ]
do
ch=$(echo "$str" | cut -c $len)
s1=$s1$ch
len=`expr $len - 1`
done
if [ $s1 != $str ]
then
echo "The string is not a palindrome"
else
echo "The string is a palindrome"
fi
```

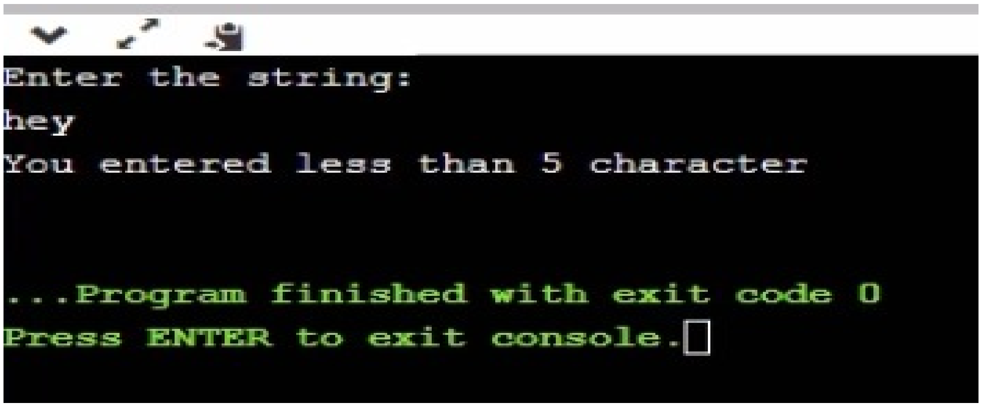


```
Enter the string:
madam
The string is a palindrome


...Program finished with exit code 0
Press ENTER to exit console.
```

## 10. Write a shell script that accepts a string from the terminal and echo a suitable message if it

**doesn’t have at least 5 characters including the other symbols.**

```
echo "Enter the string:"

read str

length=`expr $str | wc -c`

length=`expr $length - 1`

if [ $length -lt 5 ]

then

    echo "You entered less than 5 character"

fi
```



```
Enter the string:
hey
You entered less than 5 character


...Program finished with exit code 0
Press ENTER to exit console.
```

# CPU Scheduling Algorithms

## 11. First Come First Serve

```
 #include <stdio.h>

int main()

{

   float avgtat=0.0,avgwt=0.0;

   int n;

   printf("Enter number of processes::");

   scanf("%d",&n);
```

```
int a[n][100];
for(int i=0;i<n;i++){
    for(int j=0;j<3;j++){
        if(j==0){
            printf("Enter process no::");
            scanf("%d",&a[i][j]);
        }
        else if(j==1){
            printf("Enter Arrival Time ::");
            scanf("%d",&a[i][j]);
        }
        else if(j==2){
            printf("Enter Burst Time ::");
            scanf("%d",&a[i][j]);
        }
    }
}

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

        for (int j = i + 1; j < n; j++)
        {
```

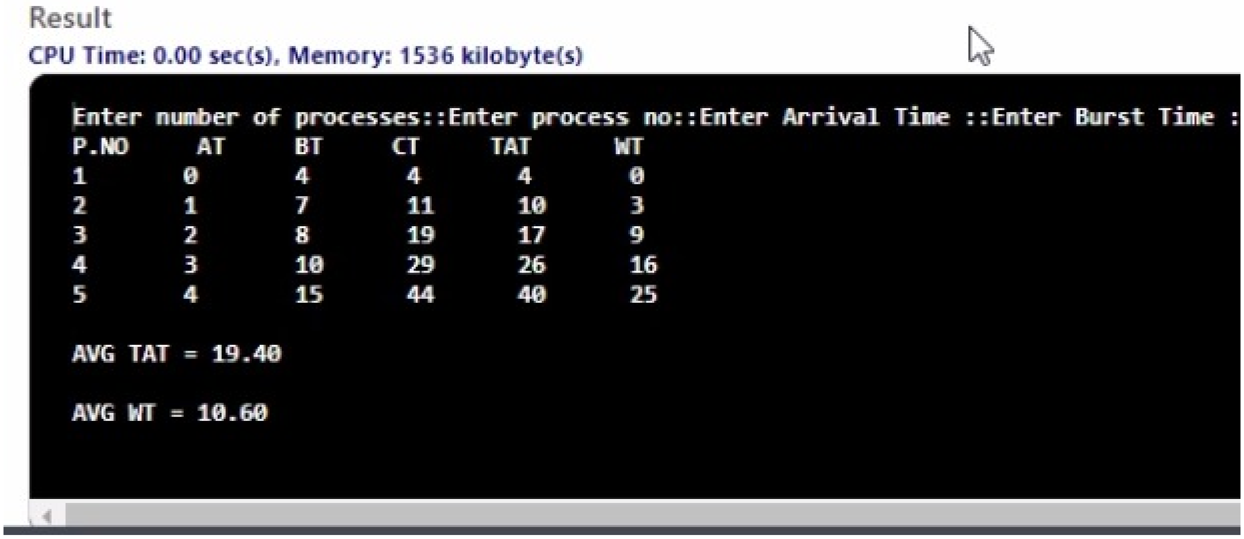
```
                           if (a[i][1] > a[j][1])
                           {

                               int temp1 =  a[i][0];
                               a[i][0] = a[j][0];
                               a[j][0] = temp1;

                               int temp2 =  a[i][1];
                               a[i][1] = a[j][1];
                               a[j][1] = temp2;

                               int temp3 =  a[i][2];
                               a[i][2] = a[j][2];
                               a[j][2] = temp3;
}

                       }

                   }

               for(int i=0;i<n;i++){
                   if(i==0){

                       a[i][3]=(a[i][1]+a[i][2]);
```

```
    }
    else{
        a[i][3]=(a[i-1][3]+a[i][2]);
    }
}
for(int i=0;i<n;i++){
    a[i][4]=(a[i][3]-a[i][1]);
    avgtat+=(float)a[i][4];
}
for(int i=0;i<n;i++){
    a[i][5]=(a[i][4]-a[i][2]);
    avgwt+=(float)a[i][5];
}
printf("P.NO     AT     BT     CT     TAT      WT\n");
 for(int i=0;i<n;i++){
    for(int j=0;j<6;j++){

        printf("%d\t",a[i][j]);
    }
    printf("\n");
}
printf("\nAVG TAT = %.2f\n",(avgtat/n));
printf("\nAVG WT = %.2f\n",(avgwt/n));
```

```
                    return 0;  }
```

## 12. Shortest Job First

```
#include <stdio.h>


int main()
{
   int n;
   printf("Enter no of processes ::");
   scanf("%d",&n);
   int sjf[n][100];
   for(int i=0;i<n;i++){
      for(int j=0;j<3;j++){
          if(j==0){
             printf("Enter process no::");
             scanf("%d",&sjf[i][j]);
         }
```



Result

CPU Time: 0.00 sec(s), Memory: 1536 kilobyte(s)

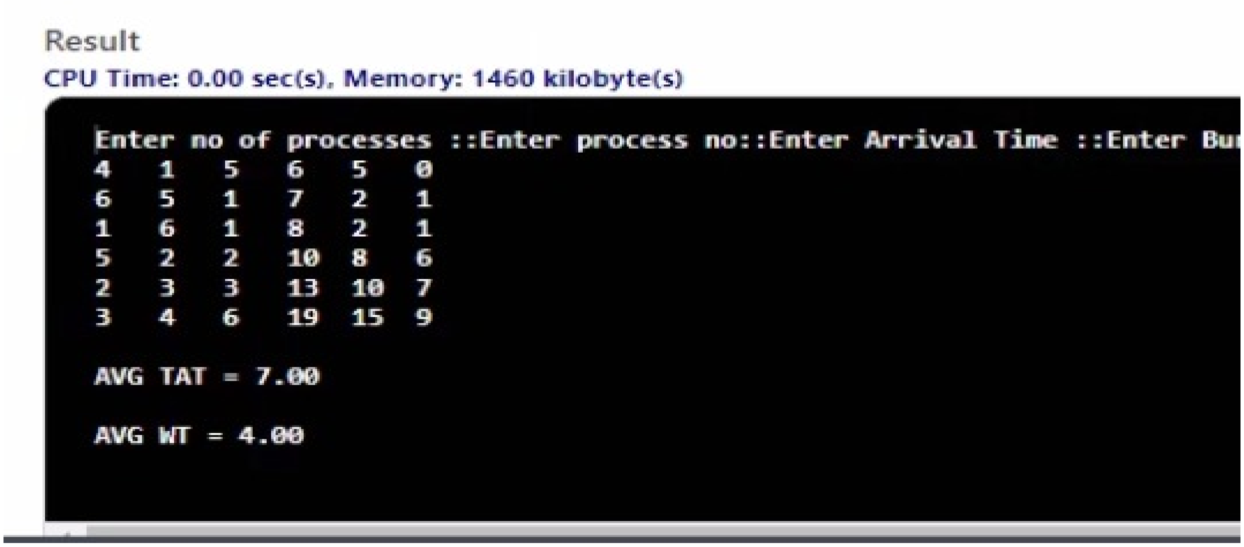
```
Enter number of processes::Enter process no::Enter Arrival Time ::Enter Burst Time :
P.NO     AT      BT      CT      TAT      WT
1        0       4       4       4        0
2        1       7       11      10       3
3        2       8       19      17       9
4        3       10      29      26       16
5        4       15      44      40       25

AVG TAT = 19.40

AVG WT = 10.60
```

```
        else if(j==1){
            printf("Enter Arrival Time ::");
            scanf("%d",&sjf[i][j]);
        }
        else if(j==2){
            printf("Enter Burst Time ::");
            scanf("%d",&sjf[i][j]);
        }

    }
    sjf[i][3]=-100;
}
//Finding Arrival time 1
int k=100;
 for (int i = 0; i < n; i++)
    {


                if(sjf[i][1]<k){
                k=sjf[i][1];
                int temp1 =  sjf[0][0];
                sjf[0][0] = sjf[i][0];
                sjf[i][0] = temp1;
        int temp2 =  sjf[0][1];
        sjf[0][1] = sjf[i][1];
        sjf[i][1] = temp2;

        int temp3 =  sjf[0][2];
        sjf[0][2] = sjf[i][2];
        sjf[i][2] = temp3;
        }



  }
//Sorting
for (int i = 1; i < n; i++)
  {

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

      if (sjf[i][2] > sjf[j][2] )
      {

        int temp1 =  sjf[i][0];
        sjf[i][0] = sjf[j][0];
        sjf[j][0] = temp1;
```

```
                int temp2 =  sjf[i][1];
                sjf[i][1] = sjf[j][1];
                sjf[j][1] = temp2;

                int temp3 =  sjf[i][2];
                sjf[i][2] = sjf[j][2];
                sjf[j][2] = temp3;





            }


        }


    }


for (int j=1; j < (n-1); j++)
        {

            if (sjf[j][2]==sjf[j+1][2] )
            {
```

```
       if(sjf[j][1]>sjf[j+1][1]){
        int temp1 =  sjf[j][0];
        sjf[j][0] = sjf[j+1][0];
        sjf[j+1][0] = temp1;

        int temp2 =  sjf[j][1];
        sjf[j][1] = sjf[j+1][1];
        sjf[j+1][1] = temp2;

        int temp3 =  sjf[j][2];
        sjf[j][2] = sjf[j+1][2];
        sjf[j+1][2] = temp3;
       }




    }
}
int cnt=0,prev=0;
sjf[0][3]=(sjf[0][1]+sjf[0][2]);
while(1){
    for(int i=1;i<n;i++){
```

```
                if(sjf[i][1]<=sjf[prev][3] && sjf[i][3]==-100){
                    sjf[i][3]=(sjf[prev][3]+sjf[i][2]);
                    prev=i;
                    cnt++;
                    break;
                }

            }
            if(cnt==(n-1)){
                    break;
                }
        }

float avgtat=0,avgwt=0;
     for(int i=0;i<n;i++){
    sjf[i][4]=(sjf[i][3]-sjf[i][1]);
    avgtat+=(float)sjf[i][4];
}
for(int i=0;i<n;i++){
    sjf[i][5]=(sjf[i][4]-sjf[i][2]);
    avgwt+=(float)sjf[i][5];
}
printf("P.NO     AT     BT     CT     TAT      WT\n");
 for(int i=0;i<n;i++){
        for(int j=0;j<6;j++){


            printf("%d\t",sjf[i][j]);
        }
        printf("\n");
    }
    printf("\nAVG TAT = %.2f\n",(avgtat/n));
    printf("\nAVG WT = %.2f\n",(avgwt/n));


    return 0;
}
```



Result

CPU Time: 0.00 sec(s), Memory: 1460 kilobyte(s)

```
Enter no of processes ::Enter process no::Enter Arrival Time ::Enter Bu
4   1   5   6   5   0
6   5   1   7   2   1
1   6   1   8   2   1
5   2   2   10  8   6
2   3   3   13  10  7
3   4   6   19  15  9

AVG TAT = 7.00

AVG WT = 4.00
```

# 33. Priority based scheduling

```
#include <stdio.h>


int main()
```

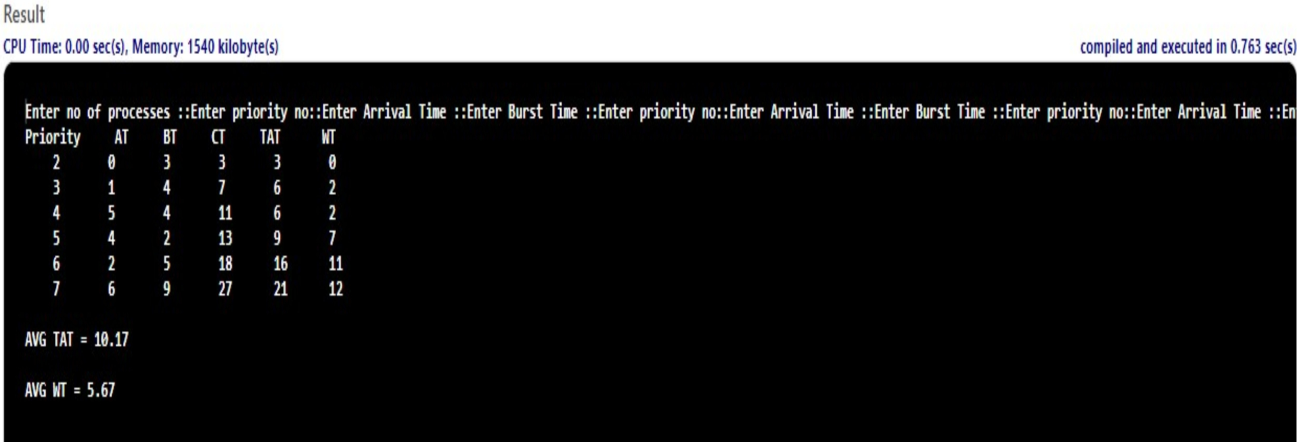
```
{
    int n;
    printf("Enter no of processes ::");
    scanf("%d",&n);
    int priority[n][100];
    for(int i=0;i<n;i++){
        for(int j=0;j<3;j++){
             if(j==0){
                printf("Enter priority no::");
                scanf("%d",&priority[i][j]);
            }
            else if(j==1){
                printf("Enter Arrival Time ::");
                scanf("%d",&priority[i][j]);
            }
            else if(j==2){
                printf("Enter Burst Time ::");
                scanf("%d",&priority[i][j]);
            }

        }
        priority[i][3]=-100;
    }
    //Finding Arrival time 1
```

```
int k=100;
 for (int i = 0; i < n; i++)
   {



             if(priority[i][1]<k){
             k=priority[i][1];
             int temp1 =  priority[0][0];
             priority[0][0] = priority[i][0];
             priority[i][0] = temp1;

             int temp2 =  priority[0][1];
             priority[0][1] = priority[i][1];
             priority[i][1] = temp2;

             int temp3 =  priority[0][2];
             priority[0][2] = priority[i][2];
             priority[i][2] = temp3;
             }



   }
//Sorting
for (int i = 1; i < n; i++)
```

```
{

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

        if (priority[i][0] > priority[j][0] )
        {

            int temp1 =  priority[i][0];
            priority[i][0] = priority[j][0];
            priority[j][0] = temp1;

            int temp2 =  priority[i][1];
            priority[i][1] = priority[j][1];
            priority[j][1] = temp2;

            int temp3 =  priority[i][2];
            priority[i][2] = priority[j][2];
            priority[j][2] = temp3;
```

```
         }


      }


   }

for(int i=0;i<n;i++){
   if(i==0){


      priority[i][3]=(priority[i][1]+priority[i][2]);
   }
   else{
      priority[i][3]=(priority[i-1][3]+priority[i][2]);
   }
}



float avgtat=0,avgwt=0;
    for(int i=0;i<n;i++){
   priority[i][4]=(priority[i][3]-priority[i][1]);
   avgtat+=(float)priority[i][4];
}
for(int i=0;i<n;i++){
   priority[i][5]=(priority[i][4]-priority[i][2]);
```

```
         avgwt+=(float)priority[i][5];
      }
      printf("\nPriority     AT     BT     CT     TAT      WT\n");
       for(int i=0;i<n;i++){
           printf("\t");
         for(int j=0;j<6;j++){


             printf("%d\t\t",priority[i][j]);
         }
         printf("\n");
      }
      printf("\nAVG TAT = %.2f\n",(avgtat/n));
      printf("\nAVG WT = %.2f\n",(avgwt/n));


      return 0;
   }
```



Result

CPU Time: 0.00 sec(s), Memory: 1540 kilobyte(s)

compiled and executed in 0.763 sec(s)

```
Enter no of processes ::Enter priority no::Enter Arrival Time ::Enter Burst Time ::Enter priority no::Enter Arrival Time ::Enter Burst Time ::Enter priority no::Enter Arrival Time ::En
Priority    AT     BT     CT     TAT     WT
    2       0      3      3      3       0
    3       1      4      7      6       2
    4       5      4      11     6       2
    5       4      2      13     9       7
    6       2      5      18     16      11
    7       6      9      27     21      12

AVG TAT = 10.17

AVG WT = 5.67
```

# 34.Round Robin

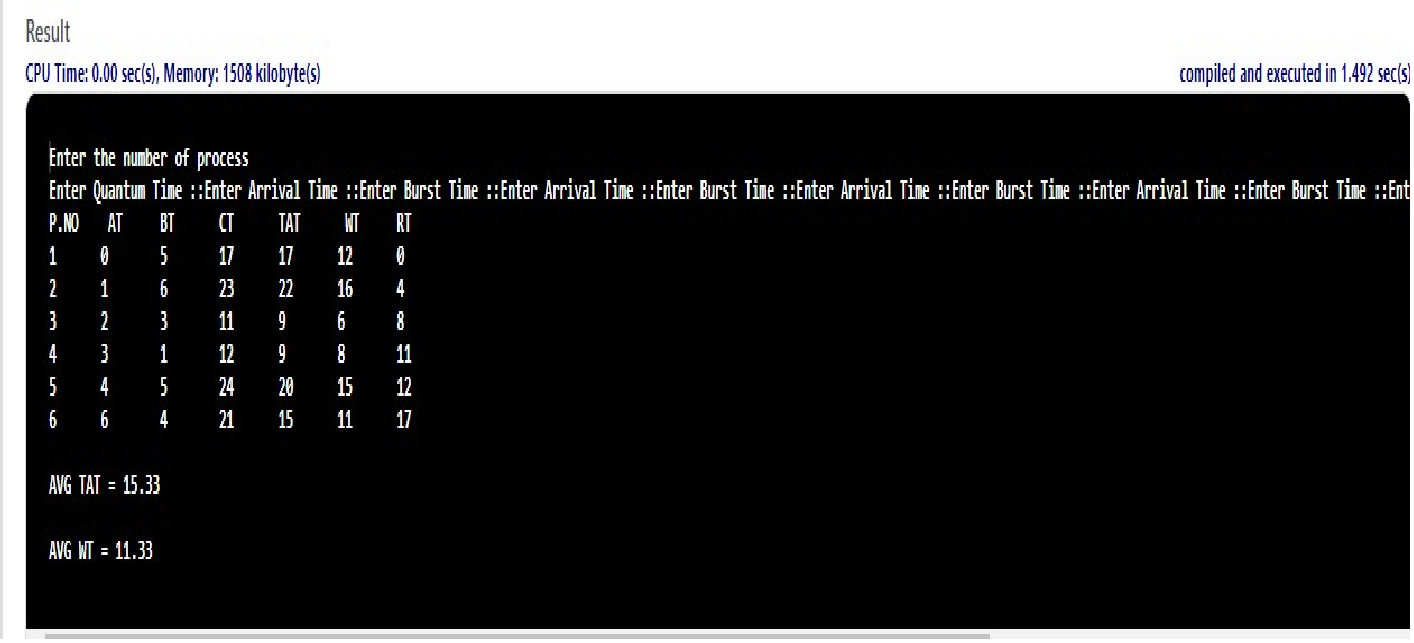
```
#include<stdio.h>

#include<math.h>

#include<string.h>


int find(int arr[],int val){


    for(int i=0;i<10;i++){

        if(arr[i]==val){

            return 1;

        }


    }

     return 0;

}

int main(){

           int n,max=0,QuantumTime,time=0,front=0,back=0;


           printf("Enter the number of process \n");

           scanf("%d",&n);

           printf("Enter Quantum Time ::");

           scanf("%d",&QuantumTime);

           int ArrivalAndBurst[1000][1000];

           for(int i=0;i<n;i++){
```

```
for(int j=0;j<3;j++){
    if(j==0){
                                       ArrivalAndBurst[i][j]=(i+1);
   }
   else if(j==1){
      printf("Enter Arrival Time ::");
      scanf("%d",&ArrivalAndBurst[i][j]);



             if(i==0){
                                       time+=ArrivalAndBurst[i][j];
                              }


               }


   else if(j==2){
      printf("Enter Burst Time ::");
      scanf("%d",&ArrivalAndBurst[i][j]);
                                       max+=ArrivalAndBurst[i][j];
                     ArrivalAndBurst[i][7]=ArrivalAndBurst[i][j];


   }
                     ArrivalAndBurst[i][3]=-100;
                     ArrivalAndBurst[i][6]=-100;
```

```
           }


   }
        max+=time;
        int ProcessQueue[1000],ind;
        while(max!=time){
             if(front==0 && back==0){
                ind=0;
             }
             else{
                ind=ProcessQueue[front++];
             }
             if(          ArrivalAndBurst[ind][6]==-100){
                ArrivalAndBurst[ind][6]=time;
             }


                        if(ArrivalAndBurst[ind][2]>=QuantumTime){
                                 ArrivalAndBurst[ind][2]-=QuantumTime;
                                 time+=QuantumTime;
                        }
                        else if(ArrivalAndBurst[ind][2]<QuantumTime &&
ArrivalAndBurst[ind][2]!=0){
                                 time+=ArrivalAndBurst[ind][2];
                                 ArrivalAndBurst[ind][2]=0;
```

```
                                }
                    if(ArrivalAndBurst[ind][2]==0 && ArrivalAndBurst[ind][3]==-100){
                                ArrivalAndBurst[ind][3]=time;
                    }
                    int limit=time;

                    for(int p=0;p<=time;p++){
                        if( find(ProcessQueue,p)==0 && p!=ind && p<n){
                            ProcessQueue[back++]=p;
                        }
                    }
                                if(ArrivalAndBurst[ind][2]!=0){
                                ProcessQueue[back++]=ind;
                                }




   }


   float avgtat=0,avgwt=0;
 for(int i=0;i<n;i++){
ArrivalAndBurst[i][4]=(ArrivalAndBurst[i][3]-ArrivalAndBurst[i][1]);
avgtat+=(float) ArrivalAndBurst[i][4];
                                ArrivalAndBurst[i][2]=ArrivalAndBurst[i][7];
```

```
  }


  for(int i=0;i<n;i++){
      ArrivalAndBurst[i][5]=(ArrivalAndBurst[i][4]-ArrivalAndBurst[i][2]);


                    avgwt+=(float) ArrivalAndBurst[i][5];
  }
printf("\nP.NO    AT     BT      CT      TAT      WT     RT\n");
   for(int i=0;i<n;i++){
      for(int j=0;j<7;j++){


          printf("%d\t   ",ArrivalAndBurst[i][j]);
      }
     printf("\n");
  }
  printf("\nAVG TAT = %.2f \n",(avgtat/n));
  printf("\nAVG WT = %.2f \n",(avgwt/n));
         }
```



Result

CPU Time: 0.00 sec(s), Memory: 1508 kilobyte(s)

compiled and executed in 1.492 sec(s)

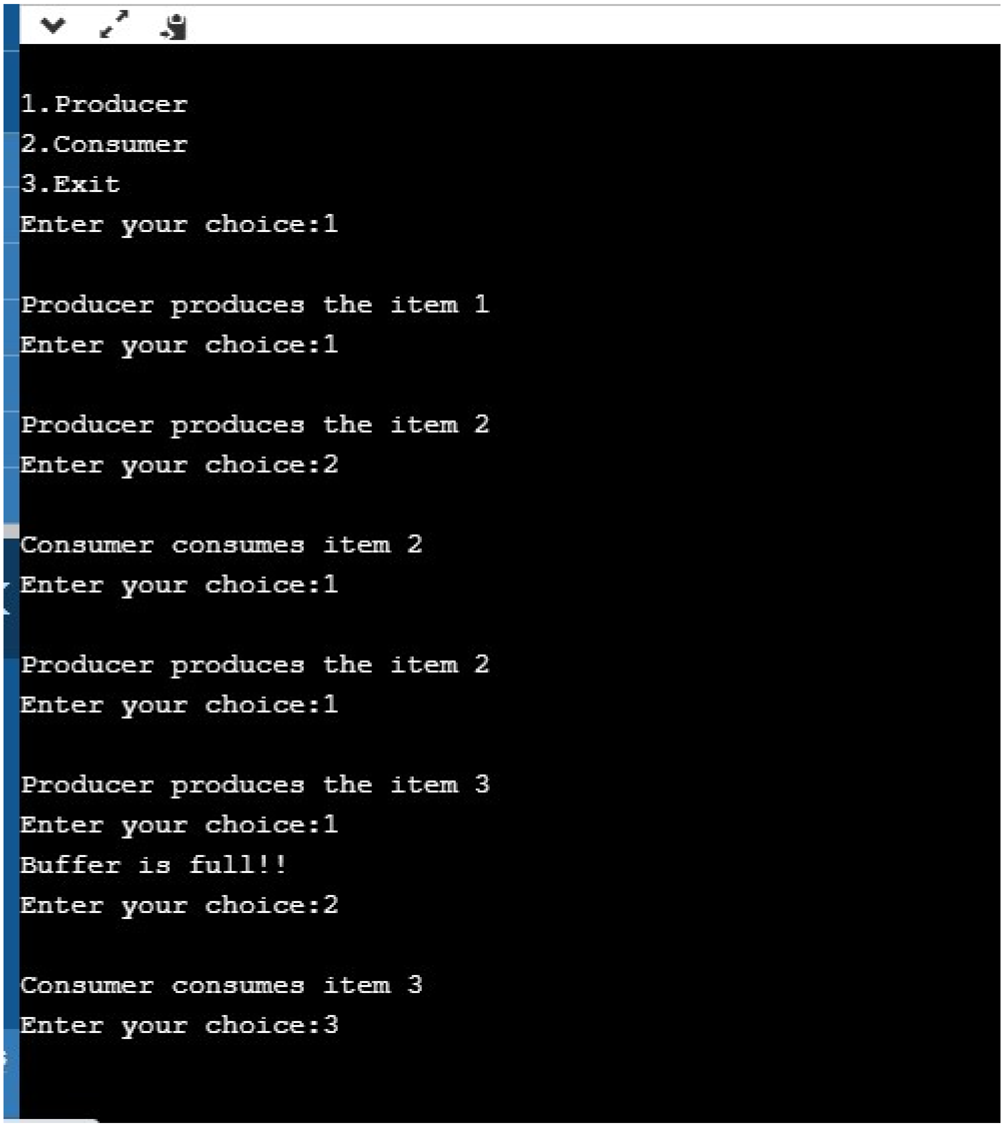
```
Enter the number of process
Enter Quantum Time ::Enter Arrival Time ::Enter Burst Time ::Enter Arrival Time ::Enter Burst Time ::Enter Arrival Time ::Enter Burst Time ::Enter Arrival Time ::Enter Burst Time ::Ent
P.NO    AT      BT      CT      TAT     WT      RT
1       0       5       17      17      12      0
2       1       6       23      22      16      4
3       2       3       11      9       6       8
4       3       1       12      9       8       11
5       4       5       24      20      15      12
6       6       4       21      15      11      17

AVG TAT = 15.33

AVG WT = 11.33
```

## 35. write a C program to implement the Producer &amp; consumer Problem using Semaphore.

```
#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);
}
```



```
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:1

Producer produces the item 2
Enter your choice:1

Producer produces the item 3
Enter your choice:1
Buffer is full!!
Enter your choice:2

Consumer consumes item 3
Enter your choice:3
```

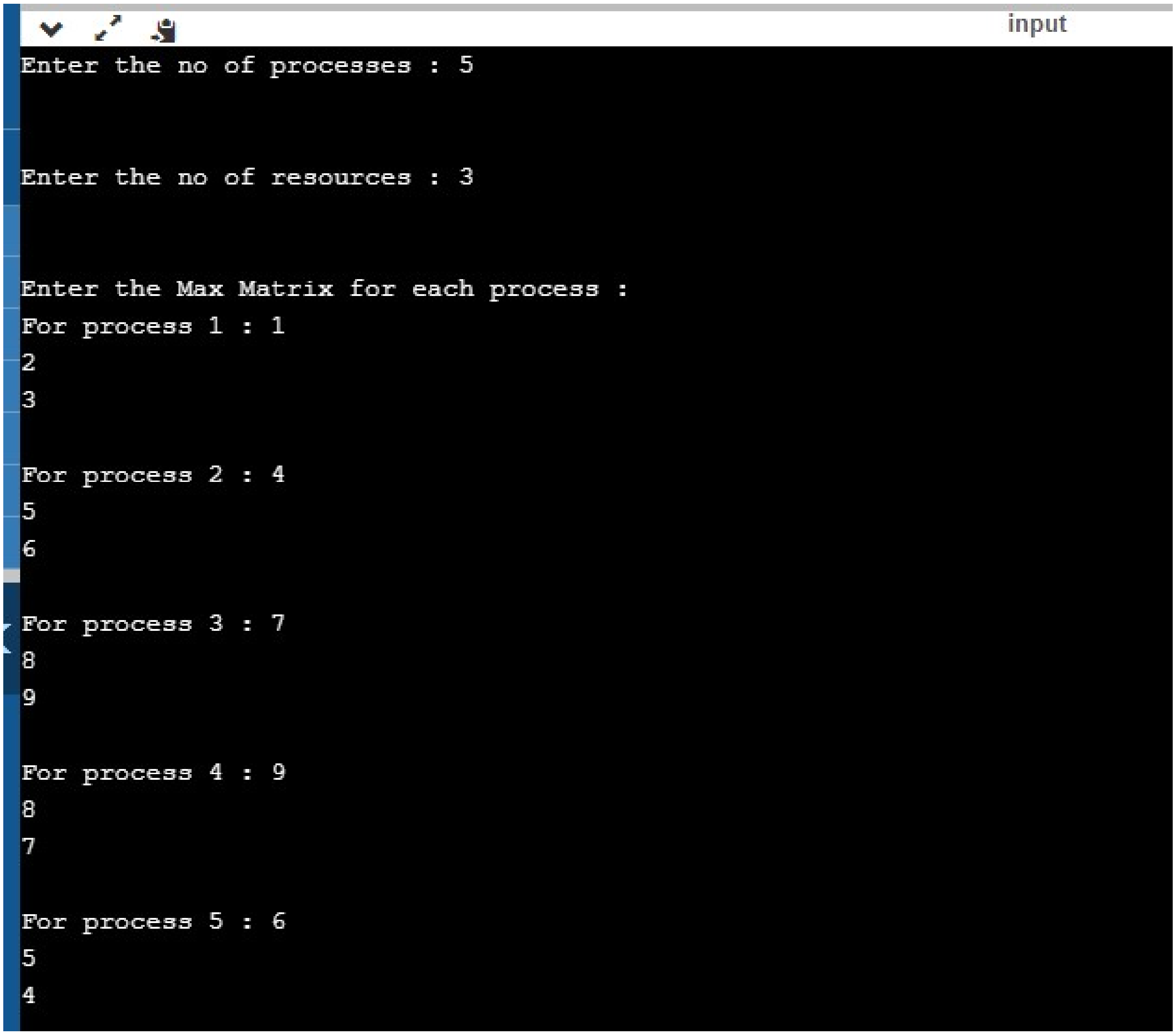
## 36. Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.

```
#include <stdio.h>

#include <stdlib.h>

int main()

{

   int Max[10][10], need[10][10], alloc[10][10], avail[10], completed[10],
safeSequence[10];

   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;


   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];

    do
    {
```

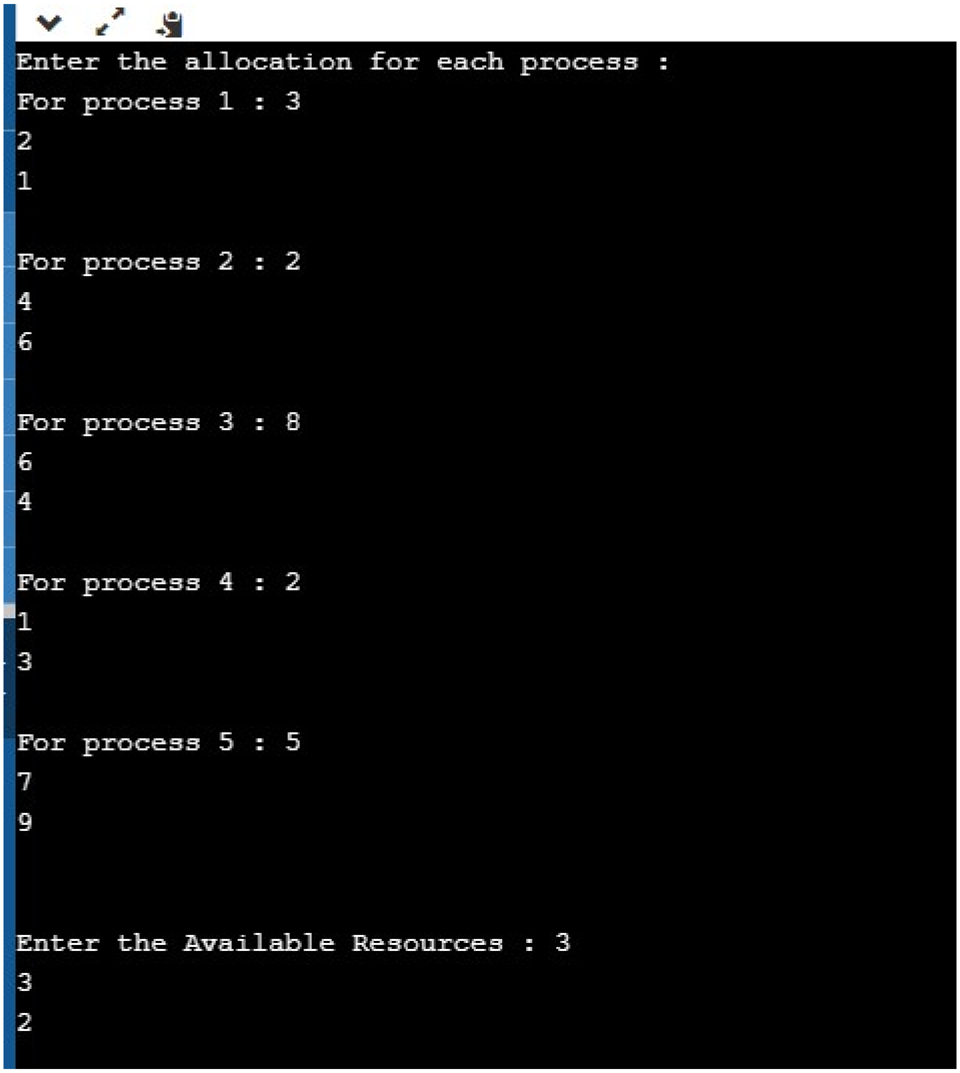
```
printf("\n Max matrix:\tAllocation matrix:\n");

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;

for(i = 0; i < p; i++)
{
    if(completed[i] == 0)//if not completed
    {
        process = i ;
        for(j = 0; j < r; j++)
        {
            if(avail[j] < need[i][j])
            {
                process = -1;
```

```
                    break;
                }
            }
        }
        if(process != -1)
            break;
    }

    if(process != -1)
    {
        printf("\nProcess %d runs to completion!", process + 1);
        safeSequence[count] = process + 1;
        count++;
        for(j = 0; j < r; j++)
        {
            avail[j] += alloc[process][j];
            alloc[process][j] = 0;
            Max[process][j] = 0;
            completed[process] = 1;
        }
    }
}
while(count != p && process != -1);
```

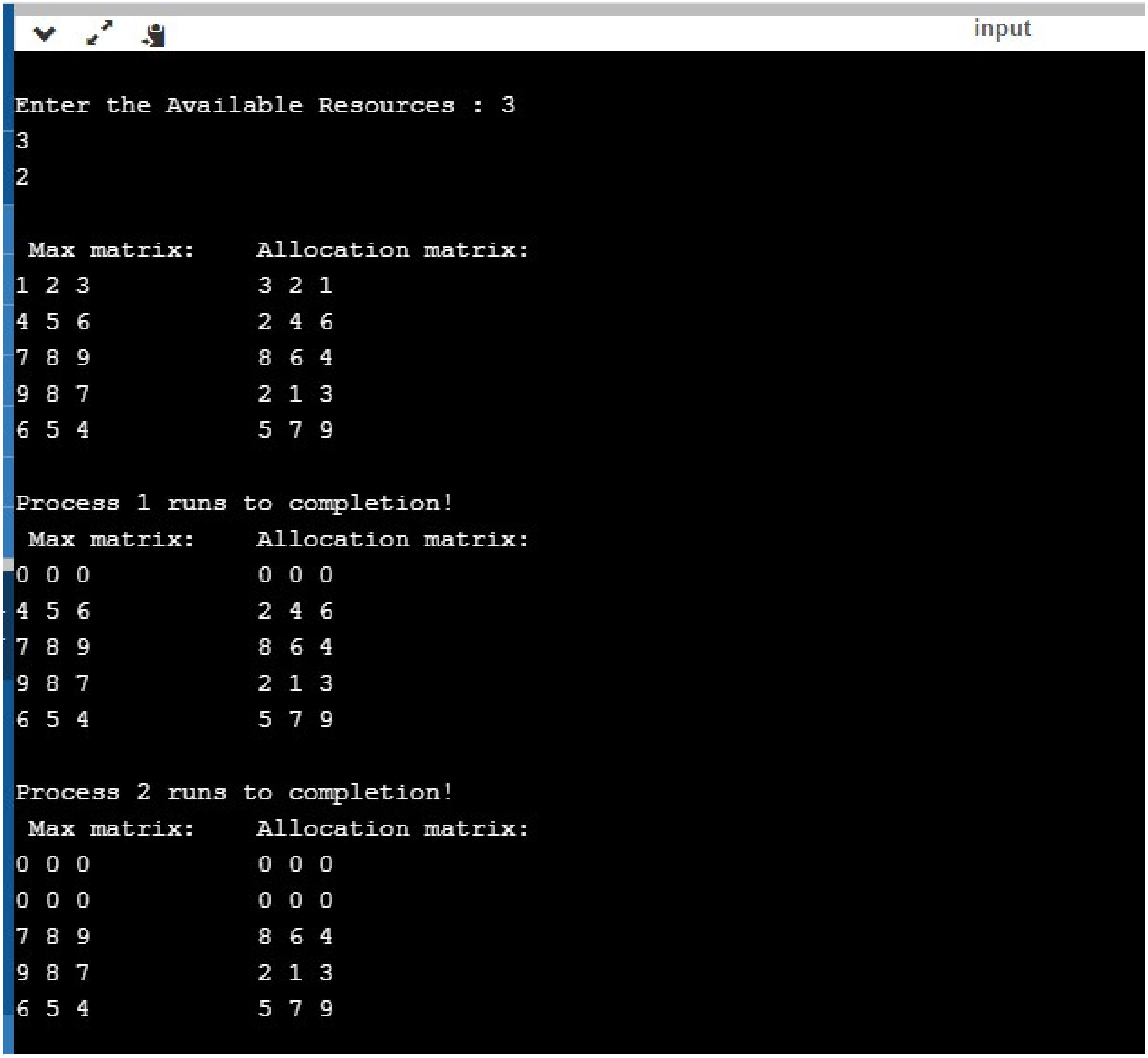
```
    if(count == p)
    {
      printf("\nThe system is in a safe state!!\n");
      printf("Safe Sequence : < ");
      for( i = 0; i < p; i++)
        printf("%d ", safeSequence[i]);
      printf(">\n");
    }
    else
      printf("\nThe system is in an unsafe state!!");

}
```



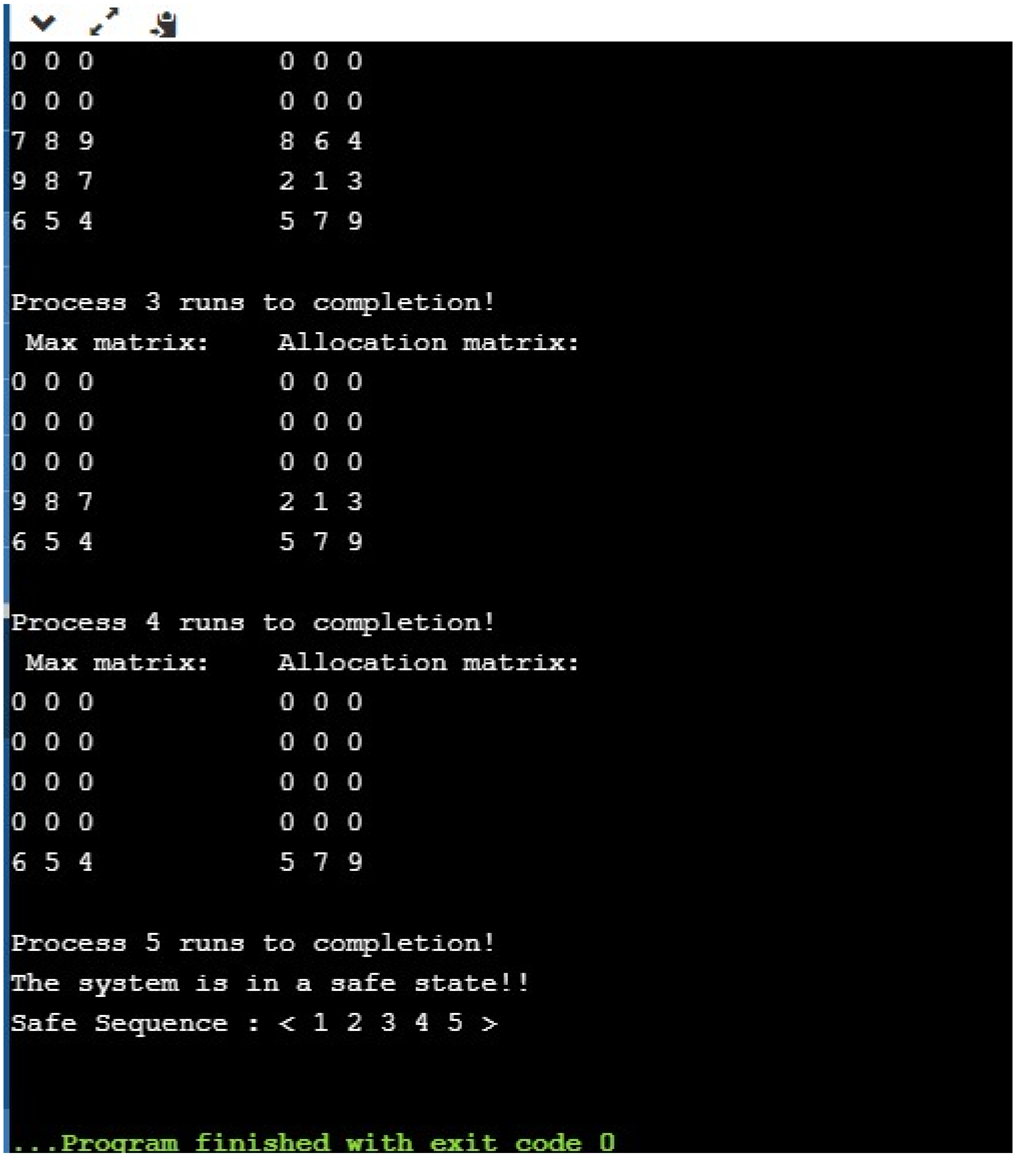
```
Enter the no of processes : 5


Enter the no of resources : 3


Enter the Max Matrix for each process :
For process 1 : 1
2
3

For process 2 : 4
5
6

For process 3 : 7
8
9

For process 4 : 9
8
7

For process 5 : 6
5
4
```



```
Enter the allocation for each process :
For process 1 : 3
2
1

For process 2 : 2
4
6

For process 3 : 8
6
4

For process 4 : 2
1
3

For process 5 : 5
7
9


Enter the Available Resources : 3
3
2
```



```
Enter the Available Resources : 3
3
2

 Max matrix:    Allocation matrix:
1 2 3           3 2 1
4 5 6           2 4 6
7 8 9           8 6 4
9 8 7           2 1 3
6 5 4           5 7 9

Process 1 runs to completion!
 Max matrix:    Allocation matrix:
0 0 0           0 0 0
4 5 6           2 4 6
7 8 9           8 6 4
9 8 7           2 1 3
6 5 4           5 7 9

Process 2 runs to completion!
 Max matrix:    Allocation matrix:
0 0 0           0 0 0
0 0 0           0 0 0
7 8 9           8 6 4
9 8 7           2 1 3
6 5 4           5 7 9
```



```
0 0 0           0 0 0
0 0 0           0 0 0
7 8 9           8 6 4
9 8 7           2 1 3
6 5 4           5 7 9

Process 3 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
9 8 7           2 1 3
6 5 4           5 7 9

Process 4 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
6 5 4           5 7 9

Process 5 runs to completion!
The system is in a safe state!!
Safe Sequence : < 1 2 3 4 5 >



...Program finished with exit code 0
```