OS EXPERIMENTS

EXPERIMENT NO: 01 **DATE:04/08/2023**

CPU SCHEDULING ALGORITHMS

AIM

To simulate following CPU scheduling algorithms to find turnaround time and waiting time :

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

ALGORITHM

- ### FCFS

1. Declare the variables
2. Declare the variable i,n as integer, totalwtime and total time is equal to zero
3. Get the value of btime[i]
4. Assign wtime[0] as zero and tatime[0] as btime[0] and inside the loop calculate waiting time and turnaround time.
5. Calculate total waiting time and total turnaround time and calculate average waiting time and turnaround time by dividing it by the total number of process
6. Print total waiting time, total turnaround time, average waiting time and average turnaround time
7. Stop the program

- ### SJF

1. Declare the variables
2. Declare the variable i,j as integer,totaltatime and totalwtime is equal to zero
3. Get the value of n and assign burst time for each process
4. Assign wtime[0] as zero and tatime[0] as btime[0] and inside the loop calculate wait time and turnaround time
5. Calculate total waiting time and total turnaround time and calculate average waiting time and average Turnaround time by dividing it by total number of process
6. Print total waiting time, total turnaround time, average waiting time, and average turnaround time
7. Stop the program

- ### ROUND ROBIN

1. Declare the variables
2. Declare the variable i,j as integer, totalwtime and totalttime is equal to zero
3. Get the number of processes n and time quantum
4. Inside the for loop get the value of burst time and arrival time
5. Check burst time of process is greater than time quantum or not
6. Calculate waiting time and turnaround time of processes
7. Calculate the total of waiting time and turnaround time and find average of waiting time and turnaround time by dividing it by number of processes
8. Stop the program

• PRIORITY

1. Declare the variables
2. Declare the variable i,j as integer,totaltatime and totalwtime is equal to zero
3. Get the value of n and assign burst time for each process
4. Assign wtime[0] as zero and tatime[0] as btime[0] and inside the loop calculate wait time and turnaround time
5. Calculate total waiting time and total turnaround time and calculate average waiting time and average turnaround time by dividing it by totalnumber of process
6. Print total waiting time, total turnaround time, average waiting time, and average turnaround time
7. Stop the program

PROGRAM CODE

```
#include<stdio.h>

#include<stdlib.h>

struct process

{

    int no,bt,at,tat,wt,ct,prior,id;

}p[20];

int ready,n,a,ct,b,t,i,j,q[50],f=-1,r=-1;

float sum_wt=0.0,sum_tat=0.0,avg_wt,avg_tat;

void sort(int n)

{

struct process temp;

for(i=0;i<n-1;i++)

{
 for(j=0;j<n-i-1;j++)

    {

    if(p[j].at>p[j+1].at)

    {

        temp=p[j];

        p[j]=p[j+1];

        p[j+1]=temp;

    }   }  }

}

void FCFS(){

int flag;
```

```
printf("\nEnter the number of processes : ");
scanf("%d",&n);
  for(i=0;i<n;i++)
  {
  printf("\nEnter arrival time and burst time of process P%d : ",i);
  scanf("%d%d",&p[i].at,&p[i].bt);

   p[i].no=i+1;
  }
  sort(n);
   p[0].ct=p[0].at+p[0].bt;
          for(i=1;i<n;i++)
          {
                  if(p[i].at>p[i-1].ct)
                  {
                          p[i].ct=p[i].at+p[i].bt;
                  }
                  else
                  {
                          p[i].ct=p[i-1].ct+p[i].bt;
                  }
}
```

```
for(i=0;i<n;i++)
    {
    p[i].tat=p[i].ct-p[i].at;
        p[i].wt=p[i].tat-p[i].bt;
sum_wt+=p[i].wt;
sum_tat+=p[i].tat;
}
avg_wt=sum_wt/n;
avg_tat=sum_tat/n;
printf("\nPROCESS\t ARRIVAL TIME \t BURST TIME \t TURNARROUND TIME
\t WAITING TIME\n");
for(i=0;i<n;i++)


{
printf("%d\t\t%d\t\t%d\t\t%d\t\t%d\n",p[i].no,p[i].at,p[i].bt,p[i].tat,p[i].wt);
}
printf("\nAverage waiting time is %.2f\n\n",avg_wt);
printf("Average turnarround time %.2f\n\n",avg_tat);
}

void SJF()
{
int count=0,t=0,short_p,temp[10],n,i;

floattotal_wt=0,total_tat=0,awt,atat;
    printf("\nEnter the number of
    proceses:\n"); scanf("%d",&n);
    for(i=0;i<n;i++)
    {
    printf("\nEnter arrival time and burst time of process P%d : ",i);
    scanf("%d%d",&p[i].at,&p[i].bt);
    temp[i]=p[i].bt;

    }
    p[19].bt=10000;
    for(t=0;count!=n;t++)
    {
    short_p=19;
for(i=0;i<n;i++)
        {
            if(p[i].bt<p[short_p].bt&& (p[i].at<=t && p[i].bt>0))
            {
                short_p=i;
            }

        }
        p[short_p].bt=p[short_p].bt-1;
        if(p[short_p].bt==0)
        {
            count++;
            p[short_p].wt=t+1-p[short_p].at-temp[short_p];
    p[short_p].tat=t+1-p[short_p].at;


    total_wt+=p[short_p].wt;
    total_tat+=p[short_p].tat;
    }
    }
    awt=total_wt/n;
    atat=total_tat/n;
 printf("process , wt, tat\n");
    for(i=0;i<n;i++)
    {
        printf("%d\t%d\t%d\n",i+1,p[i].wt,p[i].tat);
    }

    printf("Average waiting time :%.2f\n",awt);
    printf("\nAverage turnarround time:%.2f\n",atat);


}
void RR()
{
int queue[100];
```

```
 int F=-1;
 int R=-1;
     void insert(int n)
     {
if(F==-1)

F=0; R+=1;
         queue[R]=n;
     }
     int delete()
     {
         int n;
         n=queue[F];
         F+=1;
         return n;
     }
         int n,TQ,a,time=0;
         int temp[10],exist[10]={0};
         float total_wt=0,total_tat=0,avg_wt,avg_tat;
         printf("\nEnter the number of process:\n");
 scanf("%d",&n);
         for(int i=0;i<n;i++)

         {

              printf("\nEnter arrival time and burst time of process P%d : ",i);
             scanf("%d%d",&p[i].at,&p[i].bt); p[i].id=i;


             temp[i]=p[i].bt;
         }printf("\nEnter the time quantum:\n");
         scanf("%d",&TQ);
         insert(0);
         exist[0]=1;
```

```
        while(F<=R)
        {
            a=delete();
            if(p[a].bt>=TQ)
            {
                p[a].bt=p[a].bt-TQ;
                time+=TQ;
            }
            else
            {
                time+=p[a].bt;
                p[a].bt=0;
            }


             for(int i=0;i<n;i++)
            {
                if(exist[i]==0 && p[i].at<=time)
                {
                insert(i);
                exist[i]=1;
}
            }
            if(p[a].bt==0)
            {
                p[a].tat=time-p[a].at;
                p[a].wt=p[a].tat-temp[a];
                total_tat=total_tat+p[a].tat;
                total_wt=total_wt+p[a].wt;
            }
            else
```

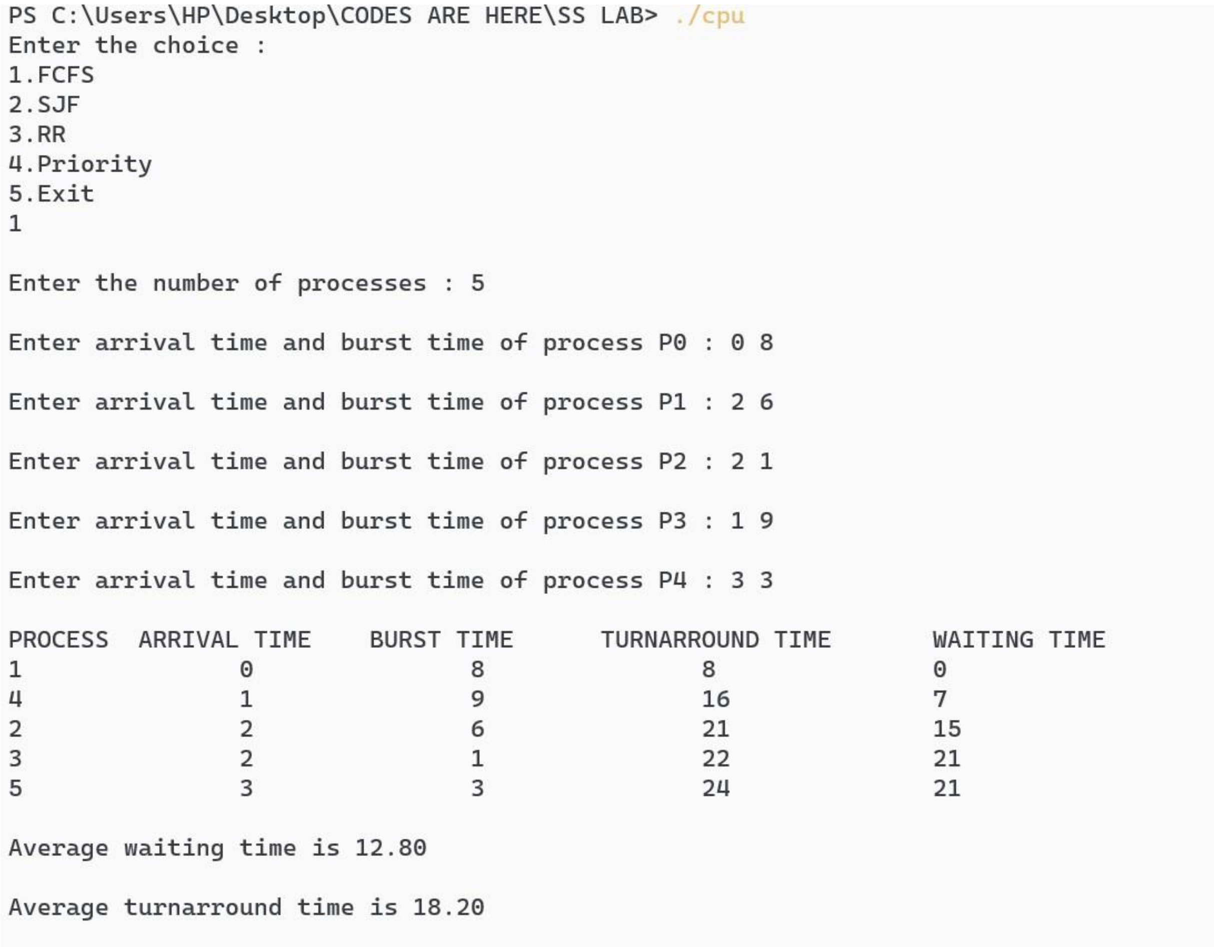
```
{
                 insert(a);
             }
         }
avg_tat=total_tat/n;
avg_wt=total_wt/n;
         // printing of the answer
         printf("ID WT TAT\n");
         for(int i=0;i<n;i++)
         {
             printf("%d %d %d\n",p[i].id,p[i].wt,p[i].tat);
         }
         printf("Average waiting time of the processes is : %.2f\n",avg_wt);
         printf("\nAverage turn around time of the processes is : %.2f\n\n",avg_tat);
     }
 void Priority(){
     int i,n,temp[20],t,count=0,sp;
     float to_wt=0,to_tat=0,avg_wt,avg_tat;
     printf("Enter the no of processes : ");
     scanf("%d",&n);
     for(i=0;i<n;i++)
     {
          printf("\nEnter Arrival time and burst time,priority of process P%d : \n",i);
          scanf("%d%d%d",&p[i].at,&p[i].bt,&p[i].prior);
         p[i].no=i;
         temp[i]=p[i].bt;
     }
     p[9].prior=1000;
     for(t=0;count!=n;t++)
     {
         sp=9;
         for(i=0;i<n;i++)
         {
             if(p[sp].prior>p[i].prior && p[i].at<=t && p[i].bt>0)
```

```
                        {
                                sp=i;
                        }
                }
                p[sp].bt=p[sp].bt-1;
                if(p[sp].bt==0)
                {
                        count++;
                        p[sp].tat=t+1-p[sp].at;
                        p[sp].wt=p[sp].tat-temp[sp];
                        to_wt+=p[sp].wt;
                        to_tat+=p[sp].tat;
                }
        }
        avg_tat=to_tat/n;
        avg_wt=to_wt/n;
        printf("P\tARRIVAL TIME\tBURST TIME\tWAITING TIME\tTURNARROUND
TIME\tPRIORITY\n");
        for(i=0;i<n;i++)
        {

printf("%d\t\t%d\t\t%d\t\t%d\t\t%d\t\t%d\n",i,p[i].at,temp[i],p[i].wt,p[i].tat,p[i].prior);
        }
        printf("Average turnarrounf time : %.2f\n",avg_tat);
        printf("\nAverage waiting time : %.2f\n",avg_wt);
}
 int main()
{
        int opt;
        do{
        printf("Enter the choice :\n 1.FCFS\n2.SJF\n3.RR\n4.Priority\n5.Exit\n");
        scanf("%d",&opt);
                switch(opt)
                {
```

```
        case 1:
        FCFS();
        break;
        case 2:
        SJF();
        break;
        case 3:
        RR();
        break;
        case 4:
        Priority();
        break;
        case 5:
        printf("Exit");
        break;
        default:
        printf("Enter the choice:");
        break;
    }
}

while(opt!=5);
return 0;

}
```

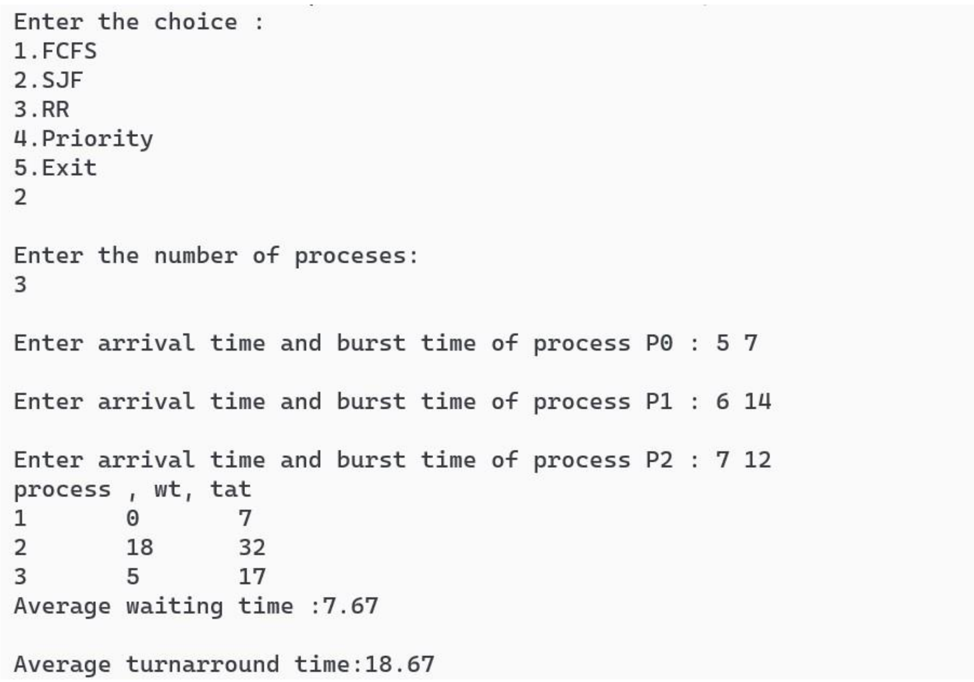
OUTPUT

FCFS



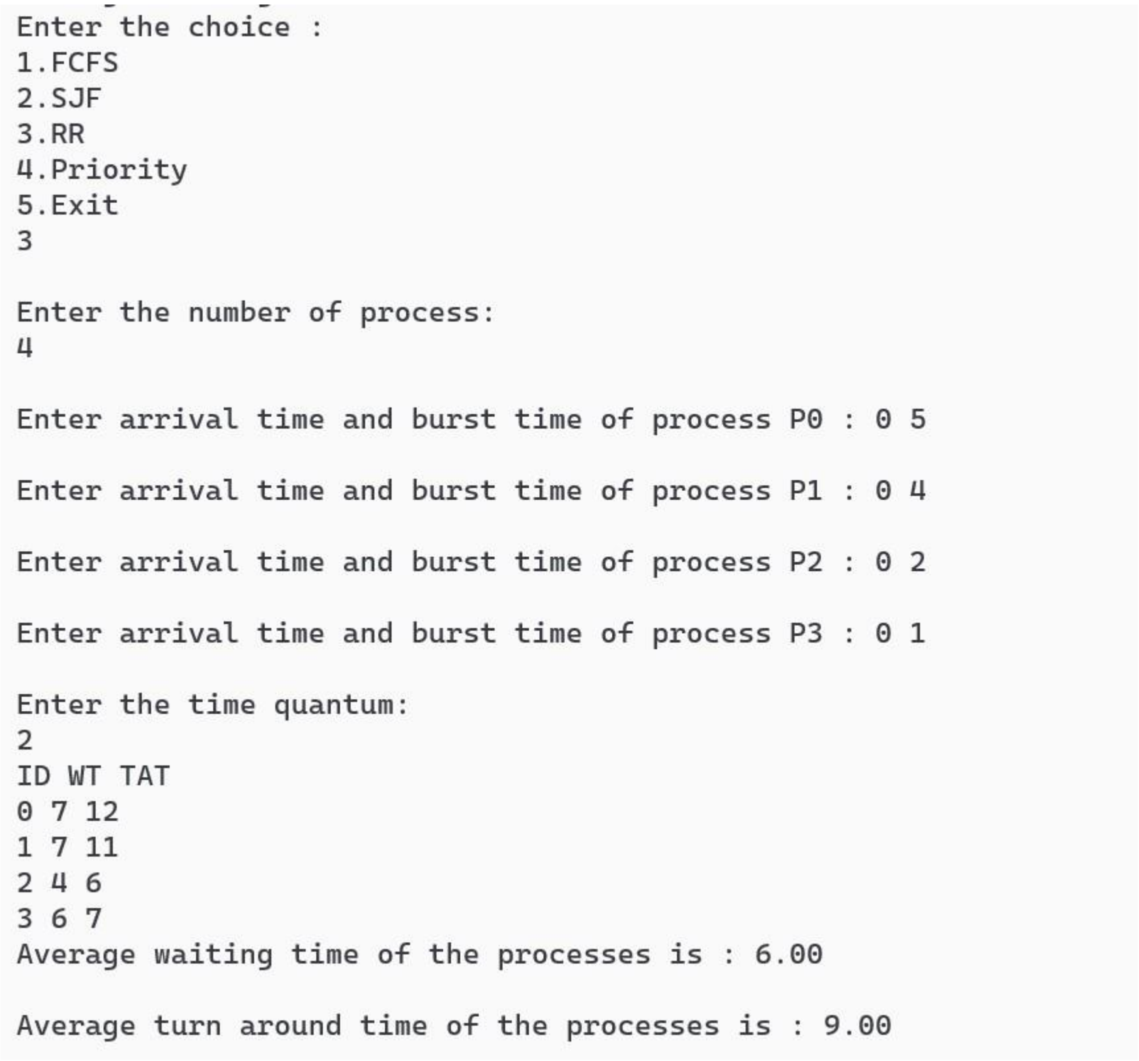
```
PS C:\Users\HP\Desktop\CODES ARE HERE\SS LAB> ./cpu
Enter the choice :
1.FCFS
2.SJF
3.RR
4.Priority
5.Exit
1

Enter the number of processes : 5

Enter arrival time and burst time of process P0 : 0 8

Enter arrival time and burst time of process P1 : 2 6

Enter arrival time and burst time of process P2 : 2 1

Enter arrival time and burst time of process P3 : 1 9

Enter arrival time and burst time of process P4 : 3 3

PROCESS  ARRIVAL TIME    BURST TIME      TURNARROUND TIME       WAITING TIME
1               0               8               8               0
4               1               9               16              7
2               2               6               21              15
3               2               1               22              21
5               3               3               24              21

Average waiting time is 12.80

Average turnarround time is 18.20
```

SJF



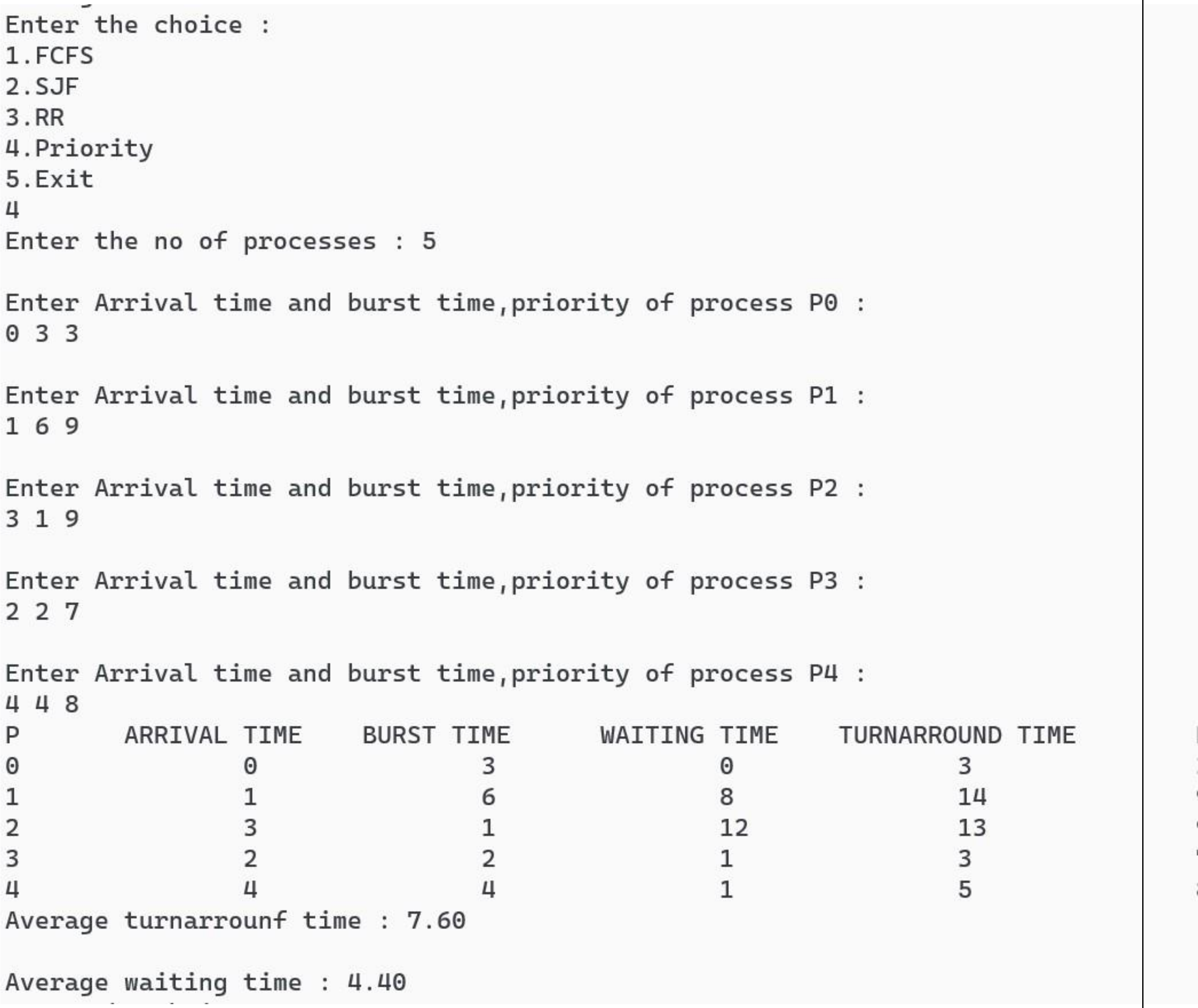
```
Enter the choice :
1.FCFS
2.SJF
3.RR
4.Priority
5.Exit
2

Enter the number of proceses:
3

Enter arrival time and burst time of process P0 : 5 7

Enter arrival time and burst time of process P1 : 6 14

Enter arrival time and burst time of process P2 : 7 12
process , wt, tat
1       0       7
2       18      32
3       5       17
Average waiting time :7.67

Average turnarround time:18.67
```

ROUNDROBI N



```
Enter the choice :
1.FCFS
2.SJF
3.RR
4.Priority
5.Exit
3

Enter the number of process:
4

Enter arrival time and burst time of process P0 : 0 5

Enter arrival time and burst time of process P1 : 0 4

Enter arrival time and burst time of process P2 : 0 2

Enter arrival time and burst time of process P3 : 0 1

Enter the time quantum:
2
ID WT TAT
0 7 12
1 7 11
2 4 6
3 6 7
Average waiting time of the processes is : 6.00

Average turn around time of the processes is : 9.00
```

PRIORITY



```
Enter the choice :
1.FCFS
2.SJF
3.RR
4.Priority
5.Exit
4
Enter the no of processes : 5

Enter Arrival time and burst time,priority of process P0 :
0 3 3

Enter Arrival time and burst time,priority of process P1 :
1 6 9

Enter Arrival time and burst time,priority of process P2 :
3 1 9

Enter Arrival time and burst time,priority of process P3 :
2 2 7

Enter Arrival time and burst time,priority of process P4 :
4 4 8
P       ARRIVAL TIME    BURST TIME      WAITING TIME    TURNARROUND TIME
0               0               3               0               3
1               1               6               8               14
2               3               1               12              13
3               2               2               1               3
4               4               4               1               5
Average turnarrounf time : 7.60

Average waiting time : 4.40
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY.

EXPERIMENT NO:02 **DATE:08/08/2023**

BANKER'S ALGORITHM

AIM

To write a C program to simulate the banker's algorithm for deadlock avoidance

ALGORITHM

Data Strutures Used :-

1. Available :- A vector of length 'm' indicates the number of available process of each type
2. Max :- An n*m matrix defines the maximum demand of each process
3. Allocation :- n*m matrix defines the number of resources of each type currently allocated to each process
4. Need :- n*m matrix indicates the remaining resource need of each processNeed[i][j]=Max[i][j]-Alloaction[i][j]

```
1 . Work are finish are the vectors of length m and n
        Initialize Work=Available
                Finish[i]=false for i=0,1,..,n-1
2 . Find index i such that Finish[i]==false and Needi <= Work
        If no such I exists , go to step 4
3 .Work = Work + Allocation
        Finish[i]=true
        Go to step 2
4 . If Finish[i]==true , then the system is in safe state
```

PROGRAM

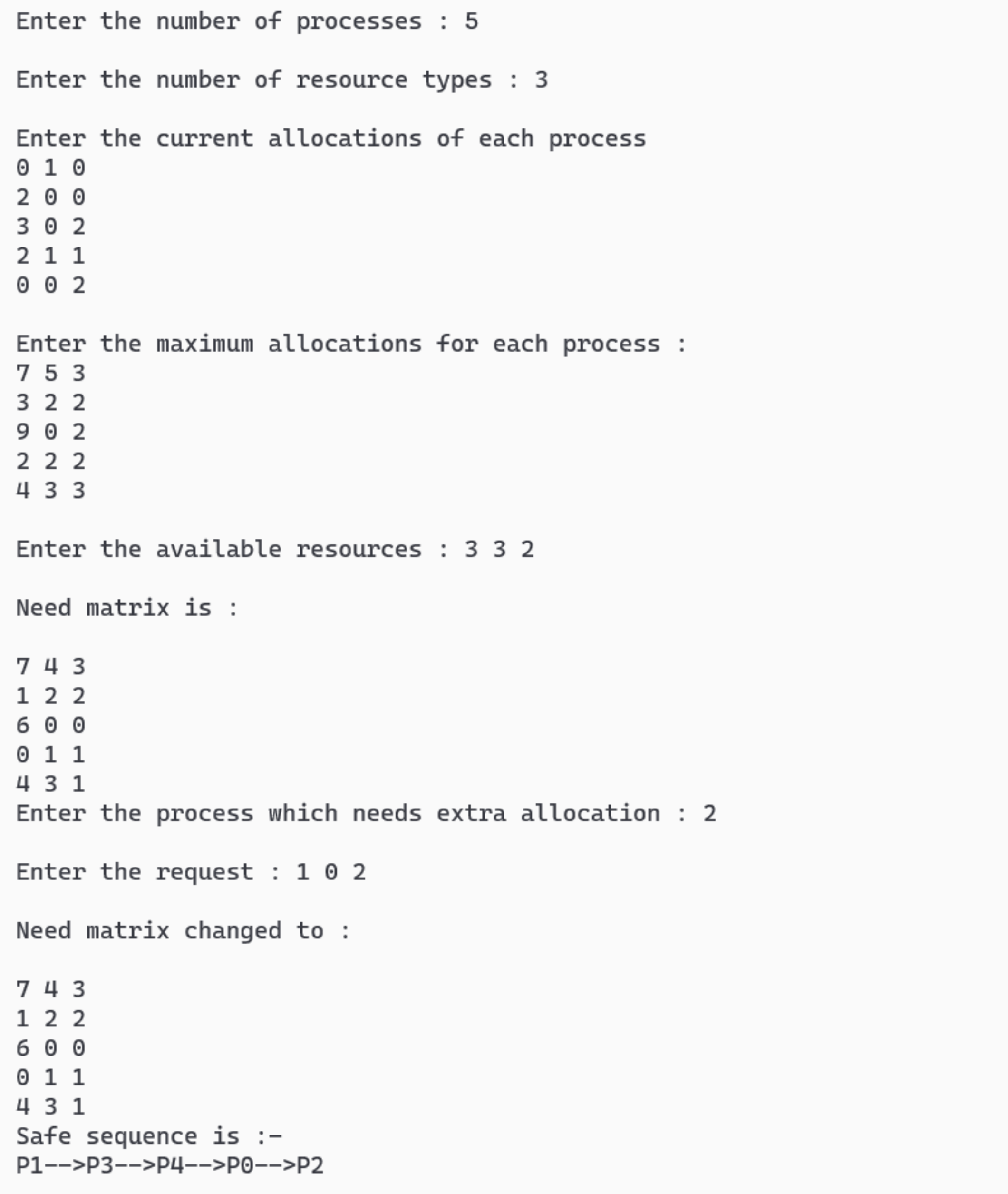
```
#include<stdio.h>
int main()


 {
 int i,j,k,y,n,m,p,alloc[10],Alloc[20][20],Max[20][20],Need[20][20],Avail[20],finish[20],safe[20],ind=0,fl
 ag;
 printf("\nEnter the number of processes : ");
 scanf("%d",&n);
```

```
printf("\nEnter the number of resource types : ");
scanf("%d",&m);
printf("\nEnter the current allocations of each process\n");
for(i=0;i<n;i++)
{
        for(j=0;j<m;j++)
        {
                scanf("%d",&Alloc[i][j]);
        }
}
printf("\nEnter the maximum allocations for each process : ");
for(i=0;i<n;i++)
{
        for(j=0;j<m;j++)
        {
                scanf("%d",&Max[i][j]);
        }
}
printf("\nEnter the available resources : ");
for(i=0;i<m;i++)
{
        scanf("%d",&Avail[i]);
}
printf("\nNeed matrix is :
\n");for(i=0;i<n;i++)
{
        printf("\n");
        for(j=0;j<m;j++)
        {
                Need[i][j]=Max[i][j]-Alloc[i][j];
                printf("%d ",Need[i][j]);
        }
}
printf("\nEnter the process which needs extra allocation : ");
scanf("%d",&p)
```

```
printf("\nEnter the request : ");
for(i=0;i<m;i++)
{
        scanf("%d",&alloc[i]);
        Alloc[p][i]+alloc[i];
}
printf("\nNeed matrix changed to :
\n");for(i=0;i<n;i++)
    {
         printf("\n");
         for(j=0;j<m;j++)
         {
              Need[i][j]=Max[i][j]-Alloc[i][j];
              printf("%d ",Need[i][j]);
         }
    }
for(i=0;i<n;i++)
{
        finish[i]=0;
}
for(i=0;i<n;i++)
{
        for(j=0;j<n;j++)
        {
                if(finish[j]==0)
                {
                        flag=0;
                        for(k=0;k<m;k++)
                        {
                                if(Need[j][k]>Avail[k])
                                {
                                        flag=1;
                                        break;
                                }
                        }
```

```
                              if(flag==0)
                             {
                                   safe[ind++]=j;
                                   for(y=0;y<m;y++)
                                         {
                                                Avail[y]+=Alloc[j][y];
                                          }
                                         finish[j]=1;
                            }}}
        }
        flag=1;
        for(i=0;i<n;i++)
        {

              if(finish[i]==0)
              {
                    flag=0;
                    printf("\nThe system is not in safe state\n");
                    break;
               }}
         if(flag==1)
        {

              printf("\nSafe sequence is :-
              \n");for(i=0;i<n;i++)
              {
                    printf("P%d",safe[i]);
                    if(i<n-1)

                    {

                    printf("\n");

                    }}]

                    return 0;
        }
```

OUTPUT



```
Enter the number of processes : 5

Enter the number of resource types : 3

Enter the current allocations of each process
0 1 0
2 0 0
3 0 2
2 1 1
0 0 2

Enter the maximum allocations for each process :
7 5 3
3 2 2
9 0 2
2 2 2
4 3 3

Enter the available resources : 3 3 2

Need matrix is :

7 4 3
1 2 2
6 0 0
0 1 1
4 3 1
Enter the process which needs extra allocation : 2

Enter the request : 1 0 2

Need matrix changed to :

7 4 3
1 2 2
6 0 0
0 1 1
4 3 1
Safe sequence is :-
P1-->P3-->P4-->P0-->P2
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY.

EXPERIMENT NO :03 **DATE:20/09/2023**

DISK SCHEDULING ALGORITHMS

AIM

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

ALGORITHM

FCFS:

1. Let us one by one take the tracks in default order and calculate the absolutedistance of the track from the head.
2. Increment the total seek count with this distance.
3. Currently serviced track position now becomes the new head position.
4. Go to step 2 until all tracks in the request array have not been serviced.
5. Let Request array represents an array storing indexes of tracks that have beenrequested in ascending order of their time of arrival. 'head' is the position ofdisk head.

SCAN:

1. Let Request array represents an array storing indexes of tracks that have been requested in ascending order of their time of arrival .'head' is the position of diskhead.
2. Let direction represents whether the head is moving towards left or right.
3. In the direction in which head is moving service all tracks one by one.
4. Calculate the absolute distance of the track from the head.
5. Increment the total seek count with this distance.
6. Currently serviced track position now becomes the new head position.
7. Go to step 3 until we reach at one of the ends of the disk.
8. If we reach at the end of the disk reverse the direction and go tostep 2 until all tracks in request array have not been serviced

C-SCAN

1. Let Request array represents an array storing indexes of tracks that have been requested in ascending order of their time of arrival. 'head' is the position of disk head.
2. The head services only in the right direction from 0 to size of the disk.

3. While moving in the left direction do not service any of the tracks.
4. When we reach at the beginning (left end) reverse the direction.
5. While moving in right direction it services all tracks one by one.
6. While moving in right direction calculate the absolute distance of the track from the head.
7. Increment the total seek count with this distance.
8. Currently serviced track position now becomes the new head position.
9. Go to step 6 until we reach at right end of the disk.
10. If we reach at the right end of the disk reverse the direction and go to step 3 until all tracks in request array have not been serviced.

PROGRAM

```
#include<stdio.h>
#include<stdlib.>
int i,j;
void fcfs(void)
{
int n,RQ[20],head,THM=0;
printf("\nEnter the number of requests : ");
scanf("%d",&n);
printf("\nEnter the request sequence : ");
for(i=0;i<n;i++)
{
scanf("%d",&RQ[i]);
}
printf("\nEnter the initial head position : ");
scanf("%d",&head);
for(i=0;i<n;i++)
{
THM+=abs(RQ[i]-
head);head=RQ[i];
}
printf("\nTotal head moment is : %d\n",THM);
```

```
  }
  void scan(void)
  {
  int indx,temp,size,n,RQ[20],head,move;
  printf("\nEnter the number of requests : ");
      scanf("%d",&n);
      printf("\nEnter the request sequence : ");
      for(i=0;i<n;i++)
      {

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

      printf("\nEnter the initial head position : ");
      scanf("%d",&head);
  printf("\nEnter the size of disk : ");
  scanf("%d",&size);
  printf("\nEnter the head movement direction(1 for high and 0 for low) : ");
  scanf("%d",&move);
for(i=0;i<n-1;i++){
  for(j=0;j<n-i-1;j++)
  {
  if(RQ[j]>RQ[j+
  1])
  {
  temp=RQ[j];
  RQ[j]=RQ[j+1
  ];
  RQ[j+1]=temp;
  }}}
  for(i=0;i<n;i++)
  {
  if(head<RQ[i])
  {
  indx=i
```

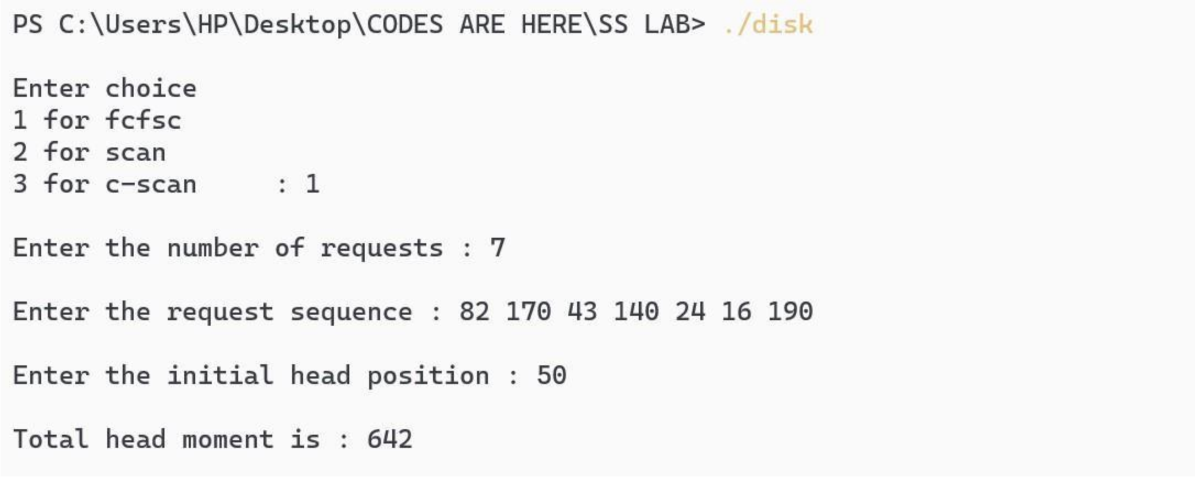
```
;
break;
}
}
int THM=0;
if(move==1
)
{
for(i=indx;i<n;i++)
{
THM+=abs(RQ[i]-
head);head=RQ[i];
}
THM+=abs(size-RQ[i-1]-
1);head=size-1;
for(i=indx-1;i>=0;i--)
{
THM+=abs(RQ[i]-
head);head=RQ[i];
}
}
else
{
for(i=indx-1;i>=0;i--)
{
                THM+=abs(RQ[i]-head);
                head=RQ[i];
          }
          THM+=abs(RQ[i+1]-0);
          head=0;
          for(i=indx;i<n;i++)
          {
```

```
THM+=abs(RQ[i]-head);
head=RQ[i];
                }
 }
 printf("\nTotal head moment is : %d\n",THM);
 }
 void cscan(void)
 {
 int indx,temp,n,size,RQ[20],head,move;
 printf("\nEnter the number of requests : ");
        scanf("%d",&n);
        printf("\nEnter the request sequence : ");
        for(i=0;i<n;i++)
        {
               scanf("%d",&RQ[i]);
        }
        printf("\nEnter the initial head position : ");
        scanf("%d",&head);
 printf("\nEnter the size of disk : ");
        scanf("%d",&size);
        printf("\nEnter the head movement direction(1 for high and 0 for low) :
        "); scanf("%d",&move);
 for(i=0;i<n;i++)
 {
 for(j=0;j<n-i-1;j++)
 {
 if(RQ[j]>RQ[j+
 1])
 {
 temp=RQ[j];
 RQ[j]=RQ[j+1];
 RQ[j+1]=temp;}}}
```

```
for(i=0;i<n;i++)
        {
               if(head<RQ[i])
               {
                      indx=
                      i;
                      break
                      ;
               }
        }
int THM=0 if(move==1)
        {
               for(i=indx;i<n;i++)
               {
                      THM+=abs(RQ[i]-head);
                      head=RQ[i];
               }
               THM+=abs(size-RQ[i-1]-
  1);THM+=abs(size-1-0);

               head=0;
               for(i=0;i<indx;i++)
               {
  THM+=abs(RQ[i]-head);
                      head=RQ[i];
}}

else {
  for(i=indx-1;i>=0;i--)

{
THM+=abs(RQ[i]-head);

                      head=RQ[i]
THM+=abs(RQ[i+1]-0);
  THM+=abs(size-1-0);

  head=size-1;
              for(i=n-1;i>=indx;i--)
              {

                     THM+=abs(RQ[i]-head);
                     head=RQ[i];

              }

        }

        printf("Total head moment is : %d\n",THM);

  }

  int main()

  {

  int ch;

  do{

printf("\nEnter choice\n1 for fcfsc\n2 for scan\n3 for c-scan\t : ");

scanf("%d",&ch);

  switch(ch){

  case 1: fcfs(); break;

   case 2: scan(); break;

  case 3: cscan();break;

   default:
            printf("Exit\n");

            break;

  }

  }

  while(ch!=4);
```

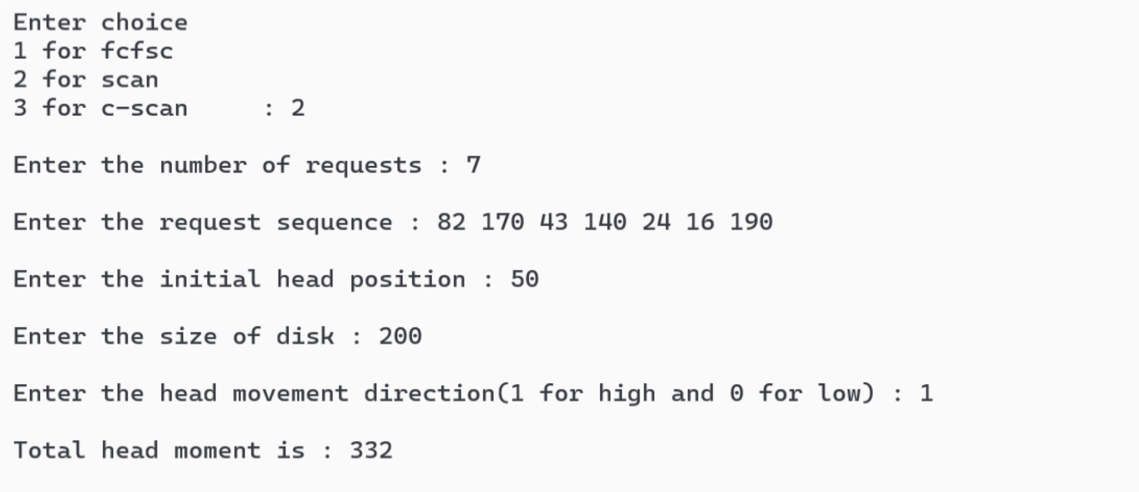
OUTPUT

FCFS

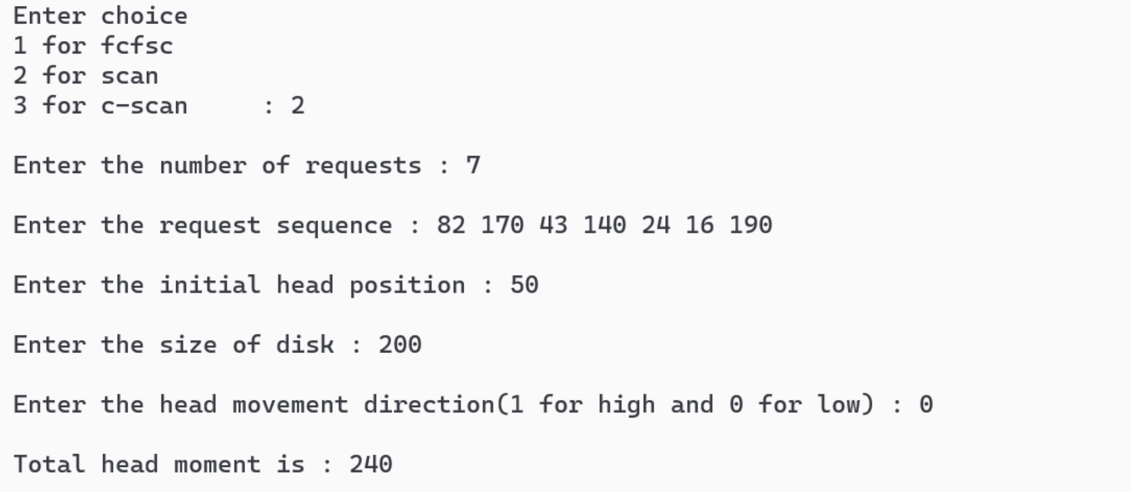


```
PS C:\Users\HP\Desktop\CODES ARE HERE\SS LAB> ./disk

Enter choice
1 for fcfsc
2 for scan
3 for c-scan     : 1

Enter the number of requests : 7

Enter the request sequence : 82 170 43 140 24 16 190

Enter the initial head position : 50

Total head moment is : 642
```

SCAN

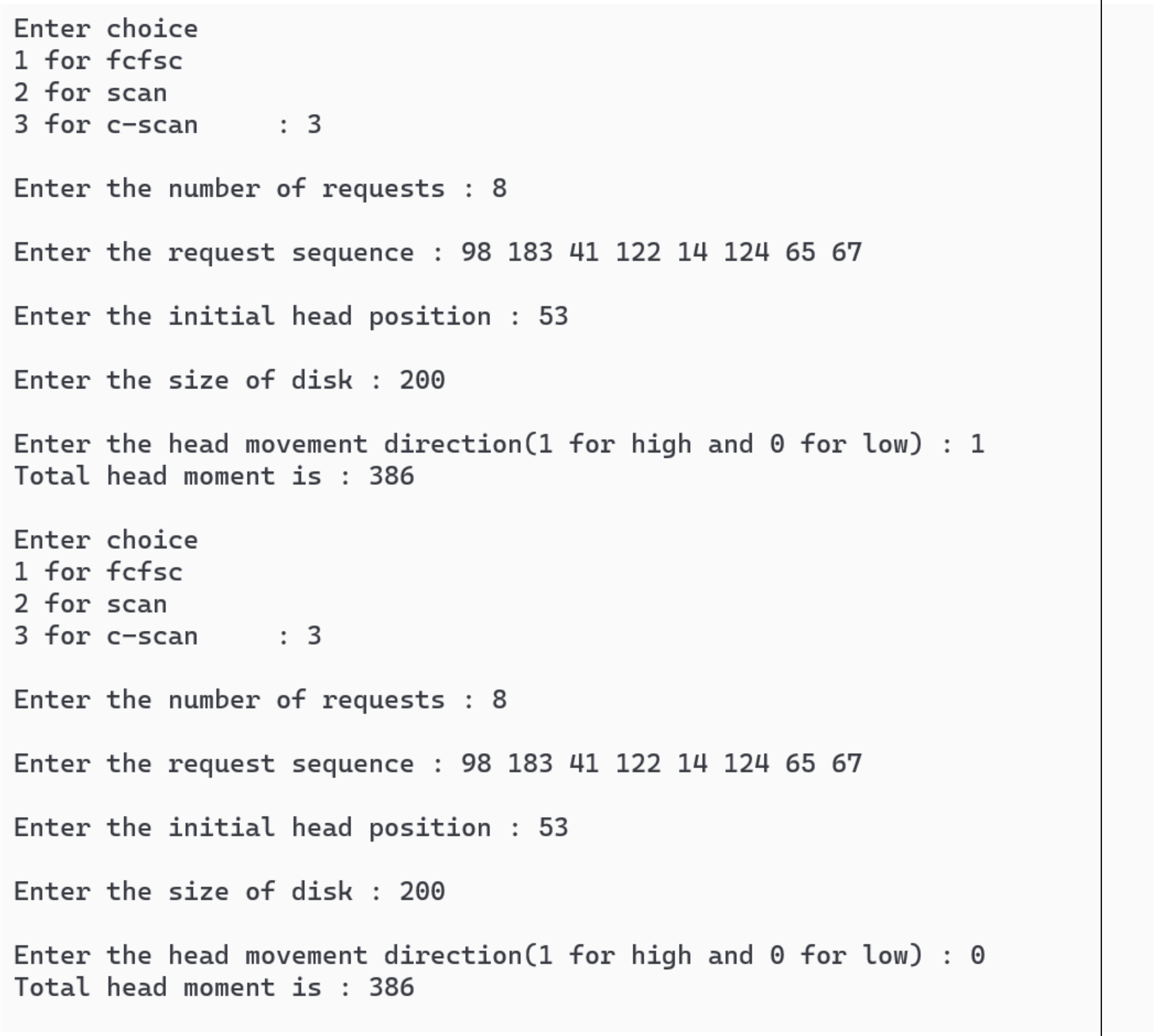


```
Enter choice
1 for fcfsc
2 for scan
3 for c-scan     : 2

Enter the number of requests : 7

Enter the request sequence : 82 170 43 140 24 16 190

Enter the initial head position : 50

Enter the size of disk : 200

Enter the head movement direction(1 for high and 0 for low) : 1

Total head moment is : 332
```



```
Enter choice
1 for fcfsc
2 for scan
3 for c-scan     : 2

Enter the number of requests : 7

Enter the request sequence : 82 170 43 140 24 16 190

Enter the initial head position : 50

Enter the size of disk : 200

Enter the head movement direction(1 for high and 0 for low) : 0

Total head moment is : 240
```

C-SCAN



```
Enter choice
1 for fcfsc
2 for scan
3 for c-scan     : 3

Enter the number of requests : 8

Enter the request sequence : 98 183 41 122 14 124 65 67

Enter the initial head position : 53

Enter the size of disk : 200

Enter the head movement direction(1 for high and 0 for low) : 1
Total head moment is : 386

Enter choice
1 for fcfsc
2 for scan
3 for c-scan     : 3

Enter the number of requests : 8

Enter the request sequence : 98 183 41 122 14 124 65 67

Enter the initial head position : 53

Enter the size of disk : 200

Enter the head movement direction(1 for high and 0 for low) : 0
Total head moment is : 386
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY.

SS EXPERIMENTS

EXPERIMENT NO :04 **DATE:27/09 /2023**

PASS 1 OF TWO PASS ASSEMBLER

AIM

To implement pass 1 of a two pass assembler

INPUT

Assembly Language program, Operation code table

OUTPUT

Intermediate file, Symbol table, Program length

ALGORITHM

```
Begin
  Read input line
  if OPCODE = ‘START’, then
    Set Starting Address as #[Operand]
    Initialize LOCCTR to Starting Address
    Write line to Intermediate file
    Read next line
  else
    Initialize LOCCTR to 0
    Set Starting Address to 0
  while OPCODE != ‘END’, do
    if line is not a comment, then
      if there is a symbol in the LABEL field, then
        Search SYMTAB for LABEL
        if found, then
          Set error flag(duplicate symbol)
        else
          Add symbol to SYMTAB with it’s address
        end if
      end if
      Search OPTAB for OPCODE
      if found, then
        Add 3 to LOCCTR // 3 = Instruction length
      else if OPCODE = ‘WORD’, then
        Add 3 to LOCCTR
      else if OPCODE = ‘RESW’, then
        Add 3 * #[Operand] to LOCCTR
      else if OPCODE = ‘RESB’, then
        Add #[Operand] to LOCCTR
      else if OPCODE = ‘BYTE’, then
```

```
Find length of constant in bytes
Add length to LOCCTR
else
Set error flag(invalid Operation Code)
end if
end if
Write line to Intermediate file
Read next input line
end while
Write last line to Intermediate file
Save (LOCCTR - Starting Address) as Program Length
End Pass 1
```

PROGRAM

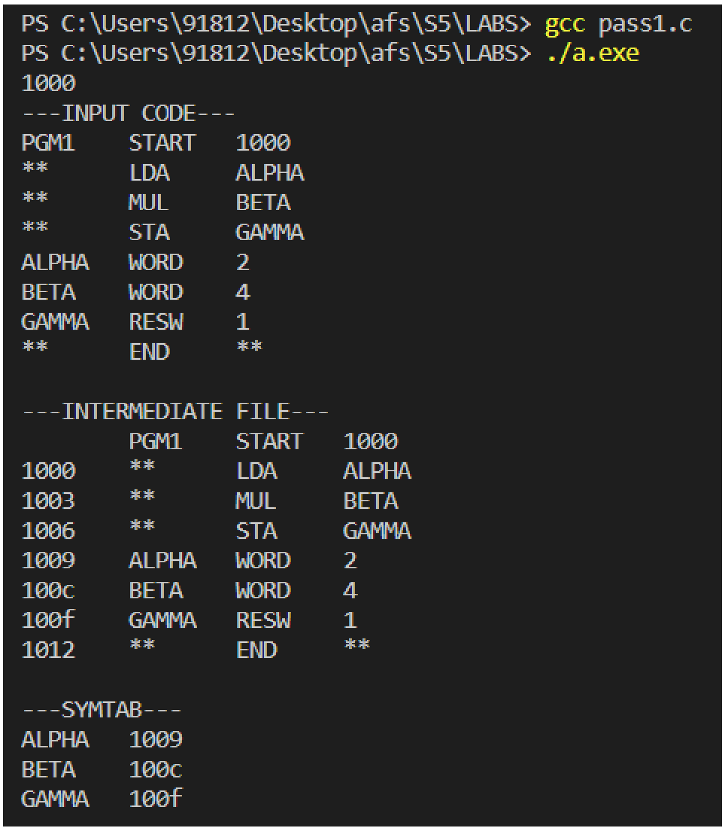
```
 #include<stdio.h>
#include<stdlib.h>
#include<string.h>
char label[10],opcode[10],operand[10],code[10],mnemonic[3];
int length;
void pass1()
{
int locctr=0x0,str;
int start;
FILE *f1,*f2,*f3,*f4,*f5;
f1 = fopen("input.txt","r");
f2 = fopen("optab.txt","r");
f3 = fopen("intermediate.txt","w");
f4 = fopen("symtab.txt","w");
f5 = fopen("length.txt","w");
fscanf(f1,"%s\t%s\t%s",label,opcode,operand);
if(strcmp(opcode,"START")==0) {
start = strtol(operand,NULL,16);
locctr=(0x1)*start;
printf("%x\n",locctr);
fprintf(f3,"\t%s\t%s\t%s\n",label,opcode,operand);
fscanf(f1,"%s\t%s\t%s",label,opcode,operand);
}
else {
locctr=0x0;
}
while(strcmp(opcode,"END")!=0) {
fprintf(f3,"%x\t%s\t%s\t%s\n",locctr,label,opcode,operand);
if(strcmp(label,"**")!=0) {
fprintf(f4,"%s\t%x\n",label,locctr);
}
fscanf(f2,"%s\t%s",code,mnemonic);
while(strcmp(code,"END")!=0) {
if(strcmp(opcode,code)==0) {
locctr+=0x3;
break;
}
fscanf(f2,"%s\t%s",code,mnemonic);
}
if(strcmp(opcode,"WORD")==0) {
locctr+=0x3;
}
else if(strcmp(opcode,"RESW")==0) {
locctr+=((0x3)*atoi(operand));
}
else if(strcmp(opcode,"RESB")==0) {
locctr+=(0x1)*atoi(operand);
}
else if(strcmp(opcode,"BYTE")==0) {
locctr+=strlen(operand)*(0x1);
}
fscanf(f1,"%s\t%s\t%s",label,opcode,operand);
}
fprintf(f3,"%x\t%s\t%s\t%s",locctr,label,opcode,operand);
length = locctr-start;
fprintf(f5,"%x",length);
fclose(f1);
fclose(f2);
fclose(f3);
fclose(f4);
fclose(f5);
}
void display()
{
char ch;
FILE *f1;
printf("---INPUT CODE---\n");
f1 = fopen("input.txt","r");
ch = fgetc(f1);
while(ch!=EOF)
{
printf("%c",ch);
ch = fgetc(f1);
}
fclose(f1);
printf("\n\n");
printf("---INTERMEDIATE FILE---\n");
f1 = fopen("intermediate.txt","r");
ch = fgetc(f1);
while(ch!=EOF)
{
printf("%c",ch);
ch = fgetc(f1);
}
fclose(f1);
printf("\n\n");
printf("---SYMTAB---\n");
f1 = fopen("symtab.txt","r");
ch = fgetc(f1);
while(ch!=EOF)
```

```
{
printf("%c",ch);
ch = fgetc(f1);
}
fclose(f1);
}
int main()
{
pass1();
display();
printf("\n");
return 0;
}
```

INPUT : Optab.txt

```
LDA 00
MUL 20
STA 0C
END *
```

OUTPUT



```
PS C:\Users\91812\Desktop\afs\S5\LABS> gcc pass1.c
PS C:\Users\91812\Desktop\afs\S5\LABS> ./a.exe
1000
---INPUT CODE---
PGM1    START   1000
**      LDA     ALPHA
**      MUL     BETA
**      STA     GAMMA
ALPHA   WORD    2
BETA    WORD    4
GAMMA   RESW    1
**      END     **

---INTERMEDIATE FILE---
        PGM1    START   1000
1000    **      LDA     ALPHA
1003    **      MUL     BETA
1006    **      STA     GAMMA
1009    ALPHA   WORD    2
100c    BETA    WORD    4
100f    GAMMA   RESW    1
1012    **      END     **

---SYMTAB---
ALPHA   1009
BETA    100c
GAMMA   100f
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY.

EXPERIMENT NO: 05 **DATE:04/10/2023**

PASS 2 OF TWO PASS ASSEMLER

AIM

To implement pass 2 of a two pass assembler

INPUT

Intermediate file (obtained from pass1), Symbol table, Program length

OUTPUT

Object program, Assembly listing

ALGORITHM

```
Begin
Read first input line(from intermediate
file)if OPCODE = ‘START’, then
Write Listing line
Read next input
lineend if
Write Header record to object
programInitialise first Text record
While OPCODE != ‘END’, do
if line is comment line,
thenRead next input line
continue
end if
Search OPTAB for
OPCODEif found then
if there is a symbol in OPERAND field
thenSearch SYMTAB for OPERAND
if found, then
Search symbol value as operand address
elseStore 0 as operand address
```

```
Set error flag (undefined symbol)
end if
else
Store 0 as operand address end
if
Assemble object code instruction
else if OPCODE = ‘BYTE’ or ‘WORD’,
then Convert constant to object code
else if OPCODE = ‘RESB’ or ‘RESW’,
then if current Text record is not empty,
then Write Text record to object program
end if
Write Listing line
Read next input line
Initialise new Text record
end if
if object code will not fit into the current Text record, then
Write Text record to object program
Initialise new Text record
end if
Add object code to Text record
Write Listing line
Read next input line
end while
Write last Text record to object program
Write End record to object program
Write last Listing line
End Pass 2
```

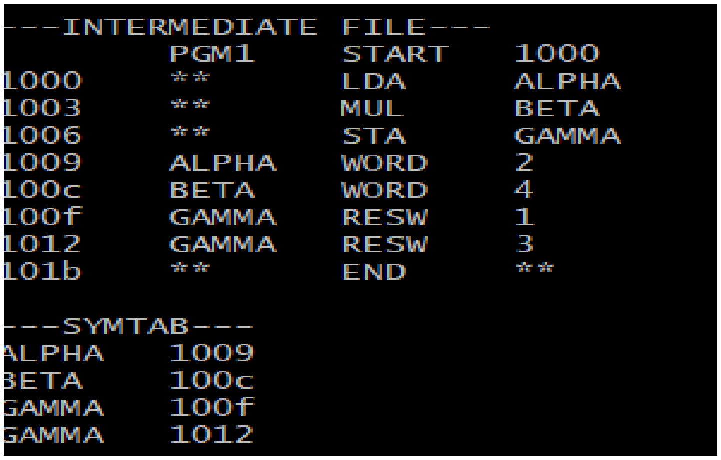
PROGRAM

```
#include<stdio.h>

 #include<string.h.>

#include<ctype.h>
```

```
 void main()
{
FILE *f1,*f2,*f3,*f4,*f5;
int i,len,j=0;
int ln = 0x0;
char ch;
charl[10],address[10],label[10],opcode[10],op[10],operand[10],code[10],mne[10],sym[10],add[1
0],start[10];
f1 =fopen("intermediate.txt","r");f2 = fopen("length.txt","r");
f3 = fopen("symtab.txt","r");
f4 = fopen("optab.txt","r");
f5 = fopen("assenbly.txt","w");
fscanf(f1,"%s%s%s",label,opcode,operand);
fprintf(f5,"\t%s\t%s\t%s\n",label,opcode,operand);
if(strcmp(opcode,"START")==0)
{
strcpy(start,operand);
fscanf(f2,"%s",l);
}
printf("H%s^%s%s\nT00%s09^",label,start,l,start);fscanf(f1,"%s%s%s%s",address,label,op,operand);

while(strcmp(op,"END")!=0)
{
if(j==3){
printf("\nT00%s09^",address);i=0;
}
fscanf(f4,"%s%s",code,mne);
while(strcmp(code,"END")!=0)
{
if(strcmp(code,op)==0)
{
fclose(f4);
fscanf(f3,"%s%s",sym,add);
while(strcmp(sym,"END")!=0)
{
if(strcmp(sym,operand)==0)
{
printf("%s%s^",mne,add);
fprintf(f5,"%s\t%s\t%s\t%s\t%s%s\n",address,label,op,operand,mne,add);
break;
}
else
{
fscanf(f3,"%s%s",sym,add);
}
}
break;
}
else
{
fscanf(f4,"%s%s",code,mne);
}
}
if(strcmp(op,"BYTE")==0||strcmp(op,"WORD")==0)
{
if(strcmp(op,"WORD")==0)
{
printf("0000%s^",operand);
fprintf(f5,"%s\t%s\t%s\t%s\t0000%s\n",address,label,op,operand,operand);
}
else
{
len = strlen(operand);
for(i=2;i<len;i++)
{
printf("%d",operand[i]);
}
printf("^");
fprintf(f5,"%s\t%s\t%s\t%s\t0000%s\n",address,label,op,operand,operand);
}
}
if(strcmp(op,"RESW")==0||strcmp(op,"RESB")==0) {
fprintf(f5,"%s\t%s\t%s\t%s\n",address,label,op,operand);
}
fscanf(f1,"%s%s%s%s",address,label,op,operand);
```

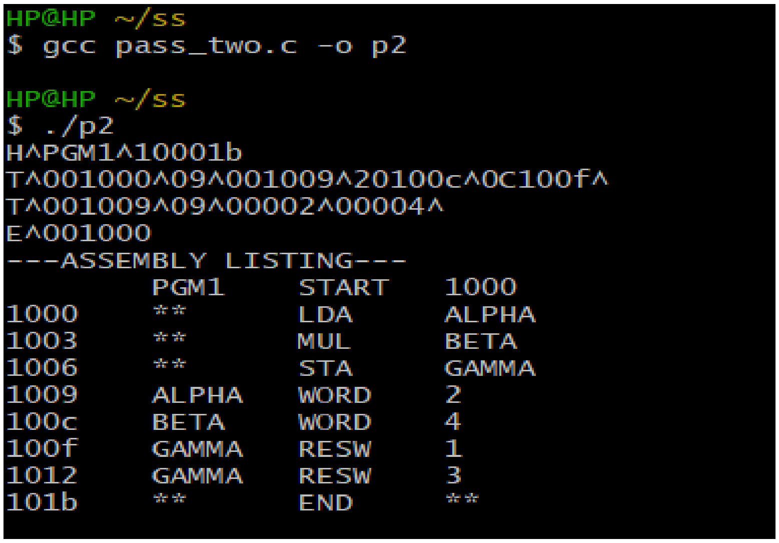
```
f4 = fopen("optab.txt","r");

fseek(f4,SEEK_SET,0);

j++;

}

printf("\n");
printf("E00%s\n",start);

fclose(f1);

fclose(f2);

fclose(f3);

fclose(f4);

fclose(f5);

printf("---ASSEMBLY LISTING---\n");
f1 = fopen("intermediate.txt","r");ch

= fgetc(f1);

while(ch!=EOF) {

printf("%c",ch); ch

= fgetc(f1);

}
fclose(f1);

printf("\n");

}
```

INPUT



```
---INTERMEDIATE FILE---
        PGM1    START   1000
1000    **      LDA     ALPHA
1003    **      MUL     BETA
1006    **      STA     GAMMA
1009    ALPHA   WORD    2
100c    BETA    WORD    4
100f    GAMMA   RESW    1
1012    GAMMA   RESW    3
101b    **      END     **

---SYMTAB---
ALPHA   1009
BETA    100c
GAMMA   100f
GAMMA   1012
```

OUTPUT



```
HP@HP ~/ss
$ gcc pass_two.c -o p2

HP@HP ~/ss
$ ./p2
H^PGM1^10001b
T^001000^09^001009^20100c^0C100f^
T^001009^09^00002^00004^
E^001000
---ASSEMBLY LISTING---
        PGM1    START   1000
1000    **      LDA     ALPHA
1003    **      MUL     BETA
1006    **      STA     GAMMA
1009    ALPHA   WORD    2
100c    BETA    WORD    4
100f    GAMMA   RESW    1
1012    GAMMA   RESW    3
101b    **      END     **
```

RESULT

PROGRAM EXECUTED SUCCESSFULL

EXPERIMENT NO:06 **DATE:08/11/2023**

SINGLE PASS ASSEMBLER

AIM

To write a C program to implement the single pass assembler

INPUT

Source file in Assembly Language

OUTPUT

Assembly Listing file, Object Program file

ALGORITHM

```
Begin
  Read input line
  if OPCODE = 'START', then
       Set Starting Address as #[Operand]
       Initialize LOCCTR to Starting Address
       Write line to Intermediate file
       Read next line
  else
       Initialize LOCCTR to 0 Set
       Starting Address to 0
  end if


  Write Header record to Object program file
  Initialise first Text record

  while OPCODE != 'END', do
       if line is a comment, then
            Read next input line
            continue
       end if

       if there is a symbol in the LABEL field, then
            Search SYMTAB for LABEL
            if found, then
                 Set error flag (duplicate symbol)
            else
                 Add symbol to SYMTAB with it's address
```

```
        end if
end if
Search OPTAB for OPCODEif
found, then
        Set LOCCTRincr to 3
else if OPCODE = ‘WORD’, thenSet
        LOCCTRincr to 3
else if OPCODE = ‘RESW’, then
        Set LOCCTRincr to 3*#[OPERAND]else
if OPCODE = ‘REWB’, then
        Set LOCCTRincr to #[OPERAND]else if
OPCODE = ‘BYTE’, then
        Find length of constant in bytesSet
        LOCCTRincr to length
else
        Set error flag(invalid operation code)
end if


if OPCODE = ‘RESB’ or ‘RESW’, then
          if current Text record is not empty, then
                  Write Text record to Object program file
        end if
        Write Listing line
        Read next input line
        Add LOCCTRincr to LOCCTR
        Initialise new Text record

else if OPCODE = ‘RESB’ or ‘RESW’, then
        Convert constant to object code
else
        if there is a symbol in OPERAND field, thenSearch
                SYMTAB for OPERAND
                 if found, then
                          Store symbol value as operand address
                else
                        Store 0 as operand address
                        Set error flag(undefined symbol)
                end if
        else

                Store 0 as operand address
        end if


        Assemble object code instruction
end if


if object code will not into the current Text record, thenWrite
        Text record to object
```

```
                    Initialise new Text record
            end if

            Add object code to Text recordWrite
            line to Intermediate file Read next
            input line
            Add LOCCTRincr ro LOCCTRend
    while

    Write last Text record to Object program fileWrite
    last Listing line
    Write End record to Object program file
    Write (LOCCTR] – Starting address) to Program length field inHeader
    record in  Object program file

    End Assemble
```

PROGRAM

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

  void main()
  {
char opcode[10], operand[10], label[10], a[10], ad[10], symbol[10], ch;char
code[10][10], code1[10][10] = {"33", "44", "53", "57"};
char mnemonic[10][10] = {"START", "LDA", "STA", "LDCH", "STCH", "END"};
char mnemonic1[10][10] = {"LDA", "STA", "LDCH", "STCH"};
int locctr, start, length, i = 0, j = 0, k, l = 0;
int st, diff, address, add, len, actual_len, finaddr, prevaddr;
FILE *fp1, *fp2, *fp3, *fp4, *fp5, *fp6, *fp7;

fp1 = fopen("input1.txt", "r");
fp2 = fopen("symtab.txt", "w");
fp3 = fopen("intermediate1.txt", "w"); fscanf(fp1,
"%s%s%s", label, opcode, operand);if
(strcmp(opcode, "START") == 0)
{
        start = atoi(operand);
        locctr = start;
        fprintf(fp3, "%s\t%s\t%s\n", label, opcode, operand);
        fscanf(fp1, "%s%s%s", label, opcode, operand);
}
```

```
else
        locctr = 0;
while (strcmp(opcode, "END") != 0)
{
        fprintf(fp3, "%d",  locctr);
        if (strcmp(label, "**") != 0)
           fprintf(fp2, "%s\t%d\n", label, locctr);
        strcpy(code[i], mnemonic[j]);
        while (strcmp(mnemonic[j], "END") != 0)
        {
           if (strcmp(opcode, mnemonic[j]) == 0)
           {
              locctr += 3;
              break;
           }
           strcpy(code[i], mnemonic[j]);
           j++;
        }
        if (strcmp(opcode, "WORD") == 0)
           locctr += 3;
        else if (strcmp(opcode, "RESW") == 0)
           locctr += (3 * (atoi(operand)));
        else if (strcmp(opcode, "RESB") == 0)
           locctr += (atoi(operand));
        else if (strcmp(opcode, "BYTE") == 0)
           ++locctr;
        fprintf(fp3, "\t%s\t%s\t%s\n", label, opcode, operand);
        fscanf(fp1, "%s%s%s", label, opcode, operand);
}
fprintf(fp3, "%d\t%s\t%s\t%s\n", locctr, label, opcode, operand);
length = locctr - start;

fclose(fp3);
fclose(fp2);
fclose(fp1);

printf("\n\nThe contents of Input file:\n\n");fp1
= fopen("input1.txt", "r");
ch = fgetc(fp1); while
(ch != EOF)
{
        printf("%c", ch);
        ch = fgetc(fp1);
}
```

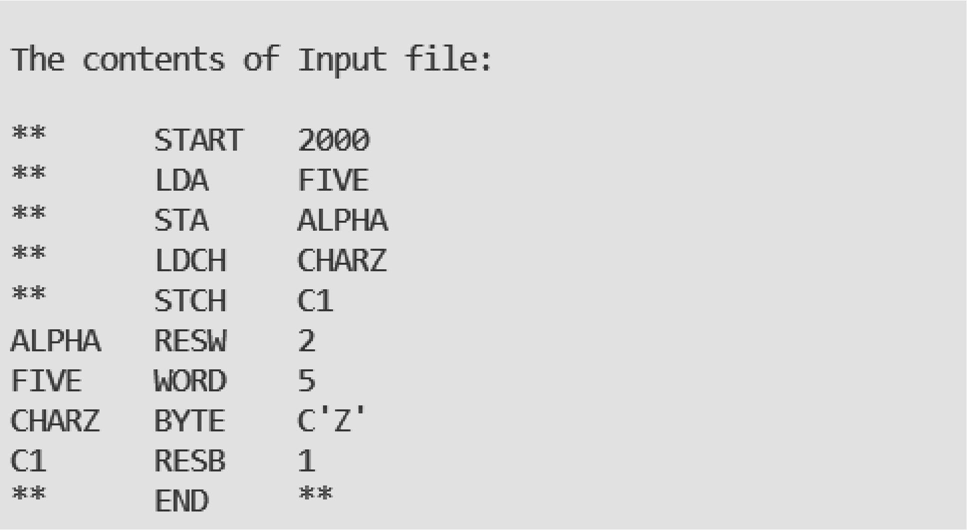
```
printf("\n\nLength of the input program is %d.", length);
printf("\n\nThe contents of Symbol Table:\n\n");
fp2 = fopen("symtab.txt", "r");ch
= fgetc(fp2);
while (ch != EOF)
{
        printf("%c", ch);
        ch = fgetc(fp2);
}

fclose(fp2);
fclose(fp1);

fp4 = fopen("output.txt", "w");
fp5 = fopen("symtab.txt", "r");
fp6 = fopen("intermediate1.txt", "r");fp7
= fopen("objcode.txt", "w");
fscanf(fp6, "%s%s%s", label, opcode, operand);
while (strcmp(opcode, "END") != 0)
{
        prevaddr = address;
        fscanf(fp6, "%d%s%s%s", &address, label, opcode, operand);
}
finaddr = address;
fclose(fp6);
fp6 = fopen("intermediate1.txt", "r"); fscanf(fp6,
"%s%s%s", label, opcode, operand);if
(strcmp(opcode, "START") == 0)
{
        fprintf(fp4, "\t%s\t%s\t%s\n", label, opcode, operand);
        fprintf(fp7, "H^%s^00%s^00%d\n", label, operand, finaddr);
        fscanf(fp6, "%d%s%s%s", &address, label, opcode, operand);
        st = address;
        diff = prevaddr - st;
        fprintf(fp7, "T^00%d^%d", address, diff);
}
while (strcmp(opcode, "END") != 0)
{
        if (strcmp(opcode, "BYTE") == 0)
        {
           fprintf(fp4, "%d\t%s\t%s\t%s\t", address, label, opcode, operand);
           len = strlen(operand);
           actual_len = len - 3;
           fprintf(fp7, "^");
```

```
            for (k = 2; k < (actual_len + 2); k++)
            {
                itoa(operand[k], ad, 16);
                fprintf(fp4, "%s", ad);
                fprintf(fp7, "%s", ad);
            }
            fprintf(fp4, "\n");
        }
        else if (strcmp(opcode, "WORD") == 0)
        {
            len = strlen(operand);
            itoa(atoi(operand), a, 10);
            fprintf(fp4, "%d\t%s\t%s\t%s\t00000%s\n", address, label, opcode, operand, a);
            fprintf(fp7, "^00000%s", a);
        }
        else if ((strcmp(opcode, "RESB") == 0) || (strcmp(opcode, "RESW") == 0))
            fprintf(fp4, "%d\t%s\t%s\t%s\n", address, label, opcode, operand);
        else
        {
            while (strcmp(opcode, mnemonic1[l]) != 0)
                l++;
            if (strcmp(operand, "COPY") == 0)
                fprintf(fp4, "%d\t%s\t%s\t%s\t%s0000\n", address, label, opcode, operand,
  code1[l]);
            else
            {
                rewind(fp5);
                fscanf(fp5, "%s%d", symbol, &add);
                while (strcmp(operand, symbol) != 0)
                    fscanf(fp5, "%s%d", symbol, &add);
                fprintf(fp4, "%d\t%s\t%s\t%s\t%s%d\n", address, label, opcode, operand, code1[l],
  add);
                fprintf(fp7, "^%s%d", code1[l], add);
        }   }

        fscanf(fp6, "%d%s%s%s", &address, label, opcode, operand);
}
fprintf(fp4, "%d\t%s\t%s\t%s\n", address, label, opcode, operand);
fprintf(fp7, "\nE^00%d", st);
printf("\nObject Program has been generated.");

fclose(fp7);
fclose(fp6);
fclose(fp5);
fclose(fp4);

printf("\n\nObject Program:\n\n");fp7
= fopen("objcode.txt",  "r"); ch =
fgetc(fp7);
while (ch != EOF)
{
        printf("%c", ch);
        ch = fgetc(fp7);
}
fclose(fp7);
  }
```

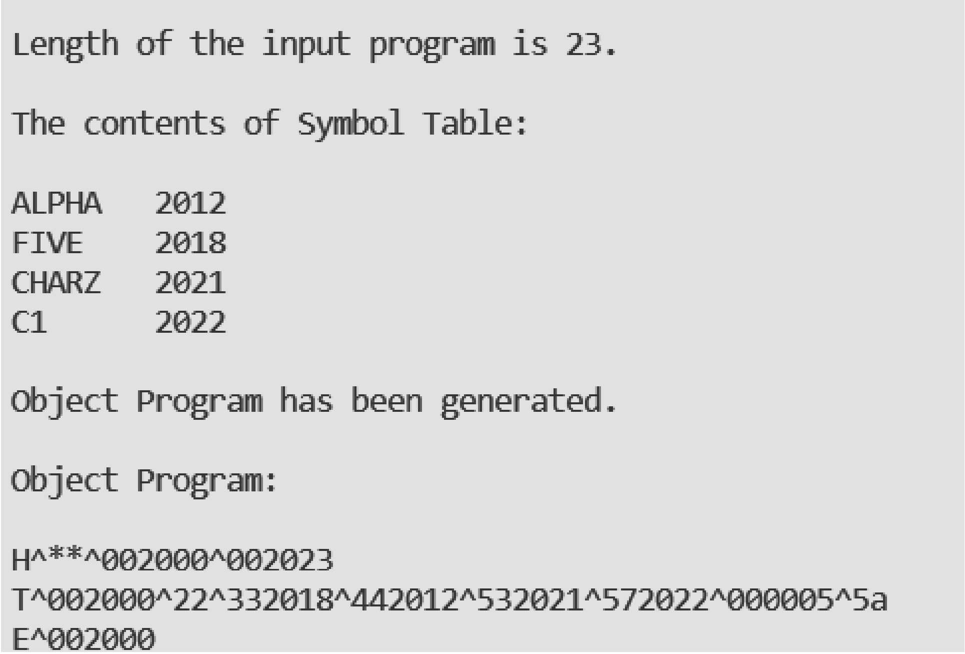
INPUT

```
**        START     2000
**        LDA       FIVE
**        STA       ALPHA
**        LDCH      CHARZ
**        STCH      C1
ALPHA     RESW      2
FIVE      WORD      5
CHARZ     BYTE      C'Z'
C1        RESB      1
**        END       **
```

OUTPUT



```
The contents of Input file:

**      START   2000
**      LDA     FIVE
**      STA     ALPHA
**      LDCH    CHARZ
**      STCH    C1
ALPHA   RESW    2
FIVE    WORD    5
CHARZ   BYTE    C'Z'
C1      RESB    1
**      END     **
```



```
Length of the input program is 23.

The contents of Symbol Table:

ALPHA   2012
FIVE    2018
CHARZ   2021
C1      2022

Object Program has been generated.

Object Program:

H^**^002000^002023
T^002000^22^332018^442012^532021^572022^000005^5a
E^002000
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY

MASM EXPERIMENTS

EXPERIMENT NO:07 **DATE:18/11/2023**

8 bit addition and multiplication using MASM

AIM

To implement 8 bit addition and multiplication

INPUT

numbers to add

OUTPUT

sum and product

- **ADDITION**

ALGORITHM

1) Load data segment starting address to DS
2) Get the first number and store it in AL
3) Move the value to BL
4) Get the second number and store it in AL
5) ADD BL and AL and store it in AL
6) Correct the Value and convert it into BCD using AAA
7) Move value in AX to BX
8) Print the value
9) Stop

PROGRAM

```
ASSUME CS:CODE, DS:DATADATA
SEGMENT
    M1 DB 10,13,"Enter first number:$" M2
    DB 10,13,"Enter second number:$"M3 DB
    10,13,"Sum: $"
DATA ENDS
PRTMSG MACRO MESSAGELEA
    DX, MESSAGE
    MOV AH,09
    INT 21H
    ENDM
GETDCM MACRO
    MOV AH, 01
    INT  21H SUB
    AL, 30HENDM
CODE  SEGMENT START:
    MOV AX, DATA
        MOV DS, AX
        PRTMSG M1
        GETDCM MOV
        BL, AL PRTMSG
        M2 GETDCM
        ADD AL, BL
        MOV AH, 00H
        AAA
        MOV BX, AX
        PRTMSG M3
        MOV DL, BH
        ADD DL, 30H
        MOV AH, 02
        INT  21H MOV
        DL, BL ADD Dl,
        30H INT  21H
        MOV AH,4CH
        INT 21H
CODE ENDS
END START
```

- **MULTIPICATION**

ALGORITHM

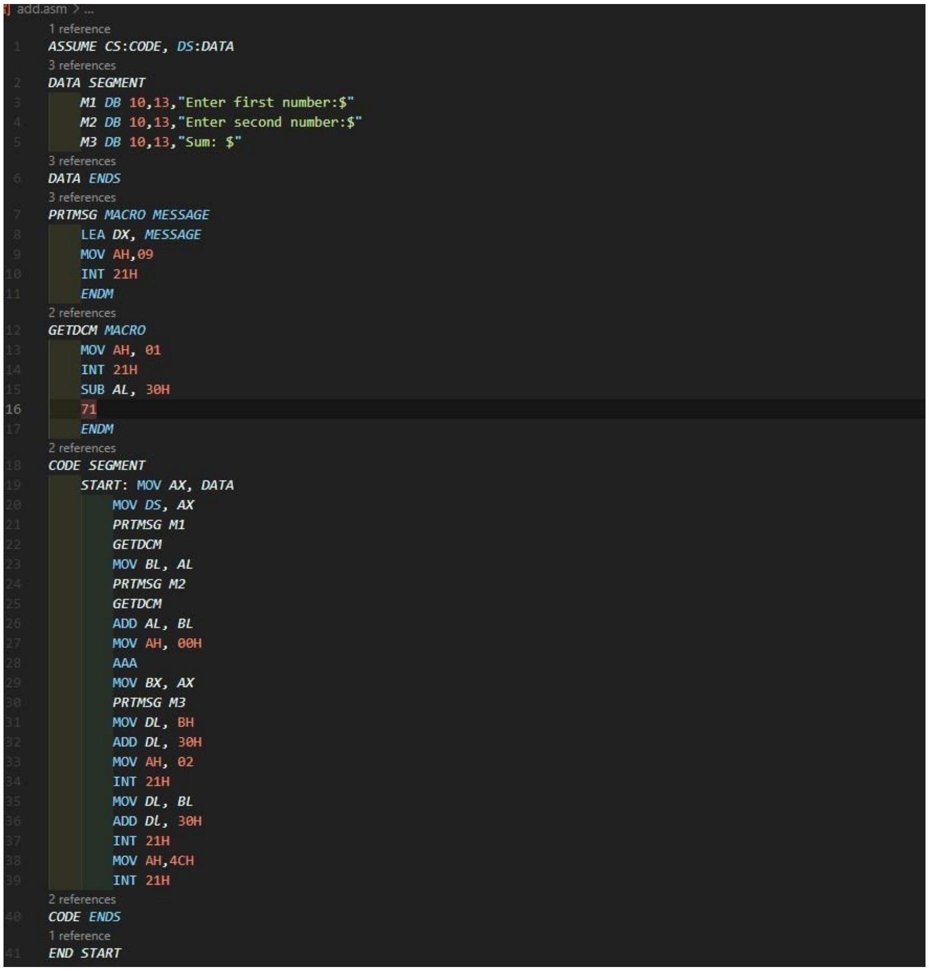
1) Load data segment starting address to DS
2) Get the first number and store it in AL
3) Move the value to BL
4) Get the second number and store it in AL
5) MUL BL and AL and store it in AX
6) Correct the Value and convert it into BCD using AAM
7) Move value in AX to BX
8) Print the value
9) Stop

PROGRAM

```
DATA SEGMENT
M1 DB 13,10,"ENTER 2 NUMBERS $"
M2 DB 13,10,"PRODUCT IS $"
DATA ENDS


PRTMSG MACRO MESSAGE
   LEA DX, MESSAGE
   MOV AH,09
   INT 21H
   ENDM
GETDCM MACRO
   MOV AH, 01
   INT 21H
   SUB AL, 30H
   ENDM

CODE SEGMENT
ASSUME CS:CODE , DS:DATA
 START:MOV AX,DATA
      MOV DS,AX
      PRTMSG M1
      GETDCM
      MOV BL,AL
      GETDCM
      MOV AH,00H
      MUL BL
      AAM
      MOV BX,AX
                  PRTMSG M2
      MOV DL,BH
      OR DL,30H
      MOV AH,02H
      INT  21H
      MOV DL,BL
      OR DL,30H
      INT  21H
      MOV AH,4CH
      INT 21H

CODE ENDS
END START
```

SAMPLE CODE AND OUTPUT

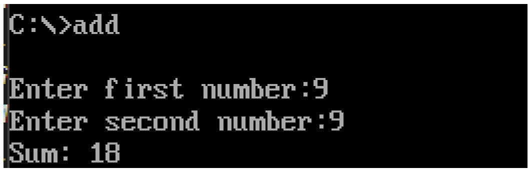
ADDITION



add.asm > ...

```
1 reference
ASSUME CS:CODE, DS:DATA
3 references
DATA SEGMENT
    M1 DB 10,13,"Enter first number:$"
    M2 DB 10,13,"Enter second number:$"
    M3 DB 10,13,"Sum: $"
3 references
DATA ENDS
3 references
PRTMSG MACRO MESSAGE
    LEA DX, MESSAGE
    MOV AH,09
    INT 21H
    ENDM
2 references
GETDCM MACRO
    MOV AH, 01
    INT 21H
    SUB AL, 30H
    71
    ENDM
2 references
CODE SEGMENT
    START: MOV AX, DATA
        MOV DS, AX
        PRTMSG M1
        GETDCM
        MOV BL, AL
        PRTMSG M2
        GETDCM
        ADD AL, BL
        MOV AH, 00H
        AAA
        MOV BX, AX
        PRTMSG M3
        MOV DL, BH
        ADD DL, 30H
        MOV AH, 02
        INT 21H
        MOV DL, BL
        ADD DL, 30H
        INT 21H
        MOV AH,4CH
        INT 21H
2 references
CODE ENDS
1 reference
END START
```

OUTPUT

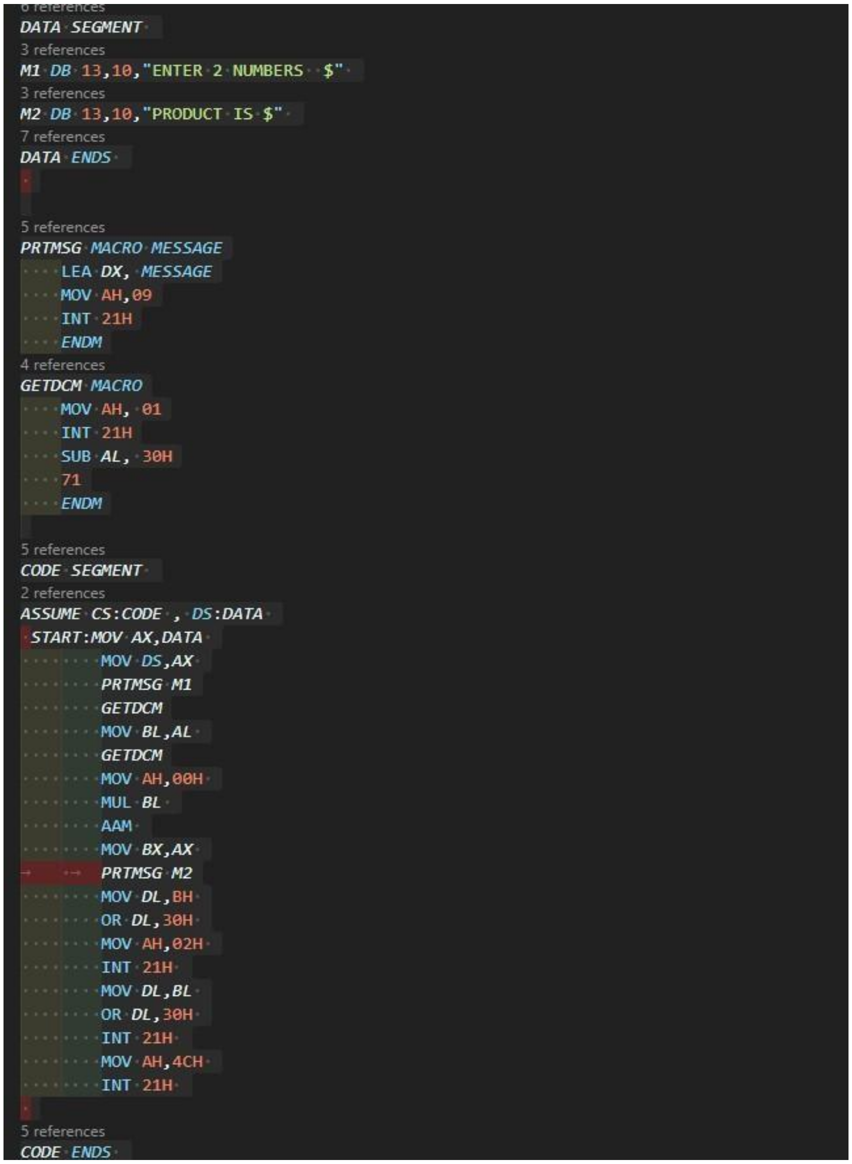


```
C:\>add

Enter first number:9
Enter second number:9
Sum: 18
```

RESULT

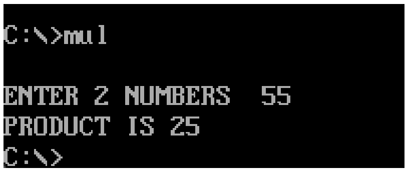
PROGRAM EXECUTED SUCCESSFULLY

MULTIPLICATION



```
6 references
DATA SEGMENT
3 references
M1 DB 13,10,"ENTER 2 NUMBERS  $"
3 references
M2 DB 13,10,"PRODUCT IS $"
7 references
DATA ENDS


5 references
PRTMSG MACRO MESSAGE
    LEA DX, MESSAGE
    MOV AH,09
    INT 21H
    ENDM
4 references
GETDCM MACRO
    MOV AH, 01
    INT 21H
    SUB AL, 30H
    71
    ENDM

5 references
CODE SEGMENT
2 references
ASSUME CS:CODE , DS:DATA
 START:MOV AX,DATA
         MOV DS,AX
         PRTMSG M1
         GETDCM
         MOV BL,AL
         GETDCM
         MOV AH,00H
         MUL BL
         AAM
         MOV BX,AX
         PRTMSG M2
         MOV DL,BH
         OR DL,30H
         MOV AH,02H
         INT 21H
         MOV DL,BL
         OR DL,30H
         INT 21H
         MOV AH,4CH
         INT 21H

5 references
CODE ENDS
```

OUTPUT



```
C:\>mul

ENTER 2 NUMBERS  55
PRODUCT IS 25
C:\>
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY

EXPERIMENT NO:08 **DATE:18/11/2023**

Check number is ODD/EVEN usingMASM

AIM

Write a program to check whether the given number is ODD/EVEN using MASM

INPUT

A number

OUTPUT

ODD or EVEN

ALGORITHM

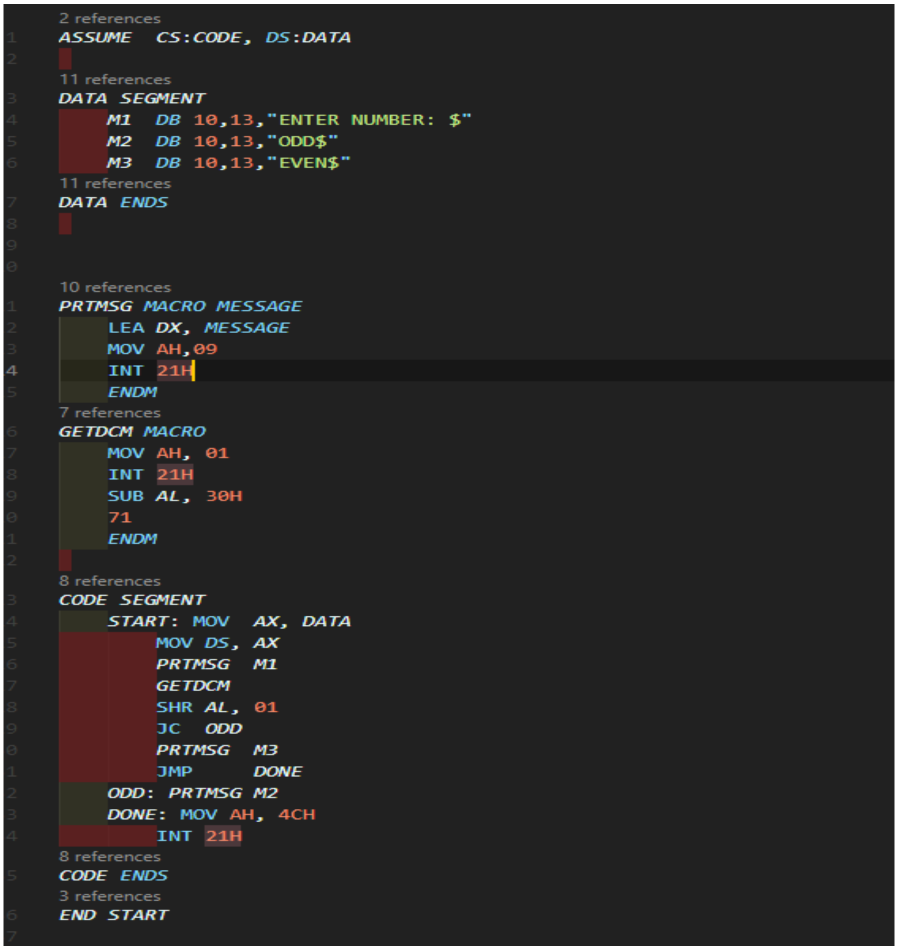
1) Load data segment starting address to DS
2) Get the first number and store it in AL
3) Do Shift right with carry in AL
4) If carry is present jump to ODD label
5) If not present Print “EVEN”
6) Jump to Stop
7) ODD: print “ODD”
8) Stop

PROGRAM

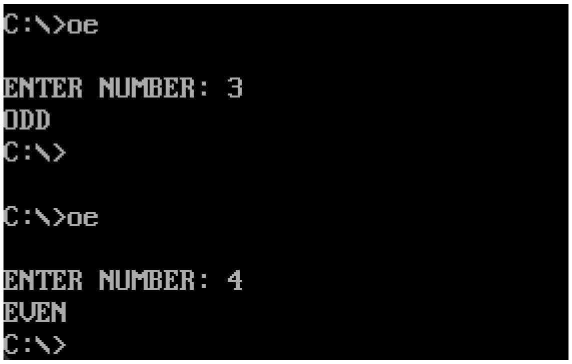
```
ASSUME      CS:CODE, DS:DATA

DATA SEGMENT
        M1    DB 10,13,"ENTER NUMBER: $"
        M2    DB 10,13,"ODD$"
        M3    DB
10,13,"EVEN$"DATA ENDS
PRTMSG MACRO
   MESSAGELEA DX,
   MESSAGE
   MOV
   AH,09INT
   21H
   ENDM
```

```
GETDCM
   MACRO
   MOV AH, 01
   INT 21H
   SUB AL,
   30HENDM

CODE SEGMENT
         START: MOV AX, DATA
                  MOV DS, AX
                  PRTMSG
                                    M
                  1GETDCM
                  SHR AL, 01 JC
                           ODD
                  PRTMSG
                           M3JMP
                           DONE
         ODD: PRTMSG
         M2 DONE: MOV
         AH, 4CH
                  INT 21H
CODE
ENDSEND
START
```

SAMPLE CODE AND OUTPUT



```
2 references
ASSUME  CS:CODE, DS:DATA

11 references
DATA SEGMENT
    M1  DB 10,13,"ENTER NUMBER: $"
    M2  DB 10,13,"ODD$"
    M3  DB 10,13,"EVEN$"
11 references
DATA ENDS



10 references
PRTMSG MACRO MESSAGE
    LEA DX, MESSAGE
    MOV AH,09
    INT 21H
    ENDM
7 references
GETDCM MACRO
    MOV AH, 01
    INT 21H
    SUB AL, 30H
    71
    ENDM

8 references
CODE SEGMENT
    START: MOV  AX, DATA
        MOV DS, AX
        PRTMSG  M1
        GETDCM
        SHR AL, 01
        JC  ODD
        PRTMSG  M3
        JMP     DONE
    ODD: PRTMSG M2
    DONE: MOV AH, 4CH
        INT 21H
8 references
CODE ENDS
3 references
END START
```



```
C:\>oe

ENTER NUMBER: 3
ODD
C:\>

C:\>oe

ENTER NUMBER: 4
EVEN
C:\>
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY

EXPERIMENT NO: 09 **DATE: 18/11/2023**

16 bit addition and multiplication using MASM

AIM

Write a program to implement 16 bit addition and multiplication using MASM

INPUT

Two numbers

OUTPUT

SUM and Product

- **ADDITION**

ALGORITHM

1) Load data segment starting address to DS
2) Get the first number and store it in AX
3) Move it to BX
4) Get second number and store it in AX
5) Move it to CX
6) Add CL add BL
7) Copy BL to AL
8) Covert to BCD using AAA
9) Store destination address in SI
10) Move AL to Destination
11)ADD AH to BH
12)Add CH to BH
13)Mov BH to AL
14)Covert to BDC format using AAA
15)Increment SI
16)Copy AL to address pointed by SI
17)Print SI
18)Stop

PROGRAM

```
ASSUME CS:CODE, DS:DATADATA
SEGMENT
        M1      DB 10,13,"ENTER FIRST NUMBER: $" M2
                DB 10,13,"ENTER SECOND NUMBER: $"
```

```
       M3     DB 10,13,"SUM: $"
  SUM DB 03
DATA ENDS

PRTMSG MACRO MESSAGELEA
  DX, MESSAGE
  MOV AH,09INT 21H ENDM
GETDCM MACRO
  MOV AH, 01 INT
  21H
  SUB AL, 30H
  ENDM

PRTDCM        MACRO
  MOV DL,[SI]
  ADD DL, 30H
  MOV AH, 02
  INT  21H
  ENDM

CODE SEGMENT
       START: MOV    AX, DATA
              MOV DS, AX PRTMSG
                            M1
              GETDCM
         MOV BH, AL
    GETDCM
              MOV BL, AL PRTMSG
                            M2
              GETDCM
         MOV CH, AL
    GETDCM
              MOV CL, AL
              ADD BL, CL
    MOV AL, BL

         MOV  AH,  00
         AAA
         LEA   SI,   SUM
         MOV   [SI],   AL
         ADD   BH,   AH
         ADD   BH,   CH
         MOV   AL,   BH
         MOV   AH,   00
         AAA
    INC SI
         MOV   [SI],   AL
         INC SI
         MOV [SI], AH
    PRTMSG    M3
         PRTDCM
    DEC SI PRTDCM
    DEC SI
              PRTDCM MOV
              AH, 4CH
```

```
                INT 21H
CODE ENDS
END START
```

- **MULTIPLICATION**

ALGORITHM

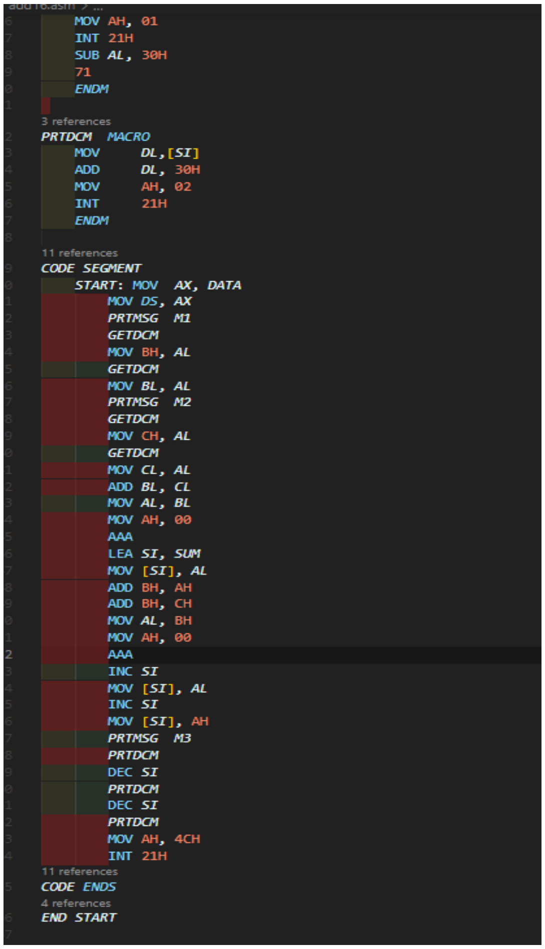
1) Load data segment starting address to DS
2) Get the first number and store it in AX
3) Get the second number and store in CX
4) Copy destination address to SI
5) Multiply CL and BL
6) Store it in destination
7) Multiply CL and store it in DX
8) Add data in destination with DL
9) Multiply BL with AL
10) Add the value in AL with DL
11) Store the value in destination
12) Display the value
13) Stop

PROGRAM

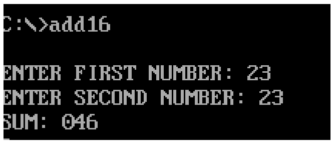
```
ASSUME          CS:CODE, DS:DATA

DATA SEGMENT
        M1      DB 10, 13, "ENTER FIRST NUMBER: $" M2   DB
        10, 13, "ENTER SECOND NUMBER: $"M3    DB    10,    13,
        "PRODUCT: $"
        PROD   DB   4   DUP(00H)

DATA ENDS

PRTMSG          MACRO           MESSAGE
  LEA DX, MESSAGE
  MOV  AH,  09
  INT        21H
  ENDM

GETDCM          MACRO
  MOV AH, 01
  INT    21H  SUB
  AL, 30HENDM

PRTDCM          MACRO
```

```
    MOV   DL,   [SI]
    ADD   DL,   30H
    MOV AH, 02
          INT          21H
    ENDM

CODE SEGMENT
                    START:                 MOV   AX,   DATA
                              MOV DS, AX
                              PRTMSG              M1
                              GETDCM
                        MOV BH, AL
          GETDCM
                              MOV BL, AL PRTMSG
                                                  M2
                              GETDCM
                        MOV CH, AL
          GETDCM
                              MOV  CL,  AL  LEA
                              SI, PRODMOV AH,
                              00HMUL BL
                              AAM
                              MOV   [SI],   AL
                              INC         SI
                              MOV [SI], AH
                        MOV   AH,  00H
                        MOV    AL,    BH
                        MUL CL
                        AAM
                        MOV DX, AX
                              ADD    DL,    [SI]
                              MOV  AH,  00H
                              MOV    AL,    CH
                              MUL BL
                              AAM
                              ADD    DX,     AX
                              MOV    AL,    DL
                              MOV  AH,  00H
                              AAM
                              ADD    DH,    AH
                              MOV    DL,    DH
                              MOV  DH,  00H
                              MOV    [SI],    AL
                              INC         SI
                              MOV  AH,  00H
                              MOV    AL,    BH
                              MUL CH
                              AAM
                              ADD    DX,     AX
                              MOV    AL,    DL
                              MOV  AH,  00H
                              AAM
                    MOV   [SI],   AL
               INC  SI
      ADD   DH,   AH
      MOV AL, DH
           MOV    [SI],    AL
      PRTMSG              M3
                    PRTDCM      DEC
                           SI
                    PRTDCM      DEC
                           SI
                    PRTDCM      DEC
                           SI
                    PRTDCM    MOV
                    AH,     4CH    INT
                           21H

CODE      ENDS
END START
```

SAMPLE CODE AND OUTPUT
ADDITION

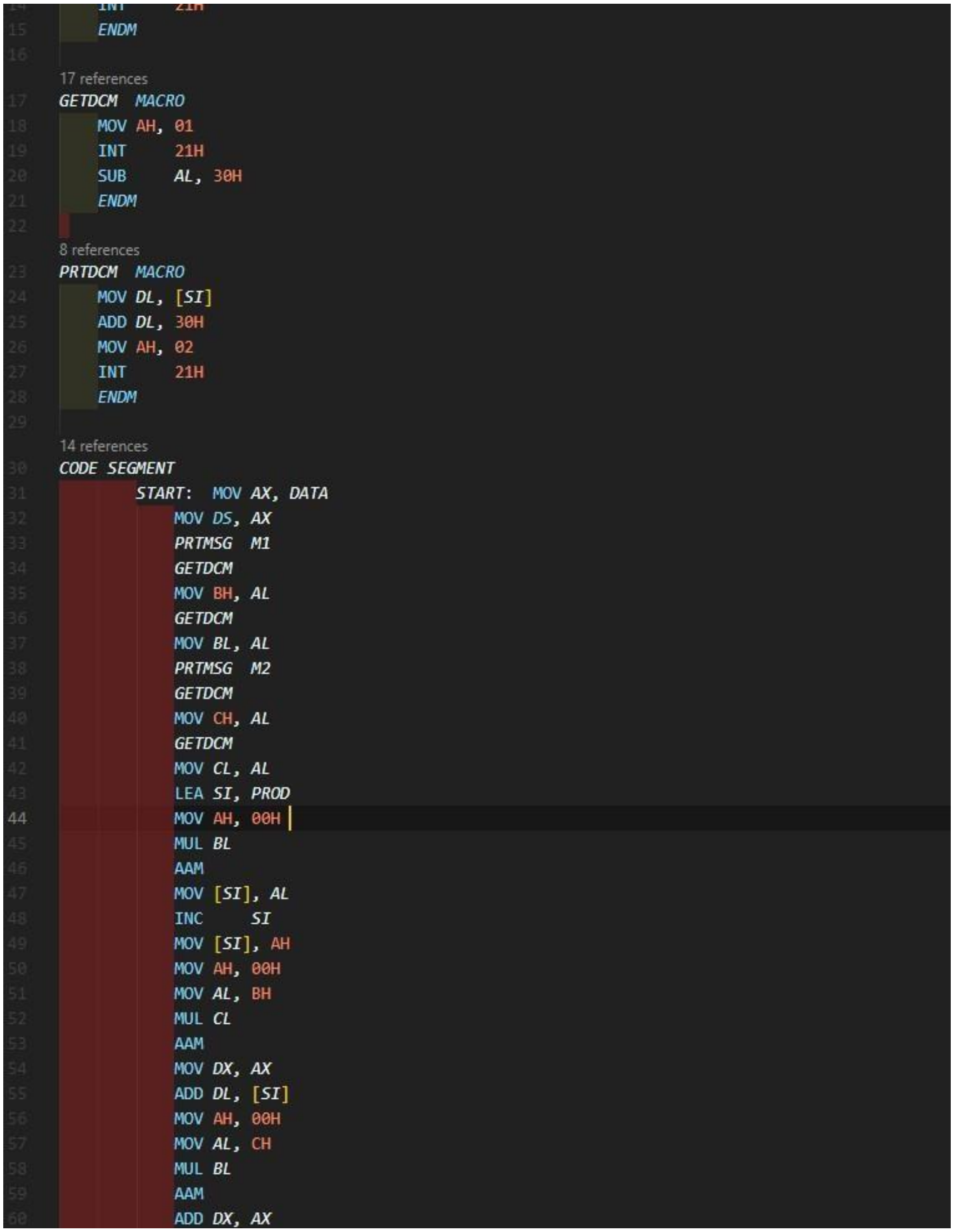


```
        MOV AH, 01
        INT 21H
        SUB AL, 30H
        71
        ENDM

    3 references
    PRTDCM  MACRO
        MOV     DL,[SI]
        ADD     DL, 30H
        MOV     AH, 02
        INT     21H
        ENDM

    11 references
    CODE SEGMENT
        START: MOV  AX, DATA
            MOV DS, AX
            PRTMSG  M1
            GETDCM
            MOV BH, AL
            GETDCM
            MOV BL, AL
            PRTMSG  M2
            GETDCM
            MOV CH, AL
            GETDCM
            MOV CL, AL
            ADD BL, CL
            MOV AL, BL
            MOV AH, 00
            AAA
            LEA SI, SUM
            MOV [SI], AL
            ADD BH, AH
            ADD BH, CH
            MOV AL, BH
            MOV AH, 00
            AAA
            INC SI
            MOV [SI], AL
            INC SI
            MOV [SI], AH
            PRTMSG  M3
            PRTDCM
            DEC SI
            PRTDCM
            DEC SI
            PRTDCM
            MOV AH, 4CH
            INT 21H
    11 references
    CODE ENDS
    4 references
    END START
```

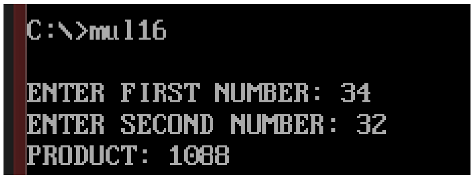


```
C:\>add16

ENTER FIRST NUMBER: 23
ENTER SECOND NUMBER: 23
SUM: 046
```

MULTPILICATION



```
        INT     21H
        ENDM

17 references
GETDCM  MACRO
        MOV AH, 01
        INT     21H
        SUB     AL, 30H
        ENDM

8 references
PRTDCM  MACRO
        MOV DL, [SI]
        ADD DL, 30H
        MOV AH, 02
        INT     21H
        ENDM

14 references
CODE SEGMENT
        START:  MOV AX, DATA
                MOV DS, AX
                PRTMSG  M1
                GETDCM
                MOV BH, AL
                GETDCM
                MOV BL, AL
                PRTMSG  M2
                GETDCM
                MOV CH, AL
                GETDCM
                MOV CL, AL
                LEA SI, PROD
                MOV AH, 00H
                MUL BL
                AAM
                MOV [SI], AL
                INC     SI
                MOV [SI], AH
                MOV AH, 00H
                MOV AL, BH
                MUL CL
                AAM
                MOV DX, AX
                ADD DL, [SI]
                MOV AH, 00H
                MOV AL, CH
                MUL BL
                AAM
                ADD DX, AX
```



```
C:\>mul16

ENTER FIRST NUMBER: 34
ENTER SECOND NUMBER: 32
PRODUCT: 1088
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY

EXPERIMENT NO:10 **DATE:18/11/2023**

Linear Search using MASM

AIM

Write a program to implement Linear Search using MASM

INPUT

Numbers

OUTPUT

Location of key

ALGORITHM

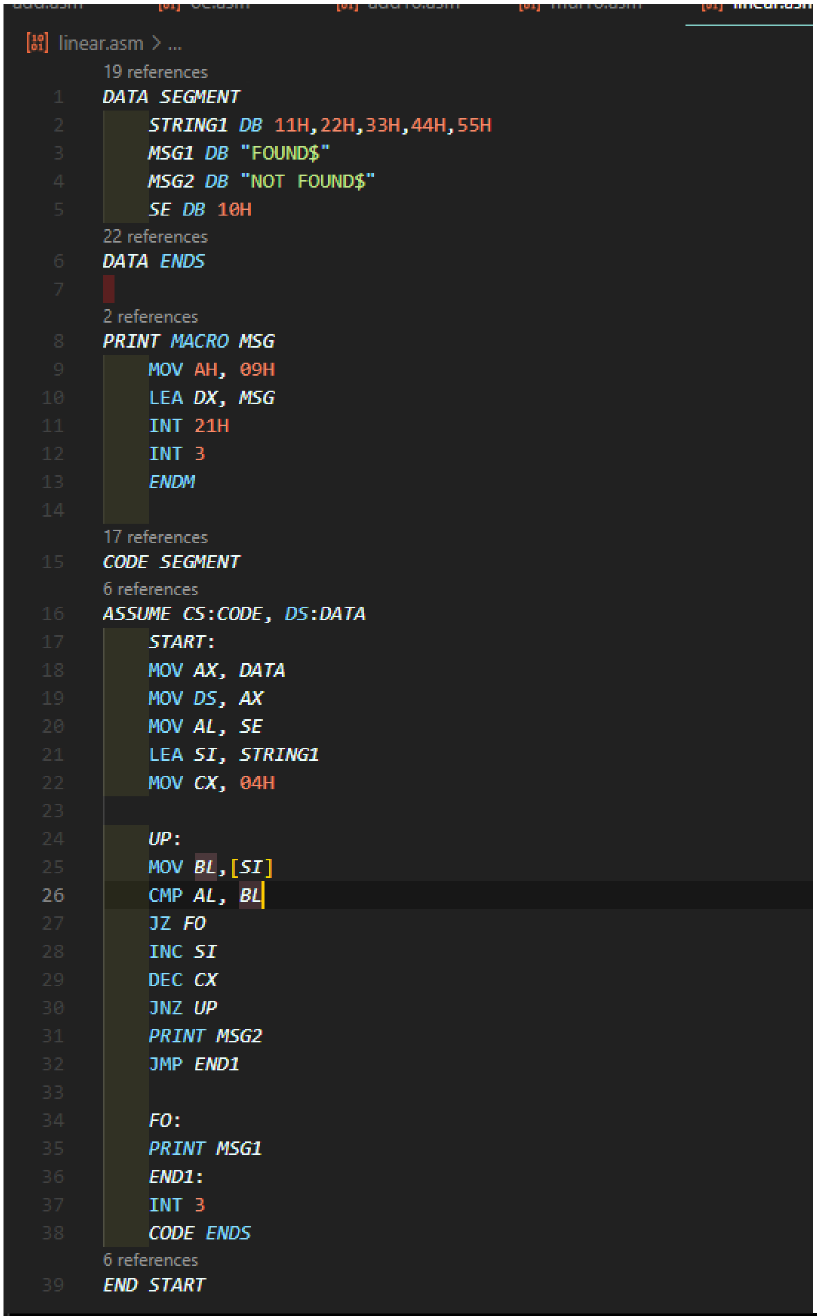
1) Load data segment starting address to DS
2) Copy value to be sreached to AL
3) Copy starting address of array to SI
4) Store size of the array to CX
5) UP:
6) Move first element to BL
7) Compare with AL
8) If Zero jump to FO:
9) Else
10) Increment SI
11) Decrement CX
12) If CX not zero Jump to UP:
13) Print NOT FOUND
14)Jump to stop 15)FO:
16) Print FOUND
17)Stop

PROGRAM

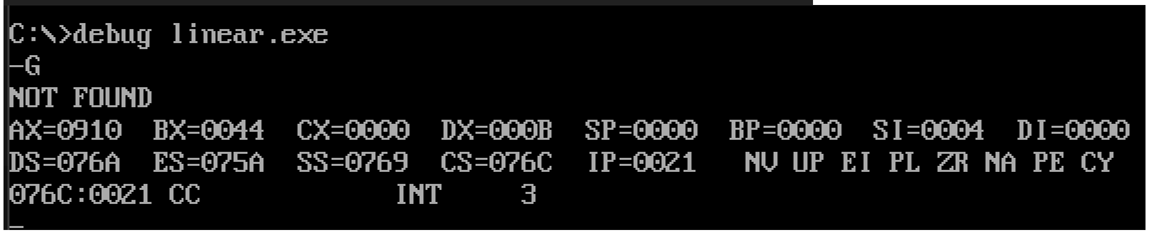
```
DATA SEGMENT
    STRING1 DB 11H,22H,33H,44H,55HMSG1 DB
    "FOUND$"
    MSG2 DB "NOT FOUND$"SE
    DB 10H
DATA ENDS

PRINT MACRO MSG
```

```
    MOV   AH,   09H
    LEA    DX,    MSG
    INT 21H
    INT     3
    ENDM

CODE SEGMENT
ASSUME  CS:CODE,  DS:DATASTART:
    MOV AX, DATA
    MOV DS, AX
    MOV AL, SE
    LEA SI, STRING1
    MOV CX, 04H

    UP:
    MOV    BL,[SI]
    CMP  AL,  BLJZ
    FO
    INC SI
    DEC CX
    JNZ UP
    PRINT MSG2
    JMP END1

    FO:
    PRINT MSG1
    END1:
    INT 3
    CODE ENDS
END START
```

SAMPLE CODE AND OUTPUT



```
DATA SEGMENT
    STRING1 DB 11H,22H,33H,44H,55H
    MSG1 DB "FOUND$"
    MSG2 DB "NOT FOUND$"
    SE DB 10H
DATA ENDS

PRINT MACRO MSG
    MOV AH, 09H
    LEA DX, MSG
    INT 21H
    INT 3
    ENDM

CODE SEGMENT
ASSUME CS:CODE, DS:DATA
    START:
    MOV AX, DATA
    MOV DS, AX
    MOV AL, SE
    LEA SI, STRING1
    MOV CX, 04H

    UP:
    MOV BL,[SI]
    CMP AL, BL
    JZ FO
    INC SI
    DEC CX
    JNZ UP
    PRINT MSG2
    JMP END1

    FO:
    PRINT MSG1
    END1:
    INT 3
    CODE ENDS
END START
```



```
C:\>debug linear.exe
-G
NOT FOUND
AX=0910  BX=0044  CX=0000  DX=000B  SP=0000  BP=0000  SI=0004  DI=0000
DS=076A  ES=075A  SS=0769  CS=076C  IP=0021   NV UP EI PL ZR NA PE CY
076C:0021 CC            INT     3
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY

EXPERIMENT NO: 11 **DATE:18/11/2023**

String manipulation using MASM

AIM

To find number of vowels, consonants and digits in string

INPUT

String

OUTPUT

count

ALGORITHM

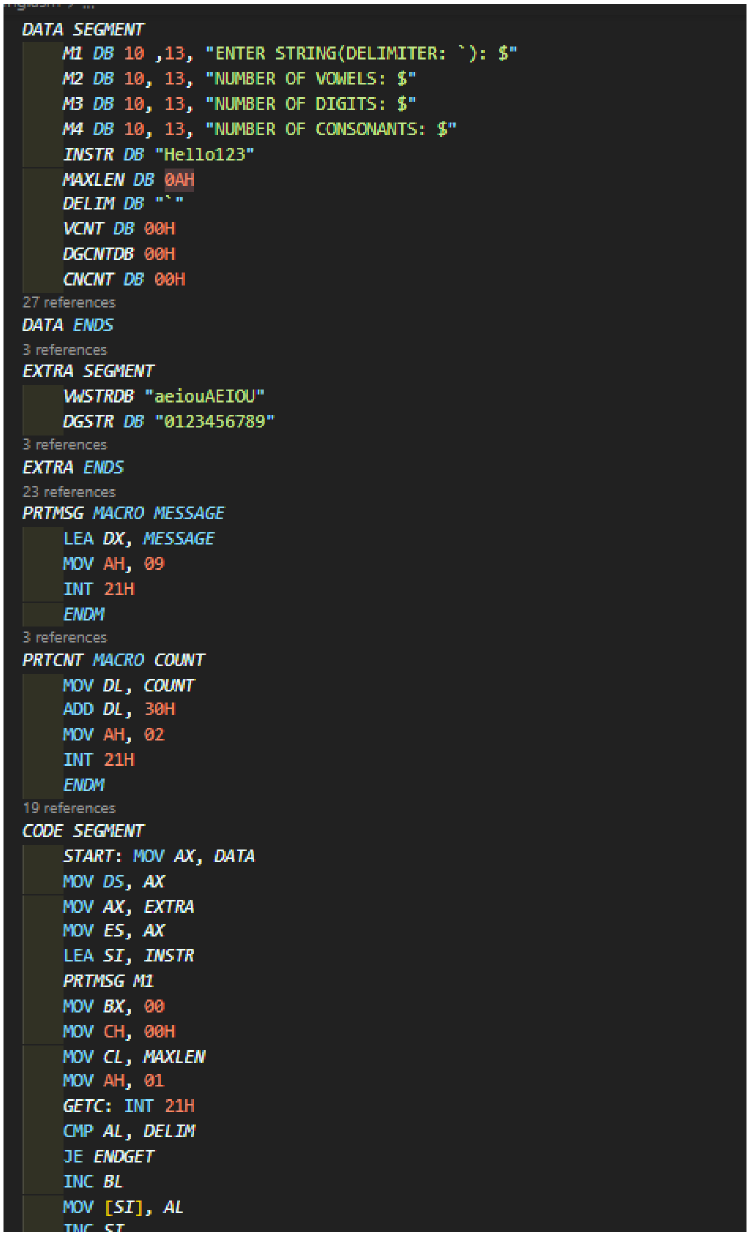
1) Load data segment starting address to DS
2) Load extra segment starting address to ES
3) Copy starting address of the string to SI
4) Move maxlength to CL
5) GETC: call interrupt 21
6) Compare AL with DELIM
7) Jump to ENDET: if equal
8) Increament BL
9) Move AL to Destination
10)Increment SI
11) Loop GETC
12)ENDGET: CLD
13)Copy starting address of string to SI
14)Move content of SI to AX
15)Increament SI
16)Copy the starting address of vowels to DI
17)Repeat when not zero SCASB:
18)Jump on not equal CHKC
19)Increament VCNT 20)Jump to ENDC
21)Display number of vowels, consonants,digits in the string

PROGRAM

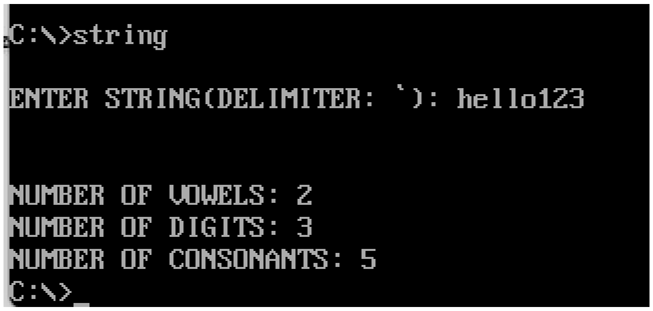
```
ASSUME CS:CODE,DS:DATA,ES:EXTRA
```

```
DATA SEGMENT
    M1 DB 10 ,13, "ENTER STRING(DELIMITER: `): $"M2 DB
    10, 13, "NUMBER OF VOWELS: $"
    M3 DB 10, 13, "NUMBER OF DIGITS: $"
    M4 DB 10, 13, "NUMBER OF CONSONANTS: $"INSTR DB
    "Hello123"
    MAXLEN DB 0AH
    DELIM DB "`" VCNT
    DB 00H DGCNT DB
    00H CNCNT DB 00H
DATA ENDS EXTRA
SEGMENT
    VWSTR DB "aeiouAEIOU"
    DGSTR DB "0123456789"
EXTRA ENDS
PRTMSG MACRO MESSAGELEA
    DX, MESSAGE
    MOV AH, 09
    INT 21H
    ENDM
PRTCNT MACRO COUNTMOV
    DL, COUNT
    ADD DL, 30H
    MOV AH, 02
    INT 21H ENDM
CODE  SEGMENT START:
    MOV AX, DATAMOV DS,
    AX
    MOV AX, EXTRA
    MOV  ES,  AX LEA
    SI, INSTR PRTMSG
    M1 MOV BX, 00
    MOV CH, 00H
    MOV CL, MAXLEN
    MOV AH, 01 GETC:
    INT 21H CMP AL,
    DELIM JE ENDGET
    INC BL
    MOV [SI], AL
    INC  SI LOOP
    GETC
    ENDGET: CLD
    LEA SI, INSTR
    CHKA: MOV AX, [SI]
    INC SI
    MOV CL, 0AH LEA
    DI, VWSTRREPNZ
    SCASB JNE CHKD
    INC VCNT
    JMP ENDC
    CHKD: MOV CL, 0AHLEA
    DI, DGSTR REPNZ
    SCASB
    JNE CHKC INC
    DGCNTJMP
    ENDC
    CHKC:    INC    CNCNT
    ENDC: MOV CL, BLDEC
    BX
    LOOP CHKA
    PRTMSG M2
    PRTCNT VCNT
    PRTMSG M3
    PRTCNT DGCNT
    PRTMSG M4
    PRTCNT CNCNT
    MOV AH, 4CH INT
    21H
    CODE ENDS
END START
```

SAMPLE CODE AND OUTPUT



```
DATA SEGMENT
        M1 DB 10 ,13, "ENTER STRING(DELIMITER: `): $"
        M2 DB 10, 13, "NUMBER OF VOWELS: $"
        M3 DB 10, 13, "NUMBER OF DIGITS: $"
        M4 DB 10, 13, "NUMBER OF CONSONANTS: $"
        INSTR DB "Hello123"
        MAXLEN DB 0AH
        DELIM DB "`"
        VCNT DB 00H
        DGCNTDB 00H
        CNCNT DB 00H
27 references
DATA ENDS
3 references
EXTRA SEGMENT
        VWSTRDB "aeiouAEIOU"
        DGSTR DB "0123456789"
3 references
EXTRA ENDS
23 references
PRTMSG MACRO MESSAGE
        LEA DX, MESSAGE
        MOV AH, 09
        INT 21H
        ENDM
3 references
PRTCNT MACRO COUNT
        MOV DL, COUNT
        ADD DL, 30H
        MOV AH, 02
        INT 21H
        ENDM
19 references
CODE SEGMENT
        START: MOV AX, DATA
        MOV DS, AX
        MOV AX, EXTRA
        MOV ES, AX
        LEA SI, INSTR
        PRTMSG M1
        MOV BX, 00
        MOV CH, 00H
        MOV CL, MAXLEN
        MOV AH, 01
        GETC: INT 21H
        CMP AL, DELIM
        JE ENDGET
        INC BL
        MOV [SI], AL
        INC SI
```



```
C:\>string

ENTER STRING(DELIMITER: `): hello123


NUMBER OF VOWELS: 2
NUMBER OF DIGITS: 3
NUMBER OF CONSONANTS: 5
C:\>_
```

RESULT

PROGRAM EXECUTED SUCCESSFULLY

TRAINER KIT PROGRAM

EXPERIMENT NO : 12 **DATE:18/11/2023**

ADDITION OF TWO 16 BIT NUMBERS USING 8086 TRAINER KIT

AIM

To add two 16-bit numbers using 8086 trainer kit.

ALGORITHM

1. Clear the AX by performing AND operation with 0000
2. Move the location where result is to be stored to BX
3. Move the location of operand 1 to SI
4. Move the location of operand 2 to DI
5. Move the contents of SI to AX
6. Add the contents of DI to AX
7. Move the result to the location stored in BX
8. Move 0000H to AX
9. Add the carry flag to AX
10. Move the result to the location stored in [BX + 2]
11. Halt

PROGRAM

ADDRESS	MNEMONICS
0400	AND AX,0000H
0403	MOV BX,0600H
0406	MOV SI,0500H
0409	MOV DI,0550H
040C	MOV AX,[SI]
040E	ADD AX,[DI]
0410	MOV [BX],AX
0412	MOV AX,0000H
0415	ADC AX,0000H
0418	MOV [BX+2],AX
041B	HLT

INPUT

0500 - B5
0501 - 7A
0550 - 2A
0551 – E5

OUTPUT

0600 - DF
0601 - 5F
0602 - 01

RESULT

SUCCESSFULLY EXECUTED

EXPERIMENT NO : 13 DATE:18/11/2023

SUBTRACTION OF TWO 16 BIT NUMBERSUSING 8086 TRAINER KIT

AIM

To subtract two 16-bit numbers using 8086 trainer kit.

ALGORITHM

1. Clear the carry flag
2. Move the location where result is to be stored to BX
3. Move the location of operand 1 to SI
4. Move the location of operand 2 to DI
5. Move the contents of SI to AX
6. Subtract the contents of DI from AX including the borrow value
7. Move the result to the location stored in BX
8. Halt

PROGRAM

ADDRESS	MNEMONICS
0400	CLC
0401	MOV BX,0900H
0404	MOV SI,0700H
0407	MOV DI,0800H
040A	MOV AX,[SI]
040C	SBB AX,[DI]
040E	MOV [BX],AX
0410	HLT

INPUT

0700 - 18
0701 - 08
0800 - 40
0801 - 10

OUTPUT

```
0900 - D8
0901 - F7
```

RESULT

SUCCESSFULLY EXECUTED

EXPERIMENT NO : 14 **DATE:18/11/2023**

MULTIPLICATION OF TWO 16 BIT NUMBERS USING 8086 TRAINER KIT

AIM

To multiply two 16-bit numbers using 8086 trainer kit.

ALGORITHM

1. Clear the carry flag
2. Move the location where result is to be stored to BX
3. Move the location of operand 1 to SI
4. Move the location of operand 2 to DI
5. Move the contents of SI to AX
6. Move the contents of DI to CX
7. Multiply CX to AX
8. Move the result from AX to the location stored in BX
9. Move the higher bits of result from DX to the location stored in [BX+2]
10. Halt

PROGRAM

```
ADDRESS          MNEMONICS

 0400            CLC
 0401            MOV BX,0700H
 0404            MOV SI,0750H
 0407            MOV DI,0800H
 040A            MOV AX,[SI]
 040C            MOV CX,[DI]
 040E            MUL CX
 0410            MOV [BX],AX
 0412            MOV [BX+2],DX
 0415            HLT
```

INPUT

```
0750 - 1A
0751 - 2B
0800 - 4B
0801 - 12
```

OUTPUT

```
0700 - 9E
0701 - 74
0702 - 14
0703 - 03
```

RESULT

SUCCESSFULLY EXECUTED

EXPERIMENT NO : 15 **DATE:18/11/2023**

DIVISION OF A 16 BIT NUMBER BY AN 8 BIT NUMBERUSING 8086 TRAINER KIT

AIM

To divide a 16-bit number by an 8 bit number using 8086 trainer kit.

ALGORITHM

1. Clear the carry flag
2. Move the location where result is to be stored to BX
3. Move the location of operand 1 to SI
4. Move the location of operand 2 to DI
5. Move the contents of SI to AX
6. Move the contents of DI to CX
7. Move 00 to CH
8. Divide CL from AX
9. Move the result from AX to the location stored in BX
10. Halt

PROGRAM

ADDRESS	MNEMONICS
0400	CLC
0401	MOV BX,0700H
0404	MOV SI,0750H
0407	MOV DI,0800H
040A	MOV AX,[SI]
040C	MOV CX,[DI]
040E	MOV CH,00H
0410	DIV CL
0412	MOV [BX],AX
0414	HLT

INPUT

0750 - 43
0751 - 12
0800 - 21

OUTPUT

0700 - 8D (Quotient)
0701 – 16 (Remainder)

RESULT

SUCCESSFULLY EXECUTED

EXPERIMENT NO : 16 **DATE:18/11/2023**

MAXIMUM OF N NUMBERSUSING 8086 TRAINER KIT

AIM

To find the maximum of n numbers using the 8086 trainer kit.

ALGORITHM

1. Clear the carry flag
2. Move the location where the result has to be stored to BX
3. Move the starting location of array to SI
4. Move the total number of elements in the array to CX
5. Move 00 to AL
6. Compare the contents of SI with AL
7. Jump to step 9 if above instruction satisfies
8. Else move the contents of SI to AL
9. Move 00 to CH
10. Increment SI
11. Continue the loop of comparing the contents of SI and AL till the counter reacheszero (LOOPNZ only loops when the zero flag is not set)
12. Move the result, ie, maximum number from AL to the location stored in BX
13. Halt

PROGRAM

ADDRESS	MNEMONICS
0400	CLC
0401	MOV BX,0700H
0404	MOV SI,0800H
0407	MOV CX,0005H
040A	MOV AL,00H
040C	CMP AL,[SI]
040E	JA 0412H
0410	MOV CH,00H
0412	INC SI

```
0413                LOOPNZ 040CH
0415                MOV [BX],AL
0417                HLT
```

INPUT

0800 - 77
0801 - 81
0802 - B4
0803 - F1
0804 - AB

OUTPUT

0700 - F1

RESULT

SUCCESSFULLY EXECUTED

EXPERIMENT NO : 17 **DATE:18/11/2023**

SORTING NUMBERS IN ASCENDING ORDER USING 8086 TRAINER KIT

AIM

To sort the numbers in ascending order using 8086 trainer kit.

ALGORITHM

1. Set the value of SI to 500.
2. Load data from offset SI to register CL.
3. Decrease value of register CL by 1.
4. Set the value of SI to 500.
5. Load data from offset SI to register CH. Decrease value of register CH by 1
6. Increase the value of SI by 1.
7. Load value from offset SI to register AL.
8. Increase the value of SI by 1.
9. Compare the value of register AL and [SI] ,ie,(AL-[SI]).
10. Jump to address 41C if carry is generated.
11. Exchange the contents of register AL and SI.
12. Decrease the value of SI by 1.
13. Exchange the contents of register AL and SI
14. Increase the value of SI by 1.
15. Decrease the value of register CH by 1.
16. Jump to address 40F if zero flat reset
17. Decrease the value of register CL by 1.
18. Jump to address 407 if zero flat reset.
19. Stop

PROGRAM

ADDRESS	MNEMONICS
0400	MOV SI,500
0403	MOV CL,[SI]
0405	DEC CL

```
0407                MOV SI,500
0409                MOV CH,[SI]
040C                DEC CH
040E                INC SI
040F                MOV AL,[SI]
0411                INC SI
0412                CMP AL,[SI]
0414                JC 041C
0416                XCHG AL,[SI]
0418                DEC SI
0419                XCHG AL,[SI]
041B                INC SI
041C                DEC CH
041E                JNZ 40F
0420                DEC CL
0422                JNZ 407
0424                HLT
```

INPUT

0500 - 5
0501 - 6
0502 - 8
0503 - 3
0504 - 5
0505 - 4

OUTPUT

0500 - 5
0501 - 3
0502 - 4
0503 - 5
0504 - 6
0505 - 8

RESULT

SUCCESSFULLY EXECUTED