Graphic Era HILL UNIVERSITY

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Term work

on

Operating Systems

(PCS 506)

2021-22

Submitted to:

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Section: I

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

GRAPHIC ERA HILL UNIVERSITY, DEHRADUN

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B.Tech CSE-I-V Sem

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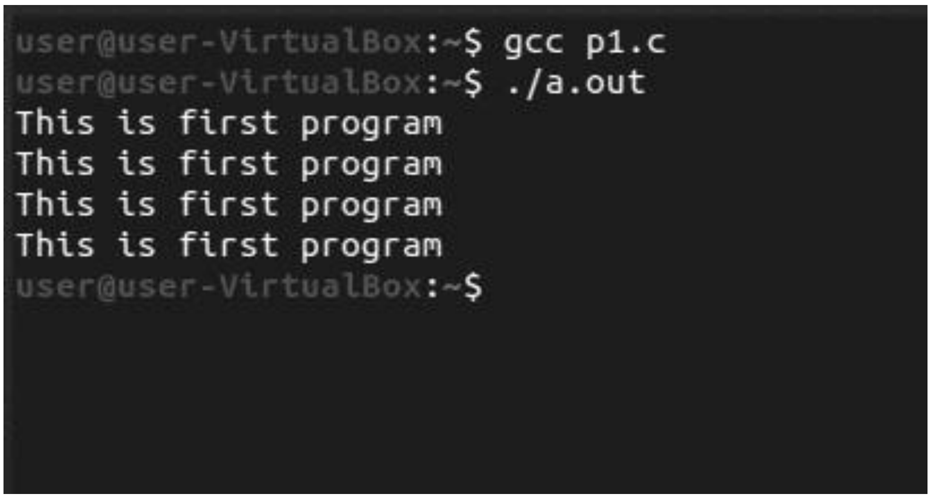
Program 1

Q1. Write a C program to demonstrate the use of fork() System call

SOURCE CODE

```
#include <stdio.h>
#include<unistd.h>
int main(){ fork();
fork();
   printf("This is first program\n");
   return 0;
}
```

OUTPUT:



```
user@user-VirtualBox:~$ gcc p1.c
user@user-VirtualBox:~$ ./a.out
This is first program
This is first program
This is first program
This is first program
user@user-VirtualBox:~$
```

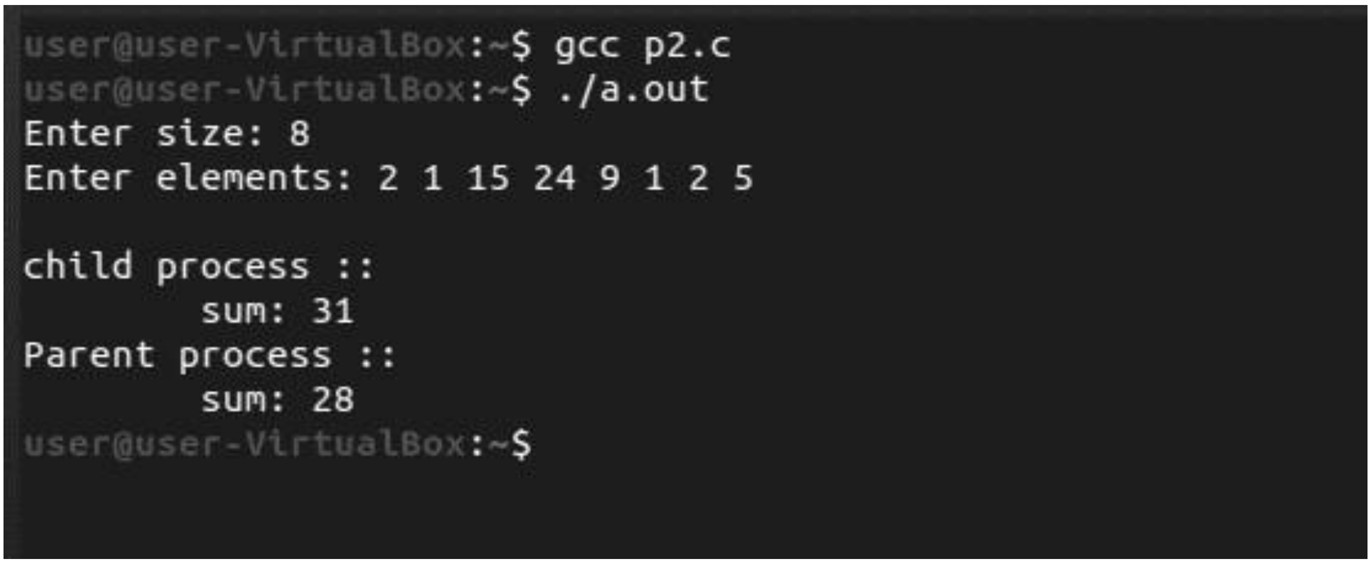
Program 2

Q2. C Program in which Parent Process Computes the SUM OF EVEN NUMBERS and Child Process Computes the sum of ODD NUMBERS stored in array using fork () . First the child process should print its answer i.e sum of odd numbers, then parent should print its answer, i.e sum of even numbers.

SOURCE CODE

```
#include<stdio.h>
#include<unistd.h>
#include<stdlib.h>
#include<sys/wait.h>
int main(){
int p,n,i,sum=0;
printf("Enter size:");
scanf("%d",&n);
int arr[n];
printf("Enter elements: ");
for(i=0;i<n;i++)
scanf("%d",&arr[i]);

p=fork();
 if(p<0){
printf("failed to create child\n");
exit(1);
}
else if(p==0){
printf("\nchild process :: ");
   for(i = 0;i<n;i++)
   if(arr[i]%2!=0)
       {
          sum+=arr[i];
       }
   printf("\n\tsum: %d",sum);
} else
if(p>0){
   wait(NULL);
   printf("\nParent process :: ");
   for(i = 0;i<n;i++)
   if(arr[i]%2==0){
          sum+=arr[i];
          } printf("\n\tsum:
   %d\n",sum);
}

return 0;
}
```

OUTPUT:



```
user@user-VirtualBox:~$ gcc p2.c
user@user-VirtualBox:~$ ./a.out
Enter size: 8
Enter elements: 2 1 15 24 9 1 2 5

child process ::
        sum: 31
Parent process ::
        sum: 28
user@user-VirtualBox:~$
```

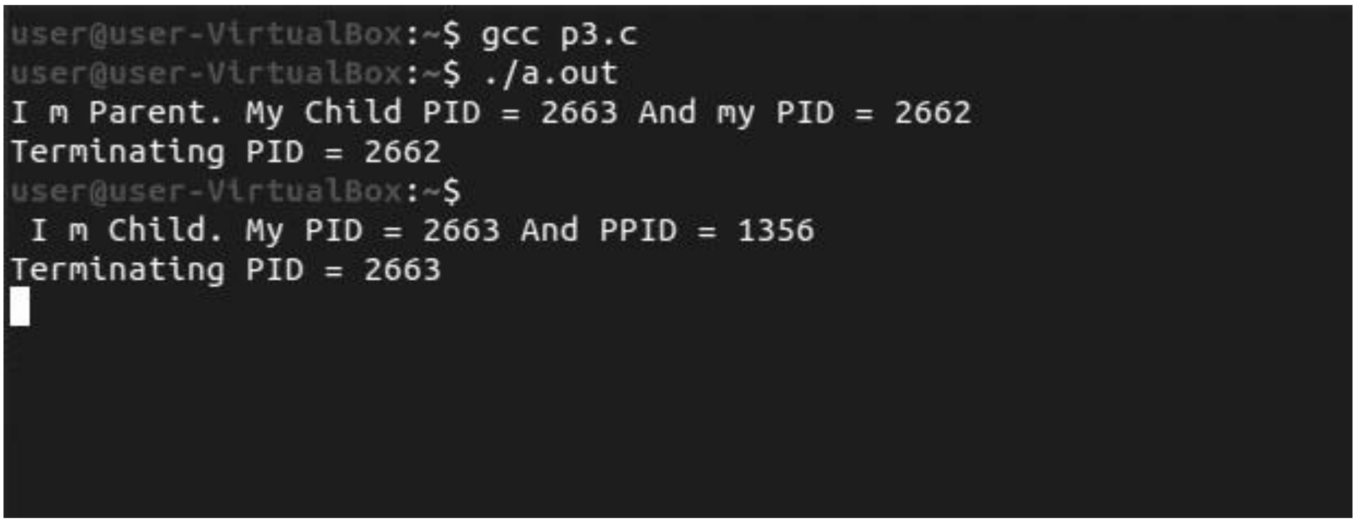
Program-3

Q3. C program to Implement the Orphan Process and Zombie Process.

SOURCE CODE

```
#include<stdio.h>
#include<unistd.>
int main(){
pid_t pid;
pid=fork();
if(pid==0){
sleep(6);
      printf("\n I m Child. My PID = %d And PPID = %d",
      getpid(),getppid());
   } else
   {
   printf("I m Parent. My Child PID = %d And my PID = %d",pid,getpid());
   }
   printf("\nTerminating PID = %d\n",getpid());
   return 0;
```

OUTPUT:



```
user@user-VirtualBox:~$ gcc p3.c
user@user-VirtualBox:~$ ./a.out
I m Parent. My Child PID = 2663 And my PID = 2662
Terminating PID = 2662
user@user-VirtualBox:~$
 I m Child. My PID = 2663 And PPID = 1356
Terminating PID = 2663
```

Program-4

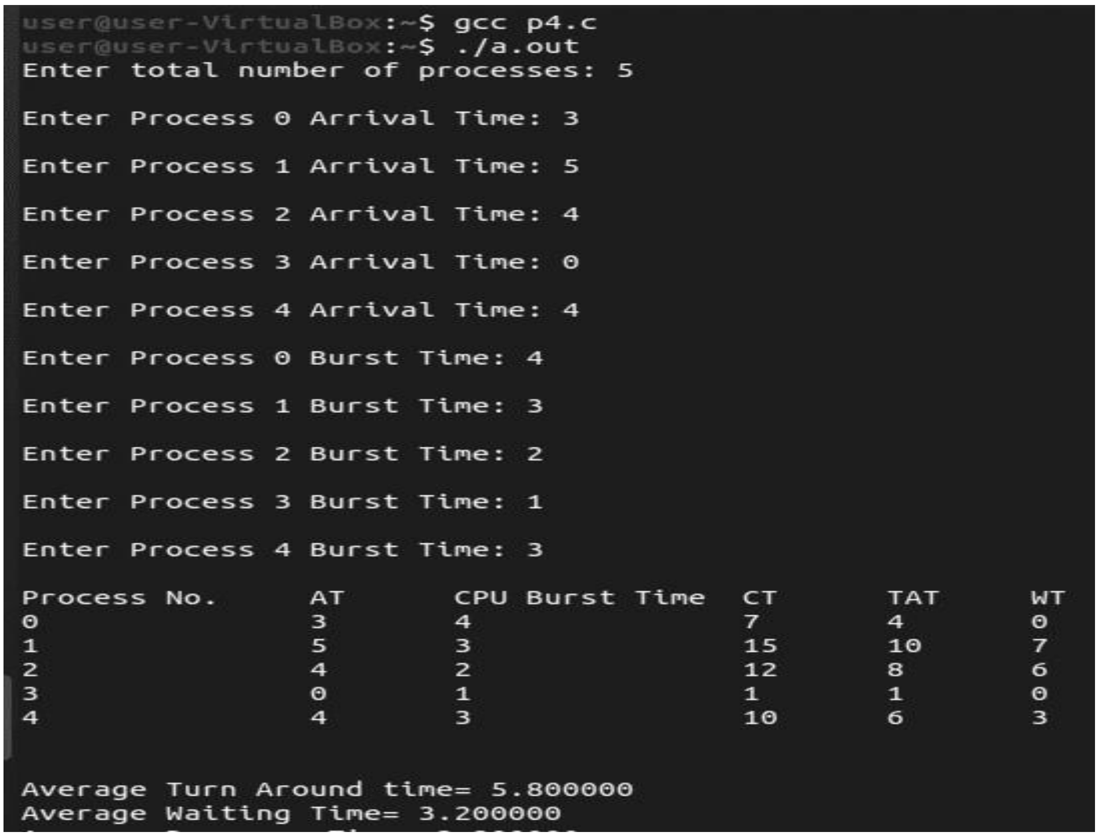
Q. C program to Implement FCFS CPU Scheduling Algorithm

SOURCE CODE

```
#include<stdio.h>
int main() {
    int n;
    printf("Enter the size of array: \n");
    scanf("%d",&n);
    int at[n];
    printf("enter the arrival time: \n");
for(int i=0;i<n;i++)     {
scanf("%d",&at[i]); }
    int bt[n];
    printf("enter the burst time: \n");
for(int i=0;i<n;i++)
    {
        scanf("%d",&bt[i]);
    }
 int ct[n],i=0;
    printf("the complition time: \n");
for(i=0;i<n;i++)
    {
        ct[i] += bt[i];

}
```

```
    printf("%d ",ct[i]);
    printf("\nthe turn around time: \n");
int tat[n],sum=0;
for(i=0;i<n;i++)
    {
 tat[i]=ct[i]-at[i];
sum += tat[i];
    }
    printf("%d ",tat[i]);
printf("\nthe waiting time: \n");
int wt[n],sum1=0;
for(i=0;i<n;i++)
    {
        wt[i]=tat[i]-bt[i];
        sum1 += wt[i];
    }
    printf("%d ",wt[i]);
   int avgtat= sum/n;
   int avgwt = sum1/n;
  printf("avg of tat: %d\n",avgtat);
printf("avg of wt: %d\n",avgwt);
}
```

<u>Output:</u>



```
user@user-VirtualBox:~$ gcc p4.c
user@user-VirtualBox:~$ ./a.out
Enter total number of processes: 5

Enter Process 0 Arrival Time: 3

Enter Process 1 Arrival Time: 5

Enter Process 2 Arrival Time: 4

Enter Process 3 Arrival Time: 0

Enter Process 4 Arrival Time: 4

Enter Process 0 Burst Time: 4

Enter Process 1 Burst Time: 3

Enter Process 2 Burst Time: 2

Enter Process 3 Burst Time: 1

Enter Process 4 Burst Time: 3

Process No.     AT      CPU Burst Time  CT      TAT     WT
0               3       4               7       4       0
1               5       3               15      10      7
2               4       2               12      8       6
3               0       1               1       1       0
4               4       3               10      6       3


Average Turn Around time= 5.800000
Average Waiting Time= 3.200000
```

Program-5

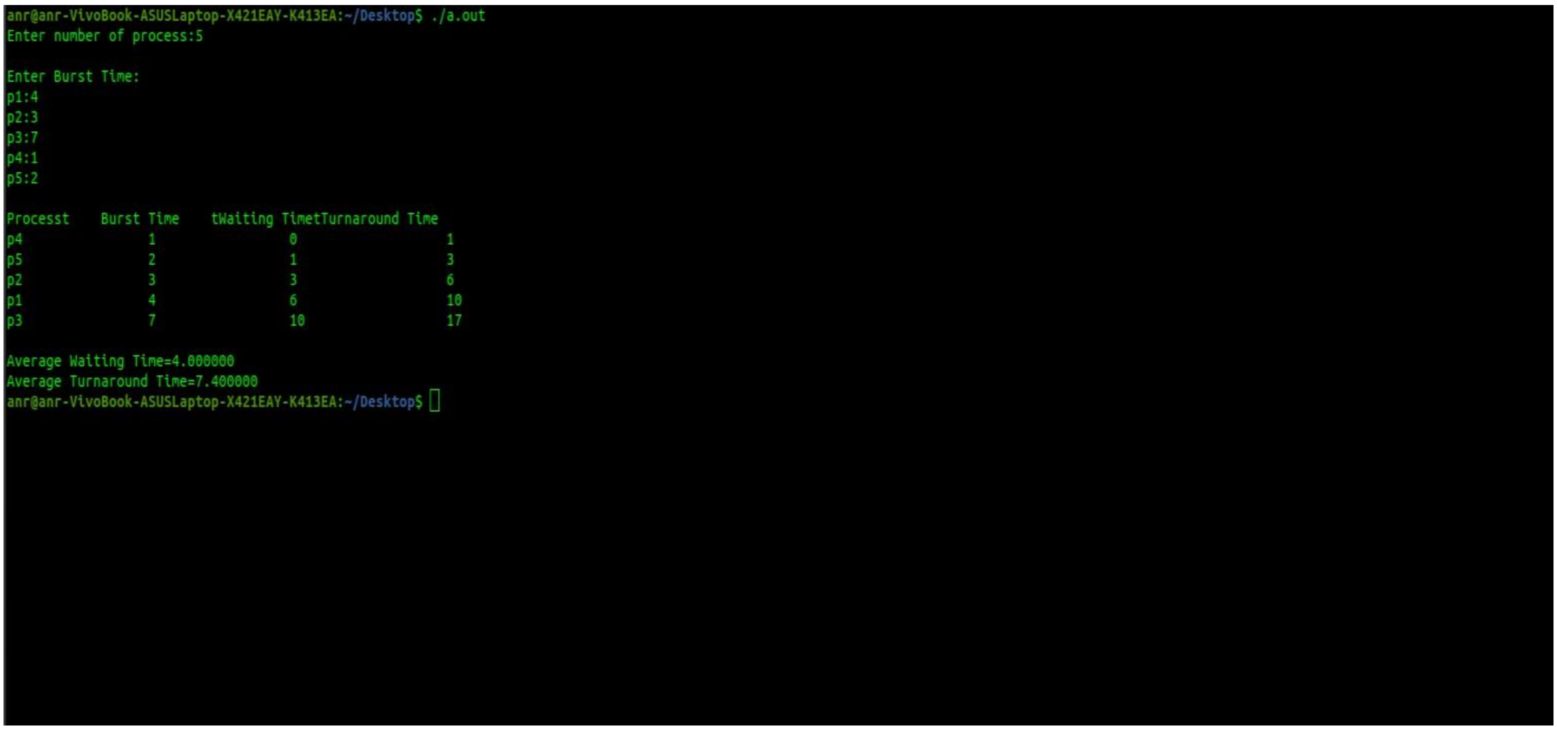
Q. C program to Implement Sortest job first non-premptive Scheduling Algorithm

SOURCE CODE

```
#include<stdio.h>
int main()
{ int
bt[20],p[20],wt[20],tat[20],i,j,n,total=0,pos,
temp;
   float avg_wt,avg_tat;
   printf("Enter number of process:");
scanf("%d",&n);

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

  //sorting of burst times
for(i=0;i<n;i++)
   {
pos=i;
      for(j=i+1;j<n;j++)
      {
         if(bt[j]<bt[pos])
            pos=j;
      }

      temp=bt[i];
bt[i]=bt[pos];
      bt[pos]=temp;

      temp=p[i];
p[i]=p[pos];
p[pos]=temp;
   }

   wt[0]=0;


   for(i=1;i<n;i++)
   {       wt[i]=0;
for(j=0;j<i;j++)
         wt[i]+=bt[j];
```

```
        total+=wt[i];
    }

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

    printf("\nProcesst    Burst Time    tWaiting
Timet Turnaround Time");
    for(i=0;i<n;i++)
    {
         tat[i]=bt[i]+wt[i];
        total+=tat[i];
   printf("\np%d\t\t  %d\t\t    %d\t\t\
%d",p[i],bt[i],wt[i],tat[i]);
    }

    avg_tat=(float)total/n;

    printf("\n\nAverage                    Waiting
Time=%f",avg_wt);
    printf("\nAverage                  Turnaround
Time=%f\n",avg_tat);
}
```

Output:



```
anr@anr-VivoBook-ASUSLaptop-X421EAY-K413EA:~/Desktop$ ./a.out
Enter number of process:5

Enter Burst Time:
p1:4
p2:3
p3:7
p4:1
p5:2

Processt    Burst Time    tWaiting TimetTurnaround Time
p4              1               0               1
p5              2               1               3
p2              3               3               6
p1              4               6               10
p3              7               10              17

Average Waiting Time=4.000000
Average Turnaround Time=7.400000
anr@anr-VivoBook-ASUSLaptop-X421EAY-K413EA:~/Desktop$ 
```

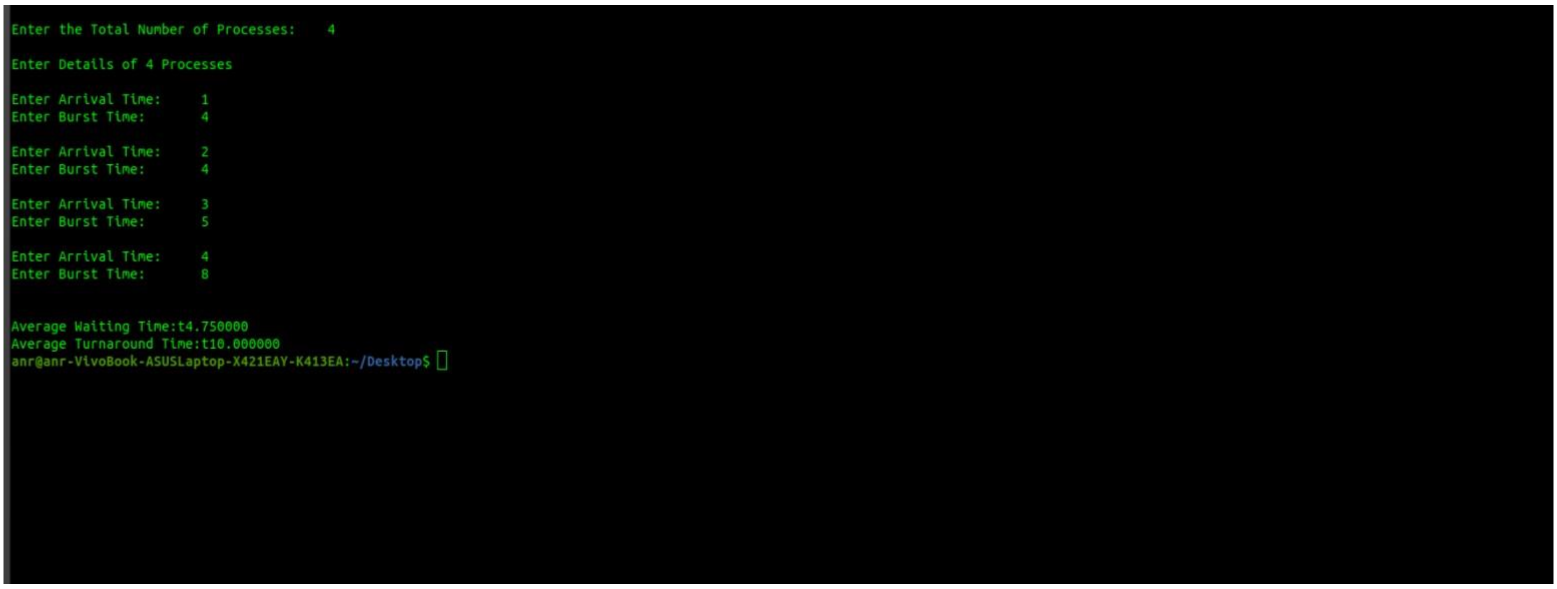
Program-6

Q. C program to Implement Sortest job first premptive Scheduling Algorithm

SOURCE CODE

```
   #include <stdio.h>

   int main()
   {
         int arrival_time[10], burst_time[10],
   temp[10];
         int i, smallest, count = 0, time, limit;
   double wait_time = 0,
   turnaround_time = 0, end;
    float average_waiting_time,
   average_turnaround_time;

printf("\nEnter the Total Number of
Processes:\t");
 scanf("%d", &limit);
 printf("\nEnter Details of %d
Processes\n", limit);
 for(i = 0; i < limit; i++)
         {
               printf("\nEnter Arrival Time:\t");
   scanf("%d", &arrival_time[i]);
   printf("Enter Burst Time:\t");
   scanf("%d", &burst_time[i]);
               temp[i] = burst_time[i];
         }
         burst_time[9] = 9999;
         for(time = 0; count != limit; time++)
         {
               smallest = 9;
               for(i = 0; i < limit; i++)
               {
                     if(arrival_time[i] <= time &&
   burst_time[i] < burst_time[smallest] &&
      burst_time[i] > 0)
                     {
                           smallest = i;
                     }
               }
               burst_time[smallest]--;
               if(burst_time[smallest] == 0)
               {
                     count++;
    end = time + 1;
    wait_time = wait_time + end -
   arrival_time[smallest] - temp[smallest];
 turnaround_time = turnaround_time + end -
arrival_time[smallest];
                }
            }
            average_waiting_time = wait_time /
    limit;
            average_turnaround_time =
    turnaround_time / limit;
    printf("\n\nAverage Waiting Time:t%lf\n",
    average_waiting_time);       printf("Average
    Turnaround Time:t%lf\n",
    average_turnaround_time);
            return 0;
    }
```

Output:



```
Enter the Total Number of Processes:    4

Enter Details of 4 Processes

Enter Arrival Time:     1
Enter Burst Time:       4

Enter Arrival Time:     2
Enter Burst Time:       4

Enter Arrival Time:     3
Enter Burst Time:       5

Enter Arrival Time:     4
Enter Burst Time:       8


Average Waiting Time:t4.750000
Average Turnaround Time:t10.000000
anr@anr-VivoBook-ASUSLaptop-X421EAY-K413EA:~/Desktop$ 
```

Program-7

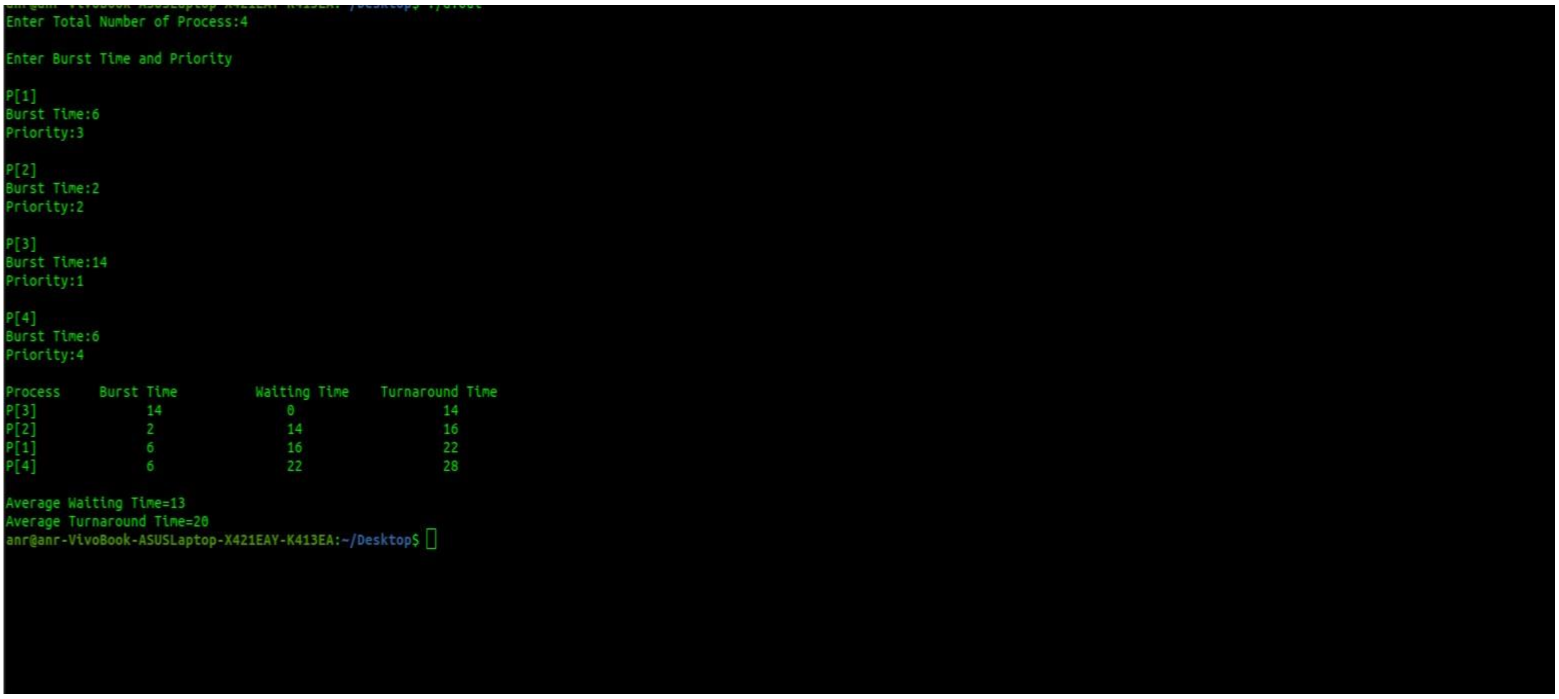
Q. C program to Implement Priority Scheduling Algorithm

SOURCE CODE

```
   #include<stdio.h>

   int main() {
   int bt[20],p[20],wt[20],
    tat[20],pr[20],i,j,n,
      total=0,pos,temp,avg_wt,avg_tat;
    printf("Enter Total Number of Process:");
   scanf("%d",&n);

     printf("\nEnter Burst Time and Priority\n");
      for(i=0;i<n;i++)
      {
      printf("\nP[%d]\n",i+1);
   printf("Burst Time:");
   scanf("%d",&bt[i]);
   printf("Priority:");
   scanf("%d",&pr[i]);
          p[i]=i+1;     //contains process number
      }

for(i=0;i<n;i++)
      {
   pos=i;
        for(j=i+1;j<n;j++)
          {
            if(pr[j]<pr[pos])
                   pos=j;
          }

          temp=pr[i];
                   pr[i]=pr[pos];
                    pr[pos]=temp;
                    temp=bt[i];
                   bt[i]=bt[pos];
                   bt[pos]=temp;
                   temp=p[i];
                   p[i]=p[pos];
                   p[pos]=temp;
      }

      wt[0]=0; //waiting time for first process is0
      //calculate waiting time
   for(i=1;i<n;i++)
      {
```

```
                wt[i]=0;
        for(j=0;j<i;j++)
                    wt[i]+=bt[j];

                total+=wt[i];
            }

            avg_wt=total/n;      //average waiting time
            total=0;

    printf("\nProcess\t   Burst Time  \tWaiting
    Time\tTurnaround Time");
     for(i=0;i<n;i++)

            {
                tat[i]=bt[i]+wt[i];     //calculate
        turnaround time
                total+=tat[i];
        printf("\nP[%d]\t\t  %d\t\t
        %d\t\t\t%d",p[i],bt[i],wt[i],tat[i]);
            }

            avg_tat=total/n;
            printf("\n\nAverageWaiting
                Time=%d",avg_wt);
           printf("\nAverage Turnaround
          Time=%d\n",avg_tat);

        return 0;
}
```

Output:



```
Enter Total Number of Process:4

Enter Burst Time and Priority

P[1]
Burst Time:6
Priority:3

P[2]
Burst Time:2
Priority:2

P[3]
Burst Time:14
Priority:1

P[4]
Burst Time:6
Priority:4

Process     Burst Time          Waiting Time    Turnaround Time
P[3]              14                 0                   14
P[2]              2                  14                  16
P[1]              6                  16                  22
P[4]              6                  22                  28

Average Waiting Time=13
Average Turnaround Time=20
anr@anr-VivoBook-ASUSLaptop-X421EAY-K413EA:~/Desktop$ 
```

Program-8

Q. C program to Implement Round robin Scheduling Algorithm

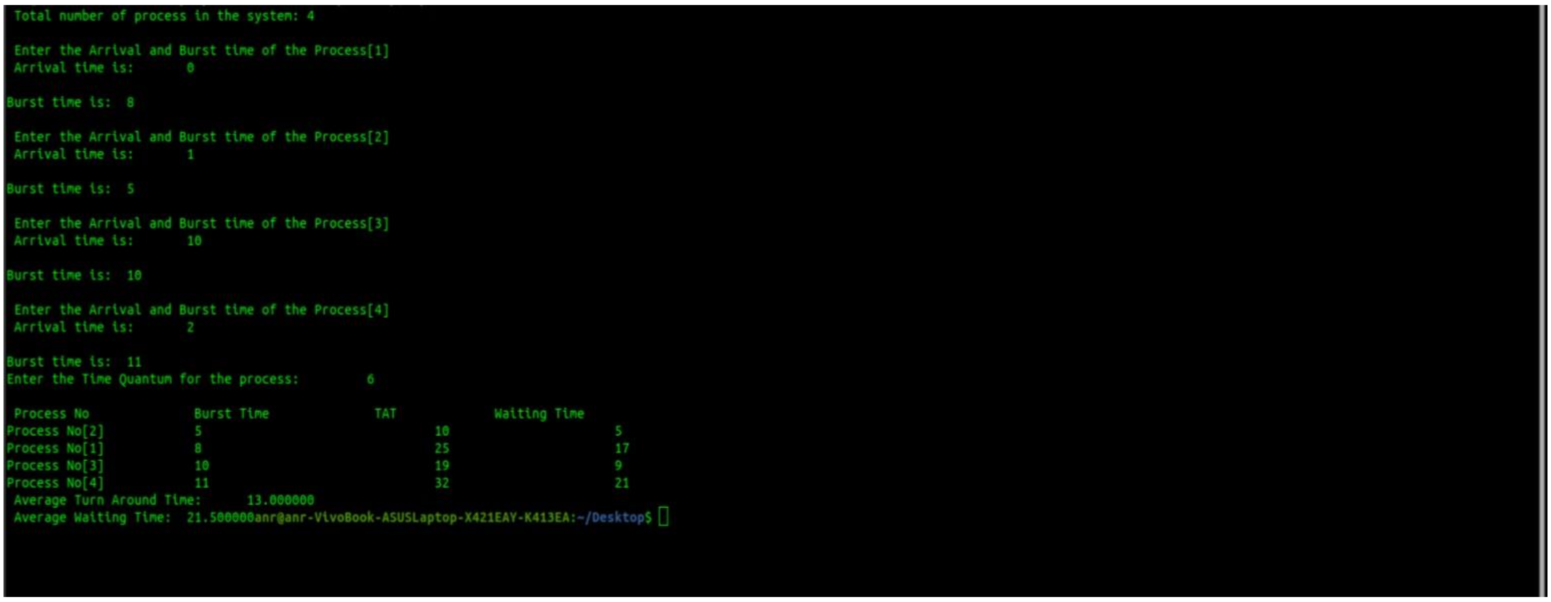
SOURCE CODE

```
#include<stdio.h>

void main()
{
    int i, NOP, sum=0,count=0, y, quant,
wt=0,  tat=0,  at[10],  bt[10],  temp[10];
float avg_wt, avg_tat;

printf(" Total number of process in the
system: ");
 scanf("%d", &NOP);
    y = NOP;

for(i=0; i<NOP; i++)
{
```

```
printf("\n Enter the Arrival and Burst time of
the Process[%d]\n", i+1);
printf(" Arrival time is: \t");  // Accept arrival
time
scanf("%d", &at[i]);

printf(" \nBurst time is: \t"); // Accept the
Burst time   scanf("%d", &bt[i]);

temp[i] = bt[i]; // store the burst time in temp
array
}
printf("Enter the Time Quantum for the
process: \t");
scanf("%d", &quant);
printf("\n Process No \t\t
Burst Time \t\t TAT
\t\t Waiting Time ");
for(sum=0, i = 0; y!=0; )
{
if(temp[i] <= quant && temp[i] > 0) // define
the conditions
{
   sum = sum + temp[i];
temp[i] = 0;
   count=1;
   }
   else if(temp[i] > 0)
   {
       temp[i] = temp[i] - quant;
sum = sum + quant;
   }
   if(temp[i]==0 && count==1)
   {
       y--; //decrement the process no.
printf("\nProcess No[%d] \t\t %d\t\t\t\t
%d\t\t\t %d", i+1, bt[i], sum-at[i], sum-
at[i]bt[i]);           wt = wt+sum-at[i]-bt[i];
tat = tat+sum-at[i];           count =0;
   }
   if(i==NOP-1)
 {
       i=0;
   }
   else if(at[i+1]<=sum)
   {
       i++;
}
 else
{
       i=0;
   }
```

```
}
Turn Around time   avg_wt = wt * 1.0/NOP;

avg_tat = tat * 1.0/NOP;   printf("\n Average
Turn Around Time: \t%f", avg_wt);

printf("\n Average Waiting Time: \t%f",
avg_tat);
}
```

Output:



```
 Total number of process in the system: 4

 Enter the Arrival and Burst time of the Process[1]
 Arrival time is:       0

Burst time is:  8

 Enter the Arrival and Burst time of the Process[2]
 Arrival time is:       1

Burst time is:  5

 Enter the Arrival and Burst time of the Process[3]
 Arrival time is:       10

Burst time is:  10

 Enter the Arrival and Burst time of the Process[4]
 Arrival time is:       2

Burst time is:  11
Enter the Time Quantum for the process:         6

 Process No             Burst Time              TAT             Waiting Time
Process No[2]           5                               10                      5
Process No[1]           8                               25                      17
Process No[3]           10                              19                      9
Process No[4]           11                              32                      21
 Average Turn Around Time:      13.000000
 Average Waiting Time:  21.500000anr@anr-VivoBook-ASUSLaptop-X421EAY-K413EA:~/Desktop$ 
```

Program-9

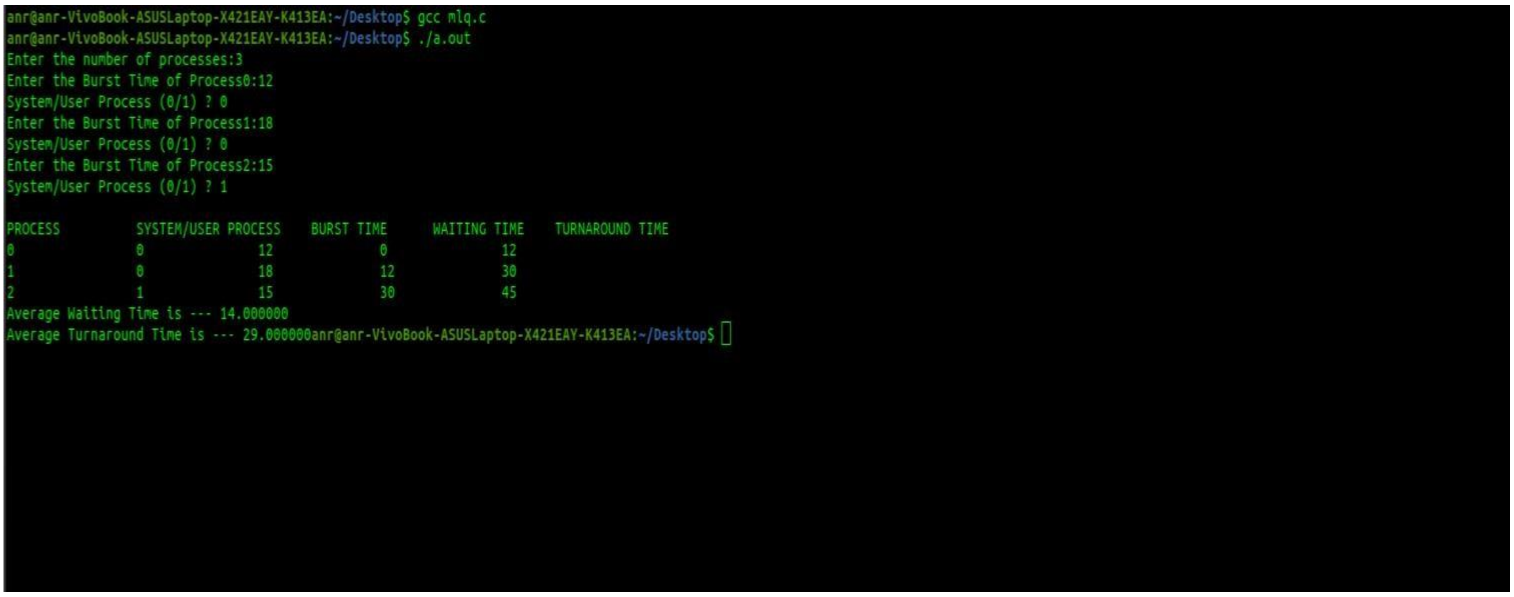
Q. C program to Implement Multilevel queue Scheduling Algorithm

SOURCE CODE

```
#include<stdio.h>
int main() {
 int p[20],bt[20], su[20], wt[20],tat[20],i, k, n,
temp;  float wtavg, tatavg;
printf("Enter the number of
                processes:");

scanf("%d",&n);
for(i=0;i<n;i++)
        {
                p[i] = i;
                printf("Enter the Burst Time of
                        Process%d:", i);
                scanf("%d",&bt[i]);
                printf("System/User Process
                        (0/1) ? ");
                scanf("%d", &su[i]);
        }
        for(i=0;i<n;i++)
                for(k=i+1;k<n;k++)
                if(su[i] > su[k])
                        {
                        temp=p[i];
                                p[i]=p[k];
                        p[k]=temp;
        temp=bt[i];
        bt[i]=bt[k];
        bt[k]=temp;
        temp=su[i];
        su[i]=su[k];
        su[k]=temp;
        }
        wtavg = wt[0] = 0;
        tatavg = tat[0] = bt[0];
        for(i=1;i<n;i++)
        {
                wt[i] = wt[i-1] + bt[i-1];
                tat[i] = tat[i-1] + bt[i];
                wtavg = wtavg + wt[i];
                tatavg = tatavg + tat[i];
        }
        printf("\nPROCESS\t\t SYSTEM/USER
PROCESS \tBURST TIME\tWAITING
TIME\tTURNAROUND TIME");
```

```
            for(i=0;i<n;i++)  {
            printf("\n%d \t\t %d \t\t %d \t\t
        %d \t\t %d ",p[i],su[i],bt[i],wt[i],tat[i]);
            printf("\nAverage Waiting Time is ---
        %f",wtavg/n);
            printf("\nAverage Turnaround Time is -
        -- %f",tatavg/n);
            return 0;
        }
    }
```

Output:



```
anr@anr-VivoBook-ASUSLaptop-X421EAY-K413EA:~/Desktop$ gcc mlq.c
anr@anr-VivoBook-ASUSLaptop-X421EAY-K413EA:~/Desktop$ ./a.out
Enter the number of processes:3
Enter the Burst Time of Process0:12
System/User Process (0/1) ? 0
Enter the Burst Time of Process1:18
System/User Process (0/1) ? 0
Enter the Burst Time of Process2:15
System/User Process (0/1) ? 1

PROCESS         SYSTEM/USER PROCESS    BURST TIME      WAITING TIME    TURNAROUND TIME
0               0               12              0               12
1               0               18              12              30
2               1               15              30              45
Average Waiting Time is --- 14.000000
Average Turnaround Time is --- 29.000000anr@anr-VivoBook-ASUSLaptop-X421EAY-K413EA:~/Desktop$ 
```