IT252 ASSIGNMENT-5

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Code-

```
#include<stdio.h>
#include <limits.h>
#define MIN -9999

/*GANTT CHART*/
void print_gantt_chart(int n,int bt[],int wt[],int tat[]) {
int i, j,time=0;
printf("\nGantt Chart:\n");

// printing top bar
printf(" ");
for(i = 0; i < n; i++) {
for(j = 0; j < bt[i]; j++) {
printf("--");
}
printf(" ");
}
printf("\n|");

// printing process id in the middle
for(i = 0; i < n; i++) {
for(j = 0; j < bt[i] - 1; j++) {
printf(" ");
}
printf("P%d", i + 1);
for(j = 0; j < bt[i] - 1; j++) {
printf(" ");
}
printf("|");
}
printf("\n ");

// printing bottom bar
for(i = 0; i < n; i++) {
for(j = 0; j < bt[i]; j++) {
printf("--");
}
printf(" ");
}
printf("\n");

// printing timeline
printf("0");
for(i = 0; i < n; i++) {
for(j = 0; j < bt[i]; j++) {
printf(" ");
time++;
}
if(tat[i] > 9) printf("\b"); // backspace : remove 1 space
printf("%d", time);
}
printf("\n");
}
```

```
// Waiting time for all processes
/* A) FCFS*/
int waitingtime_FCFS(int proc[], int n, int burst_time[], int wait_time[]) {
wait_time[0] = 0; // waiting time for the first process is 0
// Calculating the waiting time
for(int i = 1; i < n ; i++ )
wait_time[i] = burst_time[i-1] + wait_time[i-1] ;
return 0;
}

// Calculating turn around time
int turnaroundtime_FCFS( int proc[], int n, int burst_time[], int wait_time[], int tat[]) {
for (int i = 0; i < n ; i++)
tat[i] = burst_time[i] + wait_time[i];
return 0;
}

//Calculating average time
int avgtime_FCFS( int proc[], int n, int burst_time[]) {
int wait_time[n], tat[n], total_wt = 0, total_tat = 0;
//Finding waiting time of all processes
waitingtime_FCFS(proc, n, burst_time, wait_time);
//Turn around time for all processes
turnaroundtime_FCFS(proc, n, burst_time, wait_time, tat);
//Display processes & calculate total waiting time and total turn around time
printf("\nProcesses\tBurst\t\tWaiting\t\tTurnaround\n");
for (int i=0; i<n; i++) {
total_wt = total_wt + wait_time[i];
total_tat = total_tat + tat[i];
printf("P%d\t\t%d\t\t%d\t\t%d\n", proc[i], burst_time[i], wait_time[i], tat[i]);
}
//Printing average waiting time and average turn around time
printf("\nAverage waiting time = %f\n", (float)total_wt / (float)n);
printf("Average turnaround time = %f\n\n", (float)total_tat / (float)n);
//Print Gantt Chart
print_gantt_chart(n, burst_time, wait_time, tat);

return 0;
}
void FCFS(){

//process id's
int n;
printf("***First Come First Serve***\n");
printf("Enter number of process:");
scanf("%d", &n);

// int proc[] = { 1, 2, 3};
int proc[n],burst_time[n];
printf("\nEnter Burst Time:\n");
for(int i = 0; i < n; i++) {
printf("p%d:", i + 1);
scanf("%d", &burst_time[i]);
proc[i] = i + 1;
}
avgtime_FCFS(proc, n, burst_time);
}
/*B) SJF*/
void SJF(){

int bt[20], p[20], wt[20], tat[20], i, j, n, total = 0, pos, temp;
float avg_wt, avg_tat;
```

```
printf("***Shortest Job First***\n");
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 the 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;

// Calculating waiting time of all processes
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;

//Calculating turn around time of all processes and printing results & Gantt Chart
printf("\nProcesses\tBurst\t\tWaiting\t\tTurnaround\n");
for(i = 0; i < n; i++) {
tat[i] = bt[i] + wt[i];
total += tat[i];
printf("P%d\t\t%d\t\t%d\t\t%d\n", 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);

//Printing Gantt Chart
print_gantt_chart(n, bt, wt, tat);
}
/*C)SHORTEST REMAINING TIME FIRST*/
void findWaitingTime_SRTF(int p[], int n,int bt[],int at[], int wt[]) {
int rt[n];
for (int i = 0; i < n; i++)
```

```
// rt[i] = proc[i].bt;
rt[i]=bt[i];
int complete = 0, t = 0, minm = INT_MAX;
int shortest = 0, finish_time;
int check = 0;
while (complete != n) {
for (int j = 0; j < n; j++) {
if ((at[j] <= t) && (rt[j] < minm) && rt[j] > 0) {
minm = rt[j];
shortest = j;
check = 1;
}
}
if (check == 0) {
t++;
continue;
}
rt[shortest]--;
minm = rt[shortest];
if (minm == 0)
minm = INT_MAX;
if (rt[shortest] == 0) {
complete++;
check = 0;
finish_time = t + 1;
wt[shortest] = finish_time - bt[shortest] - at[shortest];
if (wt[shortest] < 0)
wt[shortest] = 0;
}
t++;
}
}

void findTurnAroundTime_SRTF(int p[], int n, int bt[],int wt[], int tat[]) {
for (int i = 0; i < n; i++)
tat[i] = bt[i] + wt[i];
}

void findavgTime_SRTF(int p[], int n,int at[],int bt[]) {
int wt[n], tat[n], total_wt = 0, total_tat = 0;
findWaitingTime_SRTF(p, n, bt,at,wt);
findTurnAroundTime_SRTF(p, n,bt, wt, tat);
printf("\nProcesses\tBurst\t\tWaiting\t\tTurnaround\n");
for (int i = 0; i < n; i++) {
total_wt = total_wt + wt[i];
total_tat = total_tat + tat[i];
printf("P%d\t\t%d\t\t%d\t\t%d\n", p[i], bt[i], wt[i], tat[i]);
}
float avg_wt=(float)total_wt/n;
float avg_tat=(float)total_tat/n;
printf("\nAverage waiting time = %.2f",avg_wt);
printf("\nAverage turn around time = %.2f", (float)total_tat / (float)n);

print_gantt_chart(n,bt,wt,tat);
}
void SRTF(){

int at[20],bt[20], p[20], wt[20], tat[20],n,total=0;
printf("***Shortest remaining Job First***\n");
printf("Enter number of process:");
scanf("%d", &n);
```

```
printf("\nEnter the Arrival and Burst time\n");
for(int i=0; i<n; i++)
{
printf("\nEnter the Arrival and Burst time of the Process %d\n", i+1);
printf("Arrival time is: "); // Accept arrival time
scanf("%d", &at[i]);
printf("Burst time is: "); // Accept the Burst time
scanf("%d", &bt[i]);
p[i] = i + 1;
}
findavgTime_SRTF(p,n,at,bt);
}
/*D)ROUND ROBIN*/
void RR(){
int i, NOP, sum=0,count=0, y, quant, wt=0, tat=0, at[10], bt[10],temp[10],TAT[10],WT[10];
float avg_wt, avg_tat;
printf("***Round Robin***\n");
printf("Enter number of process: ");
scanf("%d", &NOP);
y = NOP; // Assigning the number of process to variable y
printf("\nEnter the Arrival and Burst time\n");
// Enter the details of the process
for(i=0; i<NOP; i++){
printf("\nArrival time of process %d is: ",i+1); // Accept arrival time
scanf("%d", &at[i]);
printf("Burst time of process %d is: ",i+1); // Accept the Burst time
scanf("%d", &bt[i]);
temp[i] = bt[i]; // store the burst time in temp array
}
// Time Quantum
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 ");
printf("\nProcesses\tBurst\t\tTurnaround\tWaiting\n");
for(sum=0, i = 0; y!=0; )
{
if(temp[i] <= quant && temp[i] > 0) // Defining 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--; //Decrementing the process no.
printf("P%d\t\t%d\t\t%d\t\t%d\n", i+1, bt[i],sum-at[i], sum-at[i]-bt[i]);
wt = wt+sum-at[i]-bt[i];
WT[i]=wt;
tat = tat+sum-at[i];
TAT[i]=tat;
count =0;
}
if(i==NOP-1)
{
i=0;
}
else if(at[i+1]<=sum)
{
```

```
i++;
}
else
{
i=0;
}
}
// Calculating average waiting time and turn around time
avg_wt = wt * 1.0/NOP;
avg_tat = tat * 1.0/NOP;
printf("\nAverage Turn Around Time: %.2f", avg_tat);
printf("\nAverage Waiting Time: %.2f\n", avg_wt);
print_gantt_chart(NOP,bt,WT,TAT);
}

/*E) PRIORITY NON PREEMPTIVE*/
void read2(int i, int at[], int bt[], int pri[], int pno[])
{
printf("\nProcess No: %d\n", i+1);
pno[i] = i + 1;
printf("Enter Arrival Time: ");
scanf("%d", &at[i]);
printf("Enter Burst Time: ");
scanf("%d", &bt[i]);
printf("Enter Priority: ");
scanf("%d", &pri[i]);
}
void NP(){
int n, c, remaining, max_val, max_index;
int pno[10], at[10], bt[10], ct[10], wt[10], tat[10], pri[10];

float avgtat = 0, avgwt = 0;

printf("***Non-Preemptive Priority Scheduling***\n");
printf("Enter Number of Processes: ");
scanf("%d", &n);

for (int i = 0; i < n; i++) {
read2(i, at, bt, pri, pno);
}

remaining = n;
for (int i = 0; i < n-1; i++)
for (int j = 0; j < n-i-1; j++) {
if (pri[j] < pri[j+1]) {
int tmp = at[j];
at[j] = at[j+1];
at[j+1] = tmp;

tmp = bt[j];
bt[j] = bt[j+1];
bt[j+1] = tmp;

tmp = pri[j];
pri[j] = pri[j+1];
pri[j+1] = tmp;

tmp = pno[j];
pno[j] = pno[j+1];
pno[j+1] = tmp;
}
}
```

```
ct[0] = at[0] + bt[0];
tat[0] = ct[0] - at[0];
wt[0] = tat[0] - bt[0];

for (int i = 1; i < n; i++) {
ct[i] = ct[i-1] + bt[i];
tat[i] = ct[i] - at[i];
wt[i] = tat[i] - bt[i];
avgtat += tat[i];
avgwt += wt[i];
}

printf("\nProcesses\tArrival\t\tBurst\tPriority\tCompletion\tTurnaround\tWaiting\n");

for (int i = 0; i < n; i++) {
printf("P%d\t\t%d\t\t%d\t%d\t\t%d\t\t%d\t\t%d\n", pno[i], at[i], bt[i], pri[i], ct[i], tat[i], wt[i]);
}

avgtat /= n;
avgwt /= n;

printf("\nAverage TurnAroundTime=%.2f\nAverage WaitingTime=%.2f\n", avgtat, avgwt);

print_gantt_chart(n,bt,wt,tat);
}
/*F) PRIORITY PREEMPTIVE*/
void read1(int i, int at[], int bt[], int pri[], int temp[], int rt[])
{
printf("\nProcess No: %d\n", i+1);
printf("Enter Arrival Time: ");
scanf("%d", &at[i]);
printf("Enter Burst Time: ");
scanf("%d", &bt[i]);
rt[i] = bt[i];
printf("Enter Priority: ");
scanf("%d", &pri[i]);
temp[i] = pri[i];
}

void PP(){
int n, c, remaining, max_val, max_index;
int pno[10], at[10], bt[10], rt[10], ct[10], wt[10], tat[10], pri[10], temp[10];

float avgtat = 0, avgwt = 0;

printf("***Highest Priority First(Preemptive)***\n");
printf("Enter Number of Processes: ");
scanf("%d", &n);

for (int i = 0; i < n; i++) {
pno[i] = i + 1;
read1(i, at, bt, pri, temp, rt);
}

remaining = n;
for (int i = 0; i < n-1; i++)
for (int j = 0; j < n-i-1; j++) {
if (at[j] > at[j+1]) {
int tmp = at[j];
at[j] = at[j+1];
```

```
at[j+1] = tmp;

tmp = bt[j];
bt[j] = bt[j+1];
bt[j+1] = tmp;

tmp = pri[j];
pri[j] = pri[j+1];
pri[j+1] = tmp;

tmp = temp[j];
temp[j] = temp[j+1];
temp[j+1] = tmp;
}
}

max_val = temp[0], max_index = 0;
for (int j = 0; j < n && at[j] <= at[0]; j++) {
if (temp[j] > max_val) {
max_val = temp[j];
max_index = j;
}
}

int i = max_index;
c = ct[i] = at[i] + 1;
rt[i]--;
if (rt[i] == 0) {
temp[i] = MIN;
remaining--;
}

while (remaining > 0) {
max_val = temp[0], max_index = 0;
for (int j = 0; j < n && at[j] <= c; j++) {
if (temp[j] > max_val) {
max_val = temp[j];
max_index = j;
}
}

i = max_index;
ct[i] = c = c + 1;
rt[i]--;

if (rt[i] == 0) {
temp[i] = MIN;
remaining--;
}
}

// printf("\nProcessNo\tAT\tBT\tPri\tCT\tTAT\tWT\n");
printf("\nProcesses\tArrival\t\tBurst\tPriority\tCompletion\tTurnaround\tWaiting\n");

for (int i = 0; i < n; i++) {
tat[i] = ct[i] - at[i];
avgtat += tat[i];
wt[i] = tat[i] - bt[i];
avgwt += wt[i];
printf("P%d\t\t%d\t\t%d\t%d\t\t%d\t\t%d\t\t%d\n", pno[i], at[i], bt[i], pri[i], ct[i], tat[i], wt[i]);
}
```

```
avgtat /= n;
avgwt /= n;

printf("\nAverage TurnAroundTime=%.2f\nAverage WaitingTime=%.2f\n", avgtat, avgwt);

print_gantt_chart(n,bt,wt,tat);

}

int main(){

int ch;
while(1){
printf("1. First Come First Serve (FCFS)\n2. Shortest Job First (SJF)\n3. Shortest remaining Job First (SRTF)\n4.
Round Robin (RR)\n5. Priority non preemptive\n6. Priority Prepemptive.\n\n");
printf("Enter choice :");
scanf("%d",&ch);
if(ch>6){
break;
}
switch(ch){
case 1: FCFS();
break;

case 2: SJF();
break;

case 3: SRTF();
break;

case 4: RR();
break;

case 5: NP();
break;

case 6: PP();
break;



}
}

}
```

1. FIRST COME FIRST SERVE

a) The job which needs longer time comes first.

```
khushi@khushi-HP-Laptop-14s-dk0xxx:~/Documents/OsLAB5$ cd "/home/khushi/Documents/OsLAB5/" && gcc menuDriven.c -o menuDriven && "/home/khushi/Documents/OsLAB5/"menuDriven
1. First Come First Serve (FCFS)
2. Shortest Job First (SJF)
3. Shortest remaining Job First (SRTF)
4. Round Robin (RR)
5. Priority non preemptive
6. Priority Prepemptive.

Enter choice :1
***First Come First Serve***
Enter number of process:9

Enter Burst Time:
p1:10
p2:12
p3:15
p4:4
p5:6
p6:8
p7:1
p8:2
p9:3

Processes       Burst           Waiting         Turnaround
P1              10              0               10
P2              12              10              22
P3              15              22              37
P4              4               37              41
P5              6               41              47
P6              8               47              55
P7              1               55              56
P8              2               56              58
P9              3               58              61

Average waiting time = 36.222221
Average turnaround time = 43.000000


Gantt Chart:
 ------------------ ---------------------- ---------------------------- -------- ------------ ---------------- -- ---- ------
|         P1         |          P2          |             P3             |   P4   |     P5     |       P6       |P7| P8 |  P9  |
 ------------------ ---------------------- ---------------------------- -------- ------------ ---------------- -- ---- ------
0                  10                     22                           37       41           47               55 56   58     61
```

b) The job which requires shorter time comes first.

```
Enter choice :1
***First Come First Serve***
Enter number of process:9

Enter Burst Time:
p1:1
p2:2
p3:3
p4:4
p5:6
p6:8
p7:10
p8:12
p9:15

Processes       Burst           Waiting         Turnaround
P1              1               0               1
P2              2               1               3
P3              3               3               6
P4              4               6               10
P5              6               10              16
P6              8               16              24
P7              10              24              34
P8              12              34              46
P9              15              46              61

Average waiting time = 15.555555
Average turnaround time = 22.333334


Gantt Chart:
 -- ---- ------ -------- ------------ ---------------- -------------------- ------------------------ ----------------------------
|P1| P2 |  P3  |   P4   |     P5     |       P6       |         P7         |           P8           |              P9              |
 -- ---- ------ -------- ------------ ---------------- -------------------- ------------------------ ----------------------------
0  1    3      6        10           16               24                   34                       46                           61
```

c) The job which needs medium execution time comes first.

```
Enter choice :1
***First Come First Serve***
Enter number of process:9

Enter Burst Time:
p1:4
p2:6
p3:8
p4:10
p5:12
p6:15
p7:1
p8:2
p9:3

Processes       Burst           Waiting         Turnaround
P1              4               0               4
P2              6               4               10
P3              8               10              18
P4              10              18              28
P5              12              28              40
P6              15              40              55
P7              1               55              56
P8              2               56              58
P9              3               58              61

Average waiting time = 29.888889
Average turnaround time = 36.666668


Gantt Chart:
 -------- ------------ ---------------- -------------------- ---------------------- ------------------------------ -- ---- ------
|   P1   |     P2     |       P3       |         P4         |           P5           |              P6              |P7| P8 |  P9  |
 -------- ------------ ---------------- -------------------- ---------------------- ------------------------------ -- ---- ------
0        4            10               18                   28                     40                             55 56   58     61
```

2.SHORTEST JOB FIRST

a) The job which needs longer time comes first.

```
Enter choice :2
***Shortest Job First***
Enter number of process:9

Enter Burst Time:
p1:10
p2:12
p3:15
p4:4
p5:6
p6:8
p7:1
p8:2
p9:3

Processes       Burst           Waiting         Turnaround
P7              1               0               1
P8              2               1               3
P9              3               3               6
P4              4               6               10
P5              6               10              16
P6              8               16              24
P1              10              24              34
P2              12              34              46
P3              15              46              61


Average Waiting Time = 15.555555
Average Turnaround Time = 22.333334

Gantt Chart:
 -- ---- ------ -------- ------------ ---------------- -------------------- ---------------------- ------------------------------
|P1| P2 |  P3  |   P4   |     P5     |       P6       |         P7         |           P8           |              P9              |
 -- ---- ------ -------- ------------ ---------------- -------------------- ---------------------- ------------------------------
0  1    3      6        10           16               24                   34                     46                           61
```

b) The job which requires shorter time comes first.

```
Enter choice :2
***Shortest Job First***
Enter number of process:9

Enter Burst Time:
p1:1
p2:2
p3:3
p4:4
p5:6
p6:8
p7:10
p8:12
p9:15

Processes       Burst           Waiting         Turnaround
P1              1               0               1
P2              2               1               3
P3              3               3               6
P4              4               6               10
P5              6               10              16
P6              8               16              24
P7              10              24              34
P8              12              34              46
P9              15              46              61


Average Waiting Time = 15.555555
Average Turnaround Time = 22.333334

Gantt Chart:
 -- ---- ------ -------- ------------ ---------------- -------------------- ---------------------- ------------------------------
|P1| P2 |  P3  |   P4   |     P5     |       P6       |         P7         |           P8           |              P9              |
 -- ---- ------ -------- ------------ ---------------- -------------------- ---------------------- ------------------------------
0  1    3      6        10           16               24                   34                     46                           61
```

c) The job which needs medium execution time comes first

```
Enter choice :2
***Shortest Job First***
Enter number of process:9

Enter Burst Time:
p1:4
p2:6
p3:8
p4:10
p5:12
p6:15
p7:1
p8:2
p9:3

Processes       Burst           Waiting         Turnaround
P7              1               0               1
P8              2               1               3
P9              3               3               6
P1              4               6               10
P2              6               10              16
P3              8               16              24
P4              10              24              34
P5              12              34              46
P6              15              46              61


Average Waiting Time = 15.555555
Average Turnaround Time = 22.333334

Gantt Chart:
 -- ---- ------ -------- ------------ ---------------- -------------------- ---------------------- ------------------------------
|P1| P2 |  P3  |   P4   |     P5     |       P6       |         P7         |           P8           |              P9              |
 -- ---- ------ -------- ------------ ---------------- -------------------- ---------------------- ------------------------------
0  1    3      6        10           16               24                   34                     46                           61
```

3.SHORTEST REMAINING TIME FIRST

a) The job which needs longer time comes first.

```
Enter choice :3
***Shortest remaining Job First***
Enter number of process:9

Enter the Arrival and Burst time

Enter the Arrival and Burst time of the Process 1
Arrival time is: 0
Burst time is: 10

Enter the Arrival and Burst time of the Process 2
Arrival time is: 1
Burst time is: 12

Enter the Arrival and Burst time of the Process 3
Arrival time is: 2
Burst time is: 15

Enter the Arrival and Burst time of the Process 4
Arrival time is: 3
Burst time is: 4

Enter the Arrival and Burst time of the Process 5
Arrival time is: 4
Burst time is: 6

Enter the Arrival and Burst time of the Process 6
Arrival time is: 5
Burst time is: 8

Enter the Arrival and Burst time of the Process 7
Arrival time is: 6
Burst time is: 1

Enter the Arrival and Burst time of the Process 8
Arrival time is: 7
Burst time is: 2

Enter the Arrival and Burst time of the Process 9
Arrival time is: 8
Burst time is: 3

Processes       Burst           Waiting         Turnaround
P1              10              16              26
P2              12              33              45
P3              15              44              59
P4              4               0               4
P5              6               9               15
P6              8               21              29
P7              1               1               2
P8              2               1               3
P9              3               2               5

Average waiting time = 14.11
Average turn around time = 20.89
Gantt Chart:
 -------------------- ------------------------ ------------------------------ -------- ------------ ---------------- -- ---- ------
|         P1         |          P2            |              P3              |   P4   |     P5     |       P6       |P7| P8 |  P9  |
 -------------------- ------------------------ ------------------------------ -------- ------------ ---------------- -- ---- ------
0                    10                       22                             37       41           47               55 56   58     61
```

b) The job which requires shorter time comes first.

```
Enter choice :3
***Shortest remaining Job First***
Enter number of process:9

Enter the Arrival and Burst time

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

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

Enter the Arrival and Burst time of the Process 3
Arrival time is: 2
Burst time is: 3

Enter the Arrival and Burst time of the Process 4
Arrival time is: 3
Burst time is: 4

Enter the Arrival and Burst time of the Process 5
Arrival time is: 4
Burst time is: 6

Enter the Arrival and Burst time of the Process 6
Arrival time is: 5
Burst time is: 8

Enter the Arrival and Burst time of the Process 7
Arrival time is: 6
Burst time is: 10

Enter the Arrival and Burst time of the Process 8
Arrival time is: 7
Burst time is: 12

Enter the Arrival and Burst time of the Process 9
Arrival time is: 8
Burst time is: 15
```

```
Processes       Burst           Waiting         Turnaround
P1              1               0               1
P2              2               0               2
P3              3               1               4
P4              4               3               7
P5              6               6               12
P6              8               11              19
P7              10              18              28
P8              12              27              39
P9              15              38              53

Average waiting time = 11.56
Average turn around time = 18.33
Gantt Chart:
 -- ---- ------ -------- ------------ ---------- ---------- ---------- ---------- ----------
|P1| P2 |  P3  |   P4   |     P5     |     P6     |     P7     |     P8     |     P9     |
 -- ---- ------ -------- ------------ ---------- ---------- ---------- ---------- ----------
0  1    3      6        10           16           24           34           46           61
```

c) The job which needs medium execution time comes first

```
Enter choice :3
***Shortest remaining Job First***
Enter number of process:9

Enter the Arrival and Burst time

Enter the Arrival and Burst time of the Process 1
Arrival time is: 0
Burst time is: 4

Enter the Arrival and Burst time of the Process 2
Arrival time is: 1
Burst time is: 6

Enter the Arrival and Burst time of the Process 3
Arrival time is: 2
Burst time is: 8

Enter the Arrival and Burst time of the Process 4
Arrival time is: 3
Burst time is: 10

Enter the Arrival and Burst time of the Process 5
Arrival time is: 4
Burst time is: 12

Enter the Arrival and Burst time of the Process 6
Arrival time is: 5
Burst time is: 15

Enter the Arrival and Burst time of the Process 7
Arrival time is: 6
Burst time is: 1

Enter the Arrival and Burst time of the Process 8
Arrival time is: 7
Burst time is: 2

Enter the Arrival and Burst time of the Process 9
Arrival time is: 8
Burst time is: 3

Processes       Burst           Waiting         Turnaround
P1              4               0               4
P2              6               9               15
P3              8               14              22
P4              10              21              31
P5              12              30              42
P6              15              41              56
P7              1               0               1
P8              2               0               2
P9              3               1               4

Average waiting time = 12.89
Average turn around time = 19.67
Gantt Chart:
 -------- ------------ ---------- ---------- ---------- ---------- -- ---- ------
|   P1   |     P2     |     P3     |     P4     |     P5     |     P6     |P7| P8 |  P9  |
 -------- ------------ ---------- ---------- ---------- ---------- -- ---- ------
0        4            10           18           28           40           55 56   58     61
```

4. ROUND ROBIN

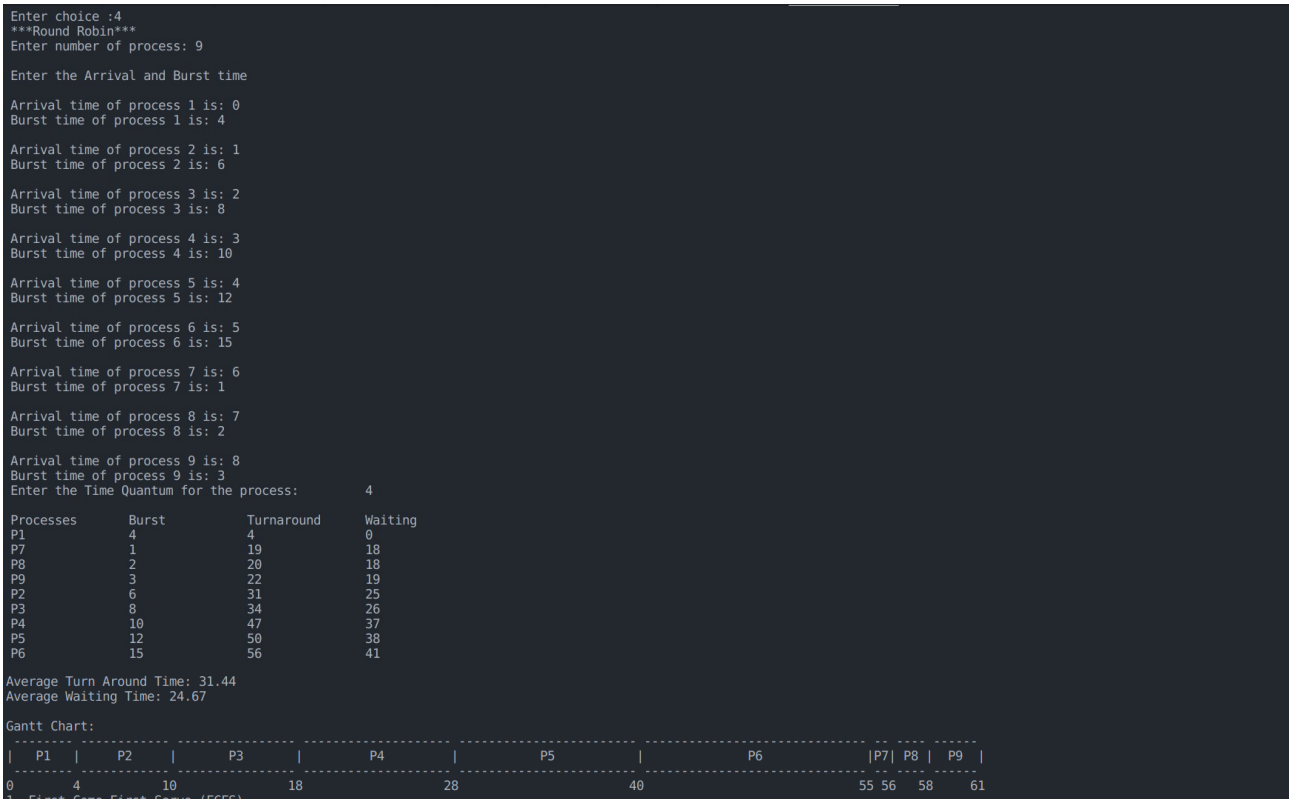
a) The job which needs longer time comes first.

```
Enter choice :4
***Round Robin***
Enter number of process: 9

Enter the Arrival and Burst time

Arrival time of process 1 is: 0
Burst time of process 1 is: 15

Arrival time of process 2 is: 1
Burst time of process 2 is: 12

Arrival time of process 3 is: 2
Burst time of process 3 is: 10

Arrival time of process 4 is: 3
Burst time of process 4 is: 4

Arrival time of process 5 is: 4
Burst time of process 5 is: 6

Arrival time of process 6 is: 5
Burst time of process 6 is: 8

Arrival time of process 7 is: 6
Burst time of process 7 is: 1

Arrival time of process 8 is: 7
Burst time of process 8 is: 2

Arrival time of process 9 is: 8
Burst time of process 9 is: 3
Enter the Time Quantum for the process:         4

Processes       Burst           Turnaround      Waiting
P4              4               13              9
P7              1               19              18
P8              2               20              18
P9              3               22              19
P5              6               40              34
P6              8               43              35
P2              12              55              43
P3              10              56              46
P1              15              61              46

Average Turn Around Time: 36.56
Average Waiting Time: 29.78

Gantt Chart:
 ------------------------------ ---------------------- -------------------- -------- ------------ ---------------- -- ---- ------
|              P1              |          P2          |         P3         |  P4    |     P5     |       P6       |P7| P8 |  P9  |
 ------------------------------ ---------------------- -------------------- -------- ------------ ---------------- -- ---- ------
0                              15                     27                   37       41           47               55 56   58     61
```

b) The job which requires shorter time comes first.

```
Enter choice :4
***Round Robin***
Enter number of process: 9

Enter the Arrival and Burst time

Arrival time of process 1 is: 0
Burst time of process 1 is: 1

Arrival time of process 2 is: 1
Burst time of process 2 is: 2

Arrival time of process 3 is: 2
Burst time of process 3 is: 3

Arrival time of process 4 is: 3
Burst time of process 4 is: 4

Arrival time of process 5 is: 4
Burst time of process 5 is: 6

Arrival time of process 6 is: 5
Burst time of process 6 is: 8

Arrival time of process 7 is: 6
Burst time of process 7 is: 10

Arrival time of process 8 is: 7
Burst time of process 8 is: 12

Arrival time of process 9 is: 8
Burst time of process 9 is: 15
Enter the Time Quantum for the process:         4

Processes       Burst           Turnaround      Waiting
P1              1               1               0
P2              2               2               0
P3              3               4               1
P4              4               7               3
P5              6               28              22
P6              8               31              23
P7              10              44              34
P8              12              47              35
P9              15              53              38

Average Turn Around Time: 24.11
Average Waiting Time: 17.33

Gantt Chart:
 -- ---- ------ -------- ------------ ---------------- -------------------- ------------------------ ------------------------------
|P1| P2 |  P3  |   P4   |     P5     |       P6       |         P7         |           P8           |              P9              |
 -- ---- ------ -------- ------------ ---------------- -------------------- ------------------------ ------------------------------
0  1    3      6        10           16               24                   34                       46                             61
```

c) The job which needs medium execution time comes first



```
Enter choice :4
***Round Robin***
Enter number of process: 9

Enter the Arrival and Burst time

Arrival time of process 1 is: 0
Burst time of process 1 is: 4

Arrival time of process 2 is: 1
Burst time of process 2 is: 6

Arrival time of process 3 is: 2
Burst time of process 3 is: 8

Arrival time of process 4 is: 3
Burst time of process 4 is: 10

Arrival time of process 5 is: 4
Burst time of process 5 is: 12

Arrival time of process 6 is: 5
Burst time of process 6 is: 15

Arrival time of process 7 is: 6
Burst time of process 7 is: 1

Arrival time of process 8 is: 7
Burst time of process 8 is: 2

Arrival time of process 9 is: 8
Burst time of process 9 is: 3
Enter the Time Quantum for the process:         4

Processes       Burst           Turnaround      Waiting
P1              4               4               0
P7              1               19              18
P8              2               20              18
P9              3               22              19
P2              6               31              25
P3              8               34              26
P4              10              47              37
P5              12              50              38
P6              15              56              41

Average Turn Around Time: 31.44
Average Waiting Time: 24.67

Gantt Chart:
 -------- ------------ ---------------- -------------------- ------------------------ ------------------------------ -- ---- ------
|   P1   |     P2     |       P3       |         P4         |           P5           |              P6              |P7| P8 |  P9  |
 -------- ------------ ---------------- -------------------- ------------------------ ------------------------------ -- ---- ------
0        4          10                18                   28                       40                           55 56   58     61
```

5.PRIORITY NON PREEMPTIVE

a) The job which needs longer time comes first.

```
Enter choice :5
***Non-Preemptive Priority Scheduling***
Enter Number of Processes: 9

Process No: 1
Enter Arrival Time: 0
Enter Burst Time: 10
Enter Priority: 9

Process No: 2
Enter Arrival Time: 1
Enter Burst Time: 12
Enter Priority: 6

Process No: 3
Enter Arrival Time: 2
Enter Burst Time: 15
Enter Priority: 7

Process No: 4
Enter Arrival Time: 3
Enter Burst Time: 4
Enter Priority: 3

Process No: 5
Enter Arrival Time: 4
Enter Burst Time: 6
Enter Priority: 8

Process No: 6
Enter Arrival Time: 5
Enter Burst Time: 8
Enter Priority: 2

Process No: 7
Enter Arrival Time: 6
Enter Burst Time: 1
Enter Priority: 8

Process No: 8
Enter Arrival Time: 7
Enter Burst Time: 2
Enter Priority: 1

Arrival time of process 9 is: 8
Burst time of process 9 is: 3
Enter the Time Quantum for the process:         4

Processes       Burst           Turnaround      Waiting
P1              4               4               0
P7              1               19              18
P8              2               20              18
P9              3               22              19
P2              6               31              25
P3              8               34              26
P4              10              47              37
P5              12              50              38
P6              15              56              41

Average Turn Around Time: 31.44
Average Waiting Time: 24.67

Gantt Chart:
 -------- ------------ --------------- ------------------ ---------------------- ----------------------------- -- ---- ------
|   P1   |     P2     |       P3       |         P4         |           P5           |              P6              |P7| P8 |  P9  |
 -------- ------------ --------------- ------------------ ---------------------- ----------------------------- -- ---- ------
0        4           10              18                 28                       40                            55 56   58     61
```

b) The job which requires shorter time comes first.

```
Enter choice :5
***Non-Preemptive Priority Scheduling***
Enter Number of Processes: 9

Process No: 1
Enter Arrival Time: 0
Enter Burst Time: 1
Enter Priority: 9

Process No: 2
Enter Arrival Time: 1
Enter Burst Time: 2
Enter Priority: 6

Process No: 3
Enter Arrival Time: 2
Enter Burst Time: 3
Enter Priority: 7

Process No: 4
Enter Arrival Time: 3
Enter Burst Time: 4
Enter Priority: 3

Process No: 5
Enter Arrival Time: 4
Enter Burst Time: 6
Enter Priority: 8

Process No: 6
Enter Arrival Time: 5
Enter Burst Time: 8
Enter Priority: 2

Process No: 7
Enter Arrival Time: 6
Enter Burst Time: 10
Enter Priority: 8

Process No: 8
Enter Arrival Time: 7
Enter Burst Time: 12
Enter Priority: 1
```

```
Process No: 9
Enter Arrival Time: 8
Enter Burst Time: 15
Enter Priority: 4

Processes       Arrival         Burst   Priority        Completion      Turnaround      Waiting
P1              0               1       9               1               1               0
P5              4               6       8               7               3               -3
P7              6               10      8               17              11              1
P3              2               3       7               20              18              15
P2              1               2       6               22              21              19
P9              8               15      4               37              29              14
P4              3               4       3               41              38              34
P6              5               8       2               49              44              36
P8              7               12      1               61              54              42

Average TurnAroundTime=24.22
Average WaitingTime=17.56

Gantt Chart:
 -- ------------ ------------------- ------ ---- ------------------------------ -------- --------------- ------------------------
|P1|     P2     |         P3         |  P4  | P5 |              P6              |   P7   |       P8       |           P9           |
 -- ------------ ------------------- ------ ---- ------------------------------ -------- --------------- ------------------------
0  1            7                  17     20   22                             37       41              49                       61
```

c) The job which needs medium execution time comes first

```
Enter choice :5
***Non-Preemptive Priority Scheduling***
Enter Number of Processes: 9

Process No: 1
Enter Arrival Time: 0
Enter Burst Time: 4
Enter Priority: 9

Process No: 2
Enter Arrival Time: 1
Enter Burst Time: 6
Enter Priority: 6

Process No: 3
Enter Arrival Time: 2
Enter Burst Time: 8
Enter Priority: 7

Process No: 4
Enter Arrival Time: 3
Enter Burst Time: 10
Enter Priority: 3

Process No: 5
Enter Arrival Time: 4
Enter Burst Time: 12
Enter Priority: 8

Process No: 6
Enter Arrival Time: 5
Enter Burst Time: 15
Enter Priority: 2

Process No: 7
Enter Arrival Time: 6
Enter Burst Time: 1
Enter Priority: 8

Process No: 8
Enter Arrival Time: 7
Enter Burst Time: 2
Enter Priority: 1

Process No: 9
Enter Arrival Time: 8
Enter Burst Time: 3
Enter Priority: 4

Processes       Arrival         Burst   Priority        Completion      Turnaround      Waiting
P1              0               4       9               4               4               0
P5              4               12      8               16              12              0
P7              6               1       8               17              11              10
P3              2               8       7               25              23              15
P2              1               6       6               31              30              24
P9              8               3       4               34              26              23
P4              3               10      3               44              41              31
P6              5               15      2               59              54              39
P8              7               2       1               61              54              52

Average TurnAroundTime=27.89
Average WaitingTime=21.56

Gantt Chart:
 -------- ----------------------- -- ---------------- ------------ ------ -------------------- ---------------------------- ----
|   P1   |          P2           |P3|       P4       |     P5     |  P6  |         P7         |             P8             | P9 |
 -------- ----------------------- -- ---------------- ------------ ------ -------------------- ---------------------------- ----
0        4                       16 17              25           31     34                   44                           59   61
```

6.PRIORITY PREEMPTIVE

a) The job which needs longer time comes first.

```
Enter choice :6
***Highest Priority First(Preemptive)***
Enter Number of Processes: 9

Process No: 1
Enter Arrival Time: 0
Enter Burst Time: 10
Enter Priority: 8

Process No: 2
Enter Arrival Time: 1
Enter Burst Time: 12
Enter Priority: 4

Process No: 3
Enter Arrival Time: 2
Enter Burst Time: 15
Enter Priority: 3

Process No: 4
Enter Arrival Time: 3
Enter Burst Time: 4
Enter Priority: 6

Process No: 5
Enter Arrival Time: 4
Enter Burst Time: 6
Enter Priority: 2

Process No: 6
Enter Arrival Time: 5
Enter Burst Time: 8
Enter Priority: 7

Process No: 7
Enter Arrival Time: 6
Enter Burst Time: 1
Enter Priority: 6

Process No: 8
Enter Arrival Time: 7
Enter Burst Time: 2
Enter Priority: 5

Process No: 9
Enter Arrival Time: 8
Enter Burst Time: 3
Enter Priority: 2

Processes       Arrival         Burst   Priority        Completion      Turnaround      Waiting
P1              0               10      8               10              10              0
P2              1               12      4               37              36              24
P3              2               15      3               52              50              35
P4              3               4       6               22              19              15
P5              4               6       2               58              54              48
P6              5               8       7               18              13              5
P7              6               1       6               23              17              16
P8              7               2       5               25              18              16
P9              8               3       2               61              53              50

Average TurnAroundTime=30.00
Average WaitingTime=23.22

Gantt Chart:
 ------------------ ---------------------- ---------------------------- -------- ------------ ---------------- -- ---- ------
|         P1         |           P2           |              P3              |   P4   |     P5     |       P6       |P7| P8 |  P9  |
 ------------------ ---------------------- ---------------------------- -------- ------------ ---------------- -- ---- ------
0                  10                     22                           37       41           47               55 56   58     61
```

b) The job which requires shorter time comes first.

```
Enter choice :6
***Highest Priority First(Preemptive)***
Enter Number of Processes: 9

Process No: 1
Enter Arrival Time: 0
Enter Burst Time: 1
Enter Priority: 8

Process No: 2
Enter Arrival Time: 1
Enter Burst Time: 2
Enter Priority: 4

Process No: 3
Enter Arrival Time: 2
Enter Burst Time: 3
Enter Priority: 3

Process No: 4
Enter Arrival Time: 3
Enter Burst Time: 4
Enter Priority: 6

Process No: 5
Enter Arrival Time: 4
Enter Burst Time: 6
Enter Priority: 2

Process No: 6
Enter Arrival Time: 5
Enter Burst Time: 8
Enter Priority: 7

Process No: 7
Enter Arrival Time: 6
Enter Burst Time: 10
Enter Priority: 6

Process No: 8
Enter Arrival Time: 7
Enter Burst Time: 12
Enter Priority: 5
```

```
Process No: 9
Enter Arrival Time: 8
Enter Burst Time: 15
Enter Priority: 2

Processes       Arrival         Burst   Priority        Completion      Turnaround      Waiting
P1              0               1       8               1               1               0
P2              1               2       4               3               2               0
P3              2               3       3               40              38              35
P4              3               4       6               15              12              8
P5              4               6       2               46              42              36
P6              5               8       7               13              8               0
P7              6               10      6               25              19              9
P8              7               12      5               37              30              18
P9              8               15      2               61              53              38

Average TurnAroundTime=22.78
Average WaitingTime=16.00

Gantt Chart:
 -- ---- ------ -------- ------------ ---------- ---------- ---------- ---------- ----------
|P1| P2 |  P3  |   P4   |     P5     |     P6     |     P7     |     P8     |     P9     |
 -- ---- ------ -------- ------------ ---------- ---------- ---------- ----------
0  1    3      6        10           16           24           34           46           61
```

c) The job which needs medium execution time comes first

```
Enter choice :6
***Highest Priority First(Preemptive)***
Enter Number of Processes: 9

Process No: 1
Enter Arrival Time: 0
Enter Burst Time: 4
Enter Priority: 8

Process No: 2
Enter Arrival Time: 1
Enter Burst Time: 6
Enter Priority: 4

Process No: 3
Enter Arrival Time: 2
Enter Burst Time: 8
Enter Priority: 3

Process No: 4
Enter Arrival Time: 3
Enter Burst Time: 10
Enter Priority: 6

Process No: 5
Enter Arrival Time: 4
Enter Burst Time: 12
Enter Priority: 2

Process No: 6
Enter Arrival Time: 5
Enter Burst Time: 15
Enter Priority: 7

Process No: 7
Enter Arrival Time: 6
Enter Burst Time: 1
Enter Priority: 6

Process No: 8
Enter Arrival Time: 7
Enter Burst Time: 2
Enter Priority: 5

Process No: 9
Enter Arrival Time: 8
Enter Burst Time: 3
Enter Priority: 2

Processes       Arrival         Burst   Priority        Completion      Turnaround      Waiting
P1              0               4       8               4               4               0
P2              1               6       4               38              37              31
P3              2               8       3               46              44              36
P4              3               10      6               29              26              16
P5              4               12      2               58              54              42
P6              5               15      7               20              15              0
P7              6               1       6               30              24              23
P8              7               2       5               32              25              23
P9              8               3       2               61              53              50

Average TurnAroundTime=31.33
Average WaitingTime=24.56

Gantt Chart:
 -------- ------------ ---------- ---------- ---------- ---------- -- ---- ------
|   P1   |     P2     |     P3     |     P4     |     P5     |     P6     |P7| P8 |  P9  |
 -------- ------------ ---------- ---------- ---------- ---------- -- ---- ------
0        4            10           18           28           40           55 56   58     61
```