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Assignment No. 03

Problem Statement : Write a program to implement scheduling algorithms – FCFS, SJF, Round Robin and Priority.

Code :

```
#include <stdio.h>
#include <stdlib.h>
#include <stdbool.h>
static int Count = 0;
struct Process
{
        char pname[10];
        int AT;
        int BT;
   int PR;
        float CT;
   float RT;
   int Queue;
        float TAT;
        float WT;
   int flag;
};

void PrintAll(struct Process P[], int n)
{
        float TTAT = 0;
        float TWT = 0;
```

```
	printf("\nProcess\tArrival\tBurst\tPriority\tCompletion\tTurnaround\tWaiting\n");
	for (int i = 0; i < n; i++)
	{
		printf("%s\t%d\t%d\t%d\t\t%.2f\t\t%.2f\t\t%.2f\n", P[i].pname, P[i].AT,
P[i].BT, P[i].PR, P[i].CT, P[i].TAT, P[i].WT);
		TTAT = TTAT + P[i].TAT;
		TWT = TWT + P[i].WT;
	}
	float AvgTAT, AvgWT;
	AvgTAT = TTAT / n;
	AvgWT = TWT/ n;
	printf("\nAverage Turnaround Time: %.2f\n", AvgTAT);
	printf("Average Waiting Time: %.2f\n", AvgWT);
}

int Partition(struct Process P[], int low, int high)
{
	int Pivot = P[high].AT;
	int i = low - 1;
	for (int j = low; j < high; j++)
	{
		if (P[j].AT < Pivot)
		{
			i++;
			struct Process temp = P[i];
			P[i] = P[j];
			P[j] = temp;
		}
```

```
        }
        struct Process temp = P[i + 1];
        P[i + 1] = P[high];
        P[high] = temp;
        return i + 1;
}

void QuickSort(struct Process P[], int low, int high)
{
        if (low < high)
        {
                int Pivot = Partition(P, low, high);
                QuickSort(P, low, Pivot - 1);
                QuickSort(P, Pivot + 1, high);
        }
}

void CalculateTime(struct Process P[], int n)
{
        int currentTime = 0;
        printf("\nGantt Chart:\n|");
   for(int i = 0; i < n; i++) {
      if(currentTime < P[i].AT) {
         printf(" IDLE |");
         currentTime = P[i].AT;
      }
      printf(" %s |", P[i].pname);
      P[i].CT = currentTime + P[i].BT;
```

```
        P[i].TAT = P[i].CT - P[i].AT;
        P[i].WT = P[i].TAT - P[i].BT;
        currentTime = P[i].CT;
    }
    printf("\n");
    PrintAll(P, n);
}

void PrintGanttSchedule(struct Process P[], int Schedule[], int n) {
            printf("\nGantt Chart: \n\n");
    int CurrentTime = 0;
    int index;
    for(int i = 0; i < Count; i++) {
        printf("----------------");
    }
    printf("\n|");
    for (int i = 0; i < n; i++) {
        index = Schedule[i];
        if (CurrentTime < P[index].AT) {
            printf("\tIdle\t|");
            CurrentTime = P[index].AT;
        }
        printf("\t%s\t|", P[index].pname);
        CurrentTime = P[index].CT;
    }
    printf("\n");
    for(int i = 0; i < Count; i++) {
        printf("----------------");
```

```
    }
    printf("\n");
    printf("0");
    CurrentTime = 0;
    for (int i = 0; i < n; i++) {
        index = Schedule[i];
        if (CurrentTime < P[index].AT) {
            printf("\t\t%d", P[index].AT);
            CurrentTime = P[index].AT;
        }
        printf("\t\t%.1f", P[index].CT);
        CurrentTime = P[index].CT;
    }
    printf("\n");
}

void PrioritySchedule(struct Process P[], int n) {
    int CurrentTime = 0;
    int i = 0;
    int Schedule[n];
    while(i < n) {
        int minPR = 999;
        int minIndex = -1;
        int j = 0;
        while(j < n) {
            if(P[j].AT <= CurrentTime && P[j].PR < minPR && !P[j].flag) {
                minPR = P[j].PR;
                minIndex = j;
```

```
        }
        j++;
        }
        if(minIndex != -1) {
            P[minIndex].CT = CurrentTime + P[minIndex].BT;
                        P[minIndex].TAT = P[minIndex].CT - P[minIndex].AT;
                        P[minIndex].WT = P[minIndex].TAT - P[minIndex].BT;
            P[minIndex].flag = 1;
            Schedule[i] = minIndex;
            CurrentTime = P[minIndex].CT;
            Count++;
            i++;
        }
        else {
            CurrentTime++;
            Count++;
        }
    }
    PrintGanttSchedule(P, Schedule, n);
}

void SJFSchedule(struct Process P[], int n) {
    int CurrentTime = 0;
    int i = 0;
    int Schedule[n];
    while(i < n) {
        int minBT = 999;
        int minIndex = -1;
```

```
        int j = 0;
        while(j < n) {
            if(P[j].AT <= CurrentTime && P[j].BT < minBT && !P[j].flag) {
                minBT = P[j].BT;
                minIndex = j;
        }
        j++;
        }
        if(minIndex != -1) {
            P[minIndex].CT = CurrentTime + P[minIndex].BT;
                        P[minIndex].TAT = P[minIndex].CT - P[minIndex].AT;
                        P[minIndex].WT = P[minIndex].TAT - P[minIndex].BT;
            P[minIndex].flag = 1;
            Schedule[i] = minIndex;
            CurrentTime = P[minIndex].CT;
            i++;
        }
        else {
            CurrentTime++;
        }
    }
    PrintGanttSchedule(P, Schedule, n);
}

void RoundRobin(struct Process P[], int n, int tq) {
    int currentTime = 0;
    int completed = 0;
    int *Schedule = (int*)malloc(1000 * sizeof(int));
```

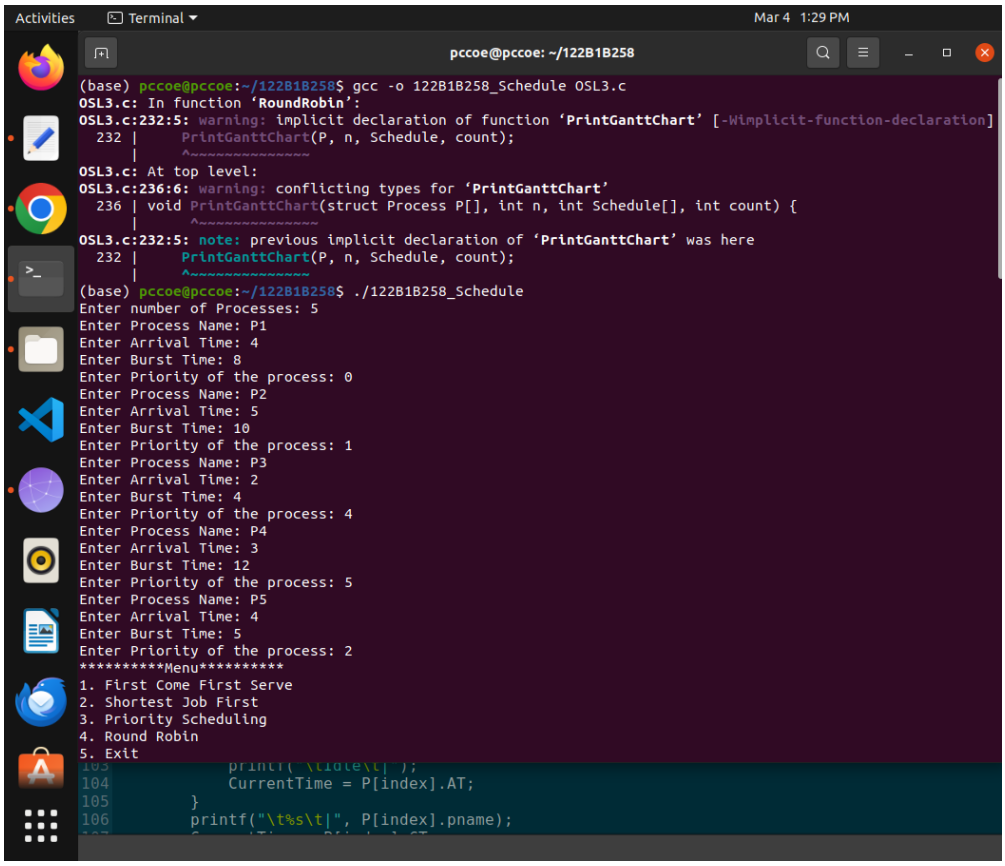
```
int count = 0;
for(int i = 0; i < n; i++) {
    P[i].RT = P[i].BT;
}
while(completed < n) {
    bool foundProcess = false;
    for(int i = 0; i < n; i++) {
        if(P[i].RT > 0 && P[i].AT <= currentTime) {
            foundProcess = true;
            int executionTime = (P[i].RT < tq) ? P[i].RT : tq;
            P[i].RT -= executionTime;
            currentTime += executionTime;
            Schedule[count++] = i;
            if(P[i].RT == 0) {
                completed++;
                P[i].CT = currentTime;
                P[i].TAT = P[i].CT - P[i].AT;
                P[i].WT = P[i].TAT - P[i].BT;
            }
        }
    }
    if(!foundProcess) {
        currentTime++;
        Schedule[count++] = -1;
    }
}
PrintGanttChart(P, n, Schedule, count);
PrintAll(P, n);
```

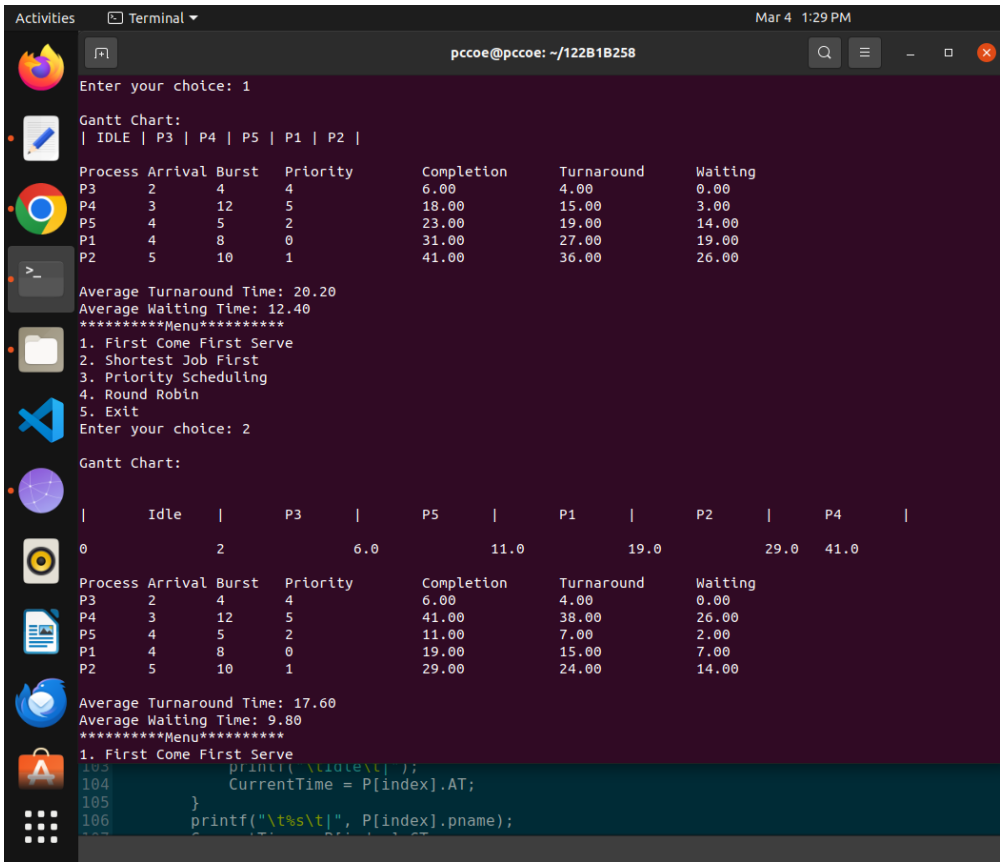
```
}

void PrintGanttChart(struct Process P[], int n, int Schedule[], int count) {
    printf("\nGantt Chart:\n|");
    int currentTime = 0;
    for(int i = 0; i < count; i++) {
        if(Schedule[i] == -1) {
            printf(" IDLE |");
        } else {
            printf(" %s |", P[Schedule[i]].pname);
        }
    }
    printf("\n");
}

void ResetParameters(struct Process P[], int n) {
    for(int i = 0; i < n; i++) {
        P[i].flag = 0;
        P[i].CT = 0;
        P[i].TAT = 0;
        P[i].WT = 0;
        P[i].RT = P[i].BT;
    }
}

int main()
{
            int n, tq, choice;
```

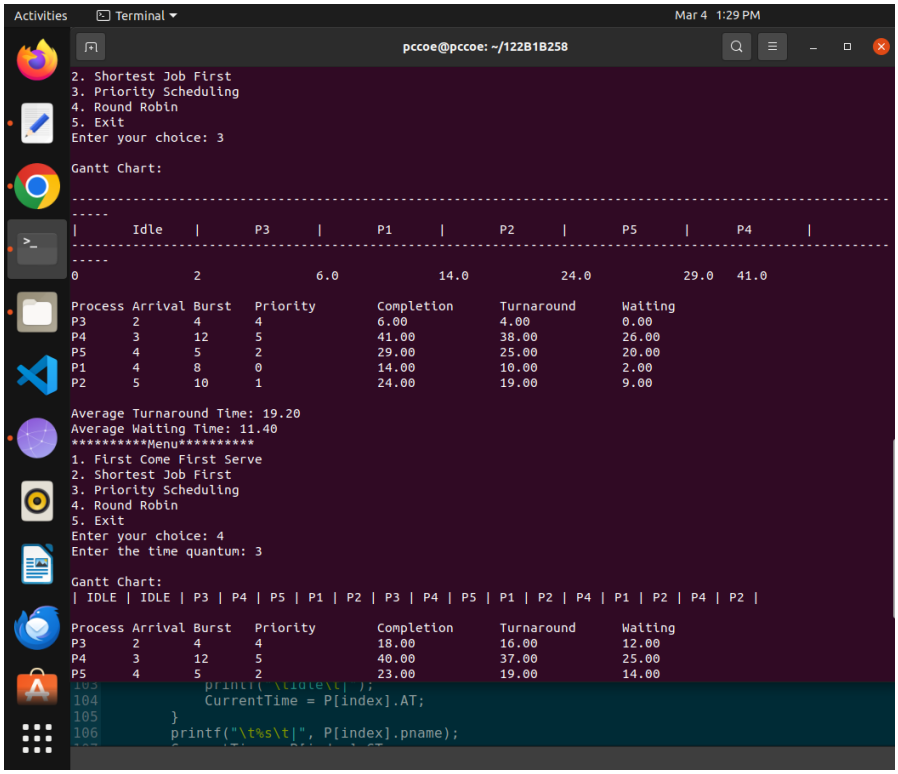
```
printf("Enter number of Processes: ");
scanf("%d", &n);
        struct Process P[n];
        for (int i = 0; i < n; i++)
        {
                printf("Enter Process Name: ");
                scanf("%s", P[i].pname);
                printf("Enter Arrival Time: ");
                scanf("%d", &P[i].AT);
                printf("Enter Burst Time: ");
                scanf("%d", &P[i].BT);
    printf("Enter Priority of the process: ");
    scanf("%d", &P[i].PR);
    P[i].flag = 0;
        }
do {
    ResetParameters(P, n);
    printf("**********Menu**********\n");
    printf("1. First Come First Serve\n");
    printf("2. Shortest Job First\n");
    printf("3. Priority Scheduling\n");
    printf("4. Round Robin\n");
    printf("5. Exit\n");
    printf("Enter your choice: ");
    scanf("%d", &choice);
    switch (choice) {
       case 1: {
          QuickSort(P, 0, n - 1);
```

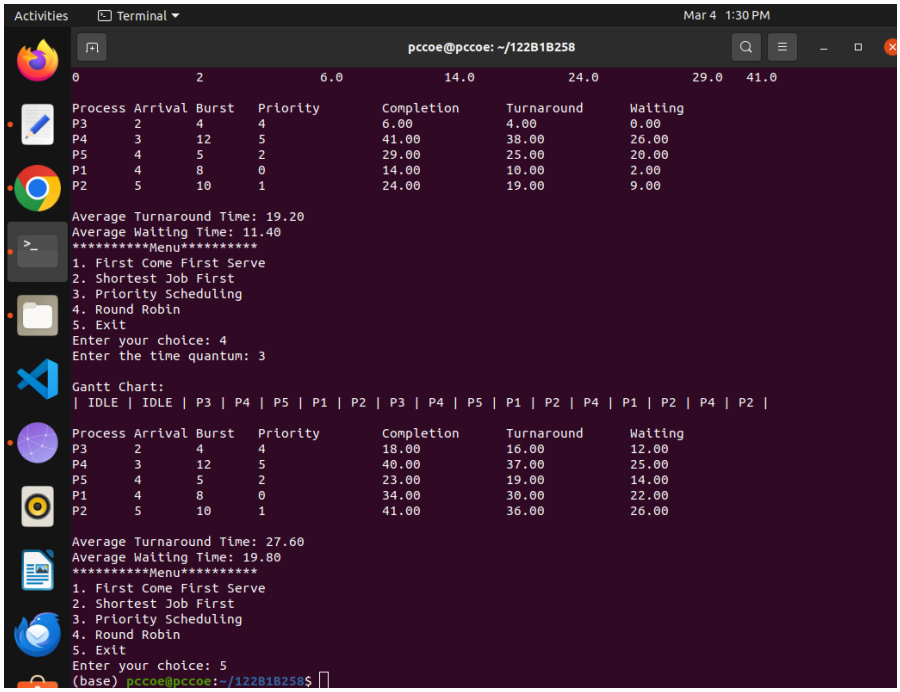
```
            CalculateTime(P, n);
        }
        break;
        case 2: {
            SJFSchedule(P, n);
            PrintAll(P, n);
        }
        break;
        case 3: {
            PrioritySchedule(P, n);
            PrintAll(P, n);
        }
        break;
        case 4: {
            printf("Enter the time quantum: ");
            scanf("%d", &tq);
            RoundRobin(P, n, tq);
        }
    }
    }while(choice != 5);
          return 0;
}
```

Output :


Activities
Terminal
Mar 4 1:29 PM
pccoe@pccoe: ~/122B1B258
(base) pccoe@pccoe:~/122B1B258$ gcc -o 122B1B258_Schedule OSL3.c
OSL3.c: In function 'RoundRobin':
OSL3.c:232:5: warning: implicit declaration of function 'PrintGanttChart' [-Wimplicit-function-declaration]
232 | PrintGanttChart(P, n, Schedule, count);
OSL3.c: At top level:
OSL3.c:236:6: warning: conflicting types for 'PrintGanttChart'
236 | void PrintGanttChart(struct Process P[], int n, int Schedule[], int count) {
OSL3.c:232:5: note: previous implicit declaration of 'PrintGanttChart' was here
232 | PrintGanttChart(P, n, Schedule, count);
(base) pccoe@pccoe:~/122B1B258$ ./122B1B258_Schedule
Enter number of Processes: 5
Enter Process Name: P1
Enter Arrival Time: 4
Enter Burst Time: 8
Enter Priority of the process: 0
Enter Process Name: P2
Enter Arrival Time: 5
Enter Burst Time: 10
Enter Priority of the process: 1
Enter Process Name: P3
Enter Arrival Time: 2
Enter Burst Time: 4
Enter Priority of the process: 4
Enter Process Name: P4
Enter Arrival Time: 3
Enter Burst Time: 12
Enter Priority of the process: 5
Enter Process Name: P5
Enter Arrival Time: 4
Enter Burst Time: 5
Enter Priority of the process: 2
**********Menu**********
1. First Come First Serve
2. Shortest Job First
3. Priority Scheduling
4. Round Robin
5. Exit
CurrentTime = P[index].AT;
printf("\t%s\t|", P[index].pname);


Activities
Terminal
Mar 4 1:29 PM
pccoe@pccoe: ~/122B1B258
Enter your choice: 1
Gantt Chart:
| IDLE | P3 | P4 | P5 | P1 | P2 |
Process Arrival Burst Priority Completion Turnaround Waiting
P3 2 4 4 6.00 4.00 0.00
P4 3 12 5 18.00 15.00 3.00
P5 4 5 2 23.00 19.00 14.00
P1 4 8 0 31.00 27.00 19.00
P2 5 10 1 41.00 36.00 26.00
Average Turnaround Time: 20.20
Average Waiting Time: 12.40
**********Menu**********
1. First Come First Serve
2. Shortest Job First
3. Priority Scheduling
4. Round Robin
5. Exit
Enter your choice: 2
Gantt Chart:
| Idle | P3 | P5 | P1 | P2 | P4 |
0 2 6.0 11.0 19.0 29.0 41.0
Process Arrival Burst Priority Completion Turnaround Waiting
P3 2 4 4 6.00 4.00 0.00
P4 3 12 5 41.00 38.00 26.00
P5 4 5 2 11.00 7.00 2.00
P1 4 8 0 19.00 15.00 7.00
P2 5 10 1 29.00 24.00 14.00
Average Turnaround Time: 17.60
Average Waiting Time: 9.80
**********Menu**********
1. First Come First Serve
CurrentTime = P[index].AT;
printf("\t%s\t|", P[index].pname);


Activities
Terminal
Mar 4 1:29 PM
pccoe@pccoe: ~/122B1B258
2. Shortest Job First
3. Priority Scheduling
4. Round Robin
5. Exit
Enter your choice: 3
Gantt Chart:
| Idle | P3 | P1 | P2 | P5 | P4 |
0 2 6.0 14.0 24.0 29.0 41.0
Process Arrival Burst Priority Completion Turnaround Waiting
P3 2 4 4 6.00 4.00 0.00
P4 3 12 5 41.00 38.00 26.00
P5 4 5 2 29.00 25.00 20.00
P1 4 8 0 14.00 10.00 2.00
P2 5 10 1 24.00 19.00 9.00
Average Turnaround Time: 19.20
Average Waiting Time: 11.40
**********Menu**********
1. First Come First Serve
2. Shortest Job First
3. Priority Scheduling
4. Round Robin
5. Exit
Enter your choice: 4
Enter the time quantum: 3
Gantt Chart:
| IDLE | IDLE | P3 | P4 | P5 | P1 | P2 | P3 | P4 | P5 | P1 | P2 | P4 | P1 | P2 | P4 | P2 |
Process Arrival Burst Priority Completion Turnaround Waiting
P3 2 4 4 18.00 16.00 12.00
P4 3 12 5 40.00 37.00 25.00
P5 4 5 2 23.00 19.00 14.00
CurrentTime = P[index].AT;
}
printf("\t%s\t|", P[index].pname);


Activities
Terminal
Mar 4 1:30 PM
pccoe@pccoe: ~/122B1B258
0 2 6.0 14.0 24.0 29.0 41.0
Process Arrival Burst Priority Completion Turnaround Waiting
P3 2 4 4 6.00 4.00 0.00
P4 3 12 5 41.00 38.00 26.00
P5 4 5 2 29.00 25.00 20.00
P1 4 8 0 14.00 10.00 2.00
P2 5 10 1 24.00 19.00 9.00
Average Turnaround Time: 19.20
Average Waiting Time: 11.40
**********Menu**********
1. First Come First Serve
2. Shortest Job First
3. Priority Scheduling
4. Round Robin
5. Exit
Enter your choice: 4
Enter the time quantum: 3
Gantt Chart:
| IDLE | IDLE | P3 | P4 | P5 | P1 | P2 | P3 | P4 | P5 | P1 | P2 | P4 | P1 | P2 | P4 | P2 |
Process Arrival Burst Priority Completion Turnaround Waiting
P3 2 4 4 18.00 16.00 12.00
P4 3 12 5 40.00 37.00 25.00
P5 4 5 2 23.00 19.00 14.00
P1 4 8 0 34.00 30.00 22.00
P2 5 10 1 41.00 36.00 26.00
Average Turnaround Time: 27.60
Average Waiting Time: 19.80
**********Menu**********
1. First Come First Serve
2. Shortest Job First
3. Priority Scheduling
4. Round Robin
5. Exit
Enter your choice: 5
(base) pccoe@pccoe:~/122B1B258$