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Assignment Title: Implement following process scheduling algorithms: FCFS , SJF (Preemptive), Priority (Non-Preemptive).

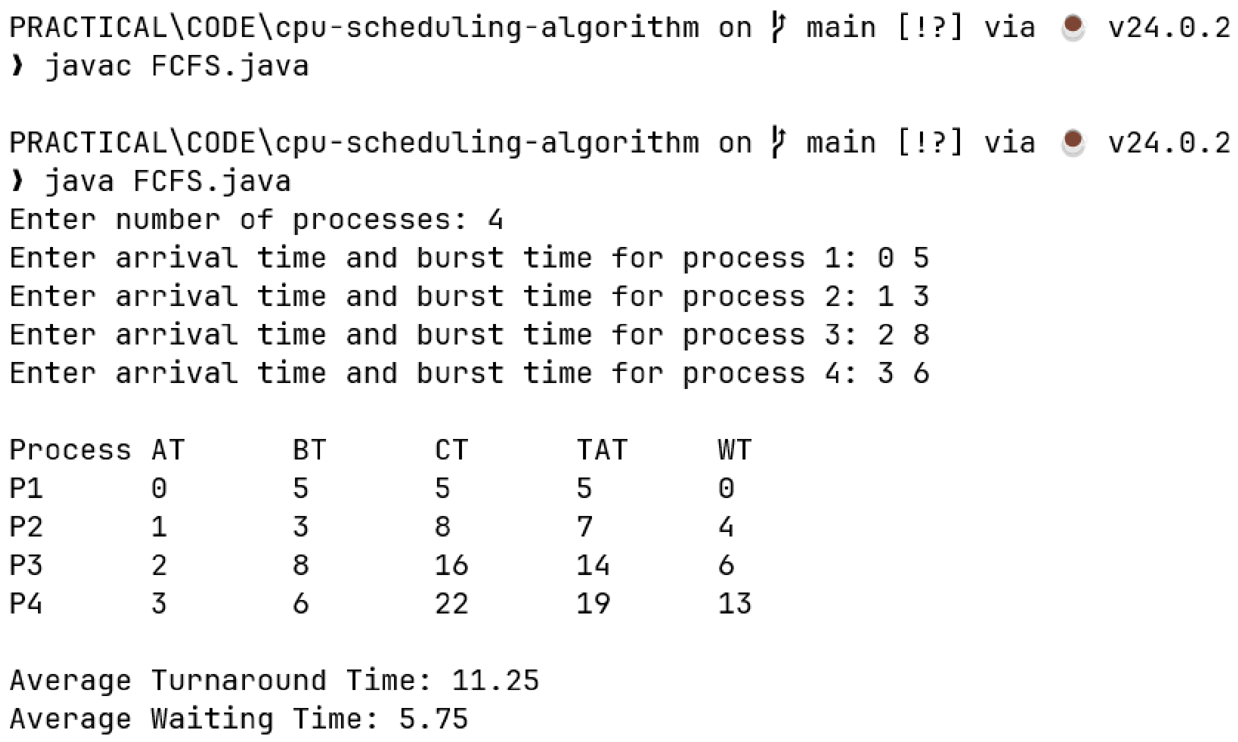
Problem Statement: Write a Java program (using OOP features) to implement following scheduling algorithms: FCFS, SJF (Preemptive), Priority (Non-Preemptive).

FCFS

CODE:

```
import java.util.*;

class Process {
    int processId;
    int arrivalTime;
    int burstTime;
    int completionTime;
    int turnaroundTime;
    int waitingTime;

    public Process(int processId, int arrivalTime, int burstTime) {
        this.processId = processId;
        this.arrivalTime = arrivalTime;
        this.burstTime = burstTime;
    }
}

public class Fcfs {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print("Enter number of processes: ");
        int n = sc.nextInt();
        List<Process> processes = new ArrayList<>();

        for (int i = 0; i < n; i++) {
            System.out.print("Enter arrival time and burst time for process " + (i + 1) + ": ");
            int arrival = sc.nextInt();
            int burst = sc.nextInt();
            processes.add(new Process(i + 1, arrival, burst));
        }

        processes.sort(Comparator.comparingInt(p -> p.arrivalTime));

        int currentTime = 0;
        double totalTAT = 0;
        double totalWT = 0;

        // Calculate times
        for (Process p : processes) {
            if (currentTime < p.arrivalTime) {
                currentTime = p.arrivalTime;
            }

            p.completionTime = currentTime + p.burstTime;
            p.turnaroundTime = p.completionTime - p.arrivalTime;
            p.waitingTime = p.turnaroundTime - p.burstTime;

            currentTime = p.completionTime;

            totalTAT += p.turnaroundTime;
            totalWT += p.waitingTime;
        }

        System.out.println("\nProcess\tAT\tBT\tCT\tTAT\tWT");
        for (Process p : processes) {
            System.out.println("P" + p.processId + "\t" +
                    p.arrivalTime + "\t" +
                    p.burstTime + "\t" +
                    p.completionTime + "\t" +
                    p.turnaroundTime + "\t" +
                    p.waitingTime);
        }
        double avgTAT = totalTAT / n;
        double avgWT = totalWT / n;

        System.out.printf("\nAverage Turnaround Time: %.2f\n", avgTAT);
        System.out.printf("Average Waiting Time: %.2f\n", avgWT);
    }
}
```

OUTPUT:



```
PRACTICAL\CODE\cpu-scheduling-algorithm on  main [!?] via ☕ v24.0.2
❯ javac FCFS.java

PRACTICAL\CODE\cpu-scheduling-algorithm on  main [!?] via ☕ v24.0.2
❯ java FCFS.java
Enter number of processes: 4
Enter arrival time and burst time for process 1: 0 5
Enter arrival time and burst time for process 2: 1 3
Enter arrival time and burst time for process 3: 2 8
Enter arrival time and burst time for process 4: 3 6

Process AT      BT      CT      TAT     WT
P1      0       5       5       5       0
P2      1       3       8       7       4
P3      2       8       16      14      6
P4      3       6       22      19      13

Average Turnaround Time: 11.25
Average Waiting Time: 5.75
```

SJF(Preemptive)

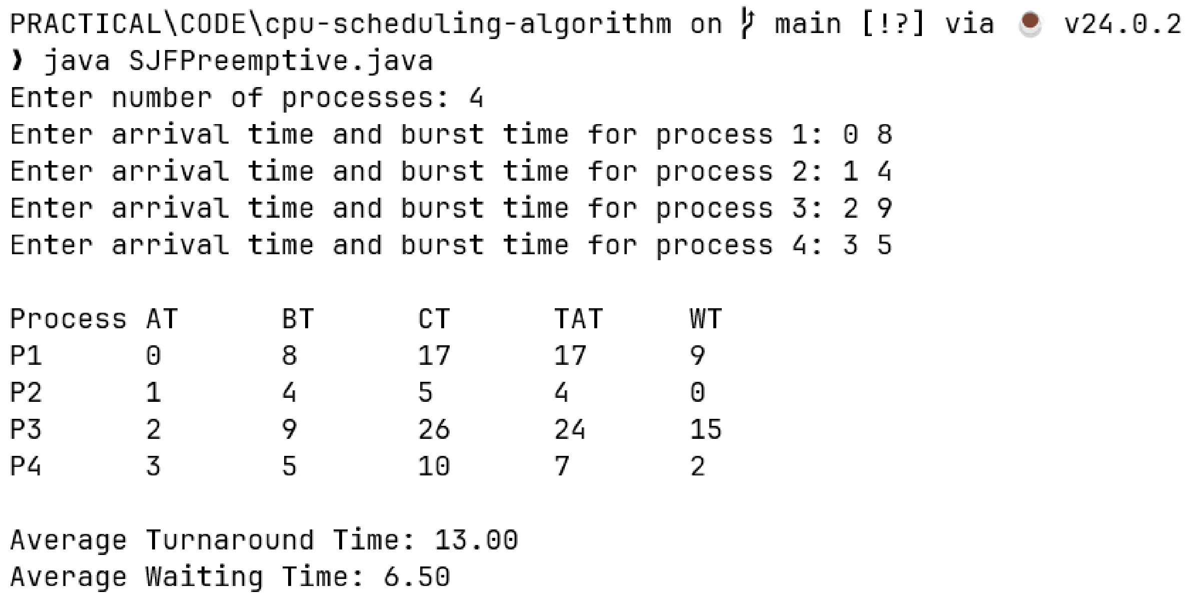
CODE:

```
import java.util.*;

class Process {
    int processId;
    int arrivalTime;
    int burstTime;
    int remainingTime;
    int completionTime;
    int turnaroundTime;
    int waitingTime;
    boolean isCompleted;

    public Process(int processId, int arrivalTime, int burstTime) {
        this.processId = processId;
        this.arrivalTime = arrivalTime;
        this.burstTime = burstTime;
        this.remainingTime = burstTime;
        this.isCompleted = false;
    }
}

public class SJFPreemptive {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print("Enter number of processes: ");
        int n = sc.nextInt();
        List<Process> processes = new ArrayList<>();
```

```
for (int i = 0; i < n; i++) {
    System.out.print("Enter arrival time and burst time for process " + (i + 1) + ": ");
    int at = sc.nextInt();
    int bt = sc.nextInt();
    processes.add(new Process(i + 1, at, bt));
}

int currentTime = 0;
int completed = 0;
double totalTAT = 0;
double totalWT = 0;

while (completed < n) {
    Process shortest = null;

    for (Process p : processes) {
        if (p.arrivalTime <= currentTime && !p.isCompleted && p.remainingTime > 0) {
            if (shortest == null || p.remainingTime < shortest.remainingTime) {
                shortest = p;
            }
        }
    }

    if (shortest != null) {
        shortest.remainingTime--;
        currentTime++;

        if (shortest.remainingTime == 0) {
            shortest.isCompleted = true;
            shortest.completionTime = currentTime;
            shortest.turnaroundTime = shortest.completionTime - shortest.arrivalTime;
            shortest.waitingTime = shortest.turnaroundTime - shortest.burstTime;

            totalTAT += shortest.turnaroundTime;
            totalWT += shortest.waitingTime;
            completed++;
        }
    } else {
        currentTime++;
    }
}

System.out.println("\nProcess\tAT\tBT\tCT\tTAT\tWT");
for (Process p : processes) {
    System.out.println("P" + p.processId + "\t" +
            p.arrivalTime + "\t" +
            p.burstTime + "\t" +
            p.completionTime + "\t" +
            p.turnaroundTime + "\t" +
            p.waitingTime);
}

System.out.printf("\nAverage Turnaround Time: %.2f\n", totalTAT / n);
System.out.printf("Average Waiting Time: %.2f\n", totalWT / n);
```

```
    }
}
```

OUTPUT:



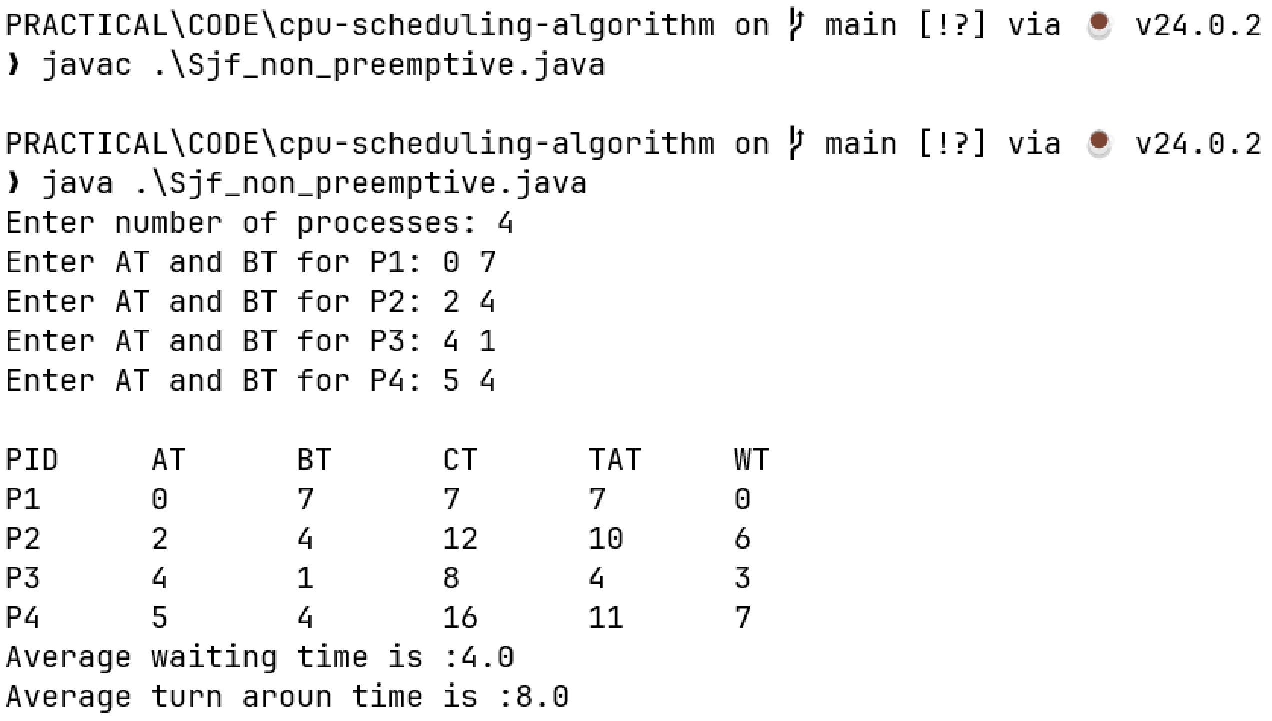
```
PRACTICAL\CODE\cpu-scheduling-algorithm on  main [!?] via ● v24.0.2
❯ java SJFPreemptive.java
Enter number of processes: 4
Enter arrival time and burst time for process 1: 0 8
Enter arrival time and burst time for process 2: 1 4
Enter arrival time and burst time for process 3: 2 9
Enter arrival time and burst time for process 4: 3 5

Process AT      BT      CT      TAT     WT
P1      0       8       17      17      9
P2      1       4       5       4       0
P3      2       9       26      24      15
P4      3       5       10      7       2

Average Turnaround Time: 13.00
Average Waiting Time: 6.50
```

Priority (Non-Preemptive)

CODE:

```
import java.util.*;

class Process {
    int pid, at, bt, ct, tat, wt;
    boolean completed = false;

    Process(int pid, int at, int bt) {
        this.pid = pid;
        this.at = at;
        this.bt = bt;
    }
}

public class Sjf_non_preemptive {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("Enter number of processes: ");
        int n = sc.nextInt();
        double twt=0;
        double ttat=0;

        List<Process> list = new ArrayList<>();
        for (int i = 0; i < n; i++) {
            System.out.print("Enter AT and BT for P" + (i + 1) + ": ");
            list.add(new Process(i + 1, sc.nextInt(), sc.nextInt()));
        }
        int time = 0, completed = 0;
        while (completed < n) {
            Process shortest = null;

            for (Process p : list) {
                if (!p.completed && p.at <= time) {
                    if (shortest == null || p.bt < shortest.bt)
                        shortest = p;
                }
            }

            if (shortest == null) {
                time++;
            } else {
                shortest.ct = time + shortest.bt;
                shortest.tat = shortest.ct - shortest.at;
                shortest.wt = shortest.tat - shortest.bt;
                shortest.completed = true;
                time = shortest.ct;
                completed++;
                twt=twt+shortest.wt;
                ttat=ttat+shortest.tat;
            }
        }

        System.out.println("\nPID\tAT\tBT\tCT\tTAT\tWT");
        for (Process p : list)
            System.out.println("P" + p.pid + "\t" + p.at + "\t" + p.bt + "\t" + p.ct + "\t" + p.tat + "\t" + p.wt);
        System.out.println("Average waiting time is :"+(twt/n));
        System.out.println("Average turn aroun time is :"+(ttat/n));
    }
}
```

OUTPUT:



```
PRACTICAL\CODE\cpu-scheduling-algorithm on main [!?] via v24.0.2
❯ javac .\Sjf_non_preemptive.java

PRACTICAL\CODE\cpu-scheduling-algorithm on main [!?] via v24.0.2
❯ java .\Sjf_non_preemptive.java
Enter number of processes: 4
Enter AT and BT for P1: 0 7
Enter AT and BT for P2: 2 4
Enter AT and BT for P3: 4 1
Enter AT and BT for P4: 5 4

PID     AT      BT      CT      TAT     WT
P1      0       7       7       7       0
P2      2       4       12      10      6
P3      4       1       8       4       3
P4      5       4       16      11      7
Average waiting time is :4.0
Average turn aroun time is :8.0
```