UNIVERSITY OF GHANA

SCHOOL OF ENGINEERING SCIENCES

COLLEGE OF BASIC AND APPLIED SCIENCES

DEPARTMENT OF COMPUTER ENGINEERING

FIRST SEMESTER 2023/2024 ACADEMIC YEAR

COURSE CODE: CPEN 307 - OPERATING SYSTEMS

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LAB: 3

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DATE: November 28, 2023

IMPLEMENTING PROCESS SCHEDULING ALGORITHMS

ABSTRACT

This lab focused on the implementation and evaluation of three process scheduling algorithms: First Come First Serve (FCFS), Non-preemptive Shortest Job Next (SJN), and Preemptive Shortest Job Next (PSJN). The primary objective was to develop classes for each algorithm, allowing user input for CPU burst times and arrival times, and assessing performance metrics such as average waiting and turnaround times. An additional challenge was to create a Ghantt Chart representation of the scheduling results.

INTRODUCTION

Process scheduling is a fundamental aspect of operating systems, playing a crucial role in orchestrating the execution sequence of various processes. This laboratory exercise is designed to delve into the implementation of three distinctive scheduling algorithms, each offering unique characteristics. The First-Come-First-Serve (FCFS) algorithm arranges processes in the order of their arrival, the Shortest Job Next (SJN) prioritizes the execution of the shortest jobs, and the Preemptive Shortest Job Next (PSJN) is a preemptive variant of SJN. Through this exploration, we aim to gain insights into the diverse strategies employed in managing the execution flow of processes within an operating system.

METHODOLOGY OR IMPLEMENTATION STEPS

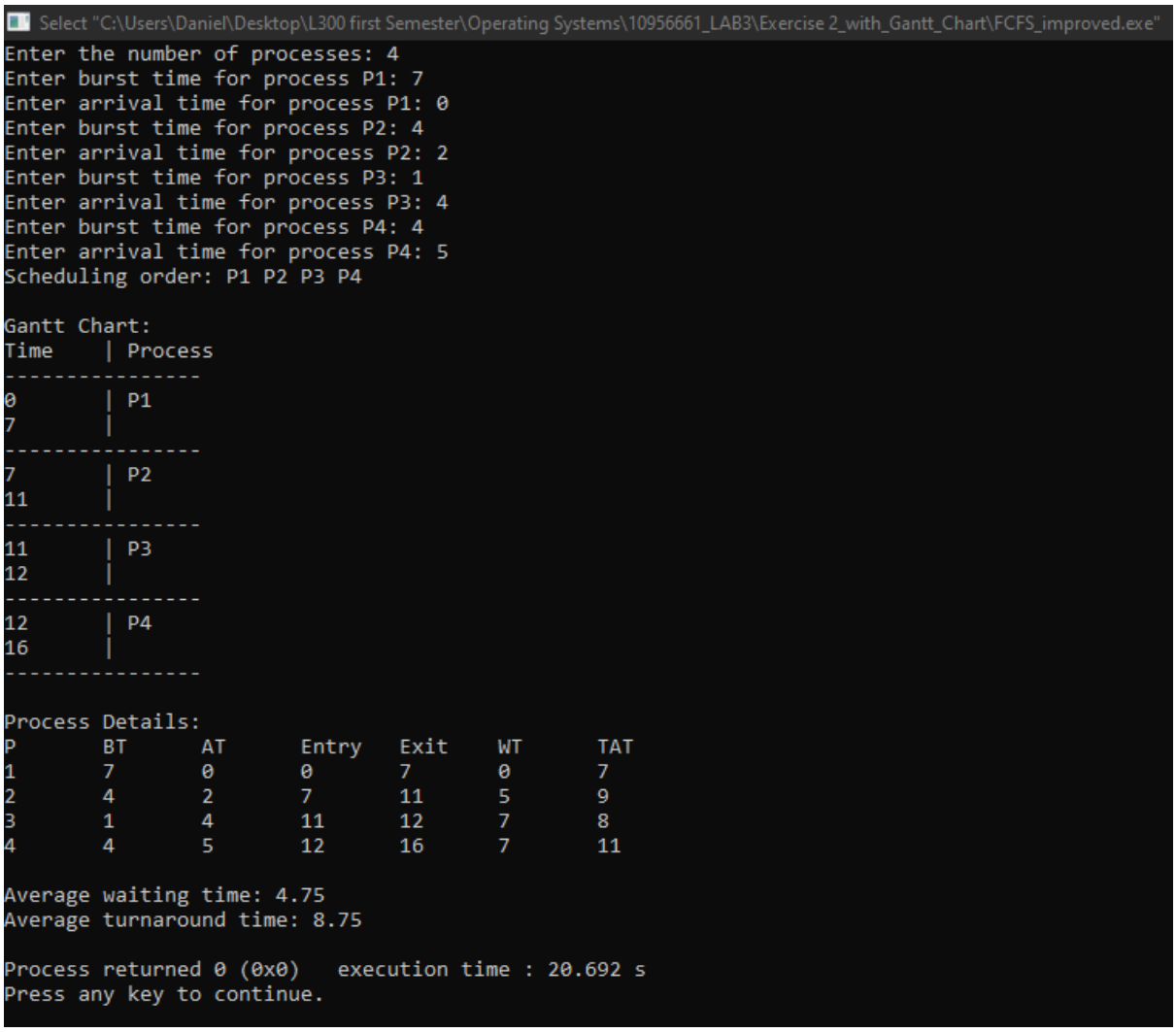
1. **Class Design:**
    - Created three classes: `FCFS`, `SJN`, and `PSJN`.
    - Each class incorporated functions for scheduling, calculating average waiting time, and computing average turnaround time.
2. **User Interaction:**
    - Solicited user input for the number of processes, CPU burst times, and arrival times.
    - Ensured flexibility by accommodating processes with different or identical arrival times.
3. **Algorithm Implementation:**
    - **FCFS:**
        - Ordered processes based on arrival times.
        - Calculated average waiting time and average turnaround time.
    - **SJN:**
        - Implemented non-preemptive shortest job next scheduling.
        - Computed average waiting time and average turnaround time.
    - **PSJN:**
        - Implemented preemptive shortest job next scheduling.
        - Determined average waiting time and average turnaround time.
4. **Performance Evaluation:**
    - Assessed the strengths and weaknesses of each algorithm based on their average waiting and turnaround times.
    - Considered scenarios where one algorithm outperformed others and potential drawbacks.

5. **Ghantt Chart Representation:**
    - Developed a Ghantt Chart to visually represent the scheduling order, time of entry, and time of exit for each process in each algorithm.

RESULTS AND DISCUSSION

- **Ghantt Chart:**
- For each scheduling algorithm, a Gantt Chart has been meticulously generated to visually represent the chronological sequence of processes, highlighting their respective entry and exit times.

- **FIRST COME FIRST SERVE(FCFS)**
- The FCFS algorithm, epitomizing simplicity, exhibits a scheduling order that strictly adheres to the arrival time of processes. Average waiting and turnaround times are computed to assess overall performance.
    - Displayed scheduling order and calculated average times.

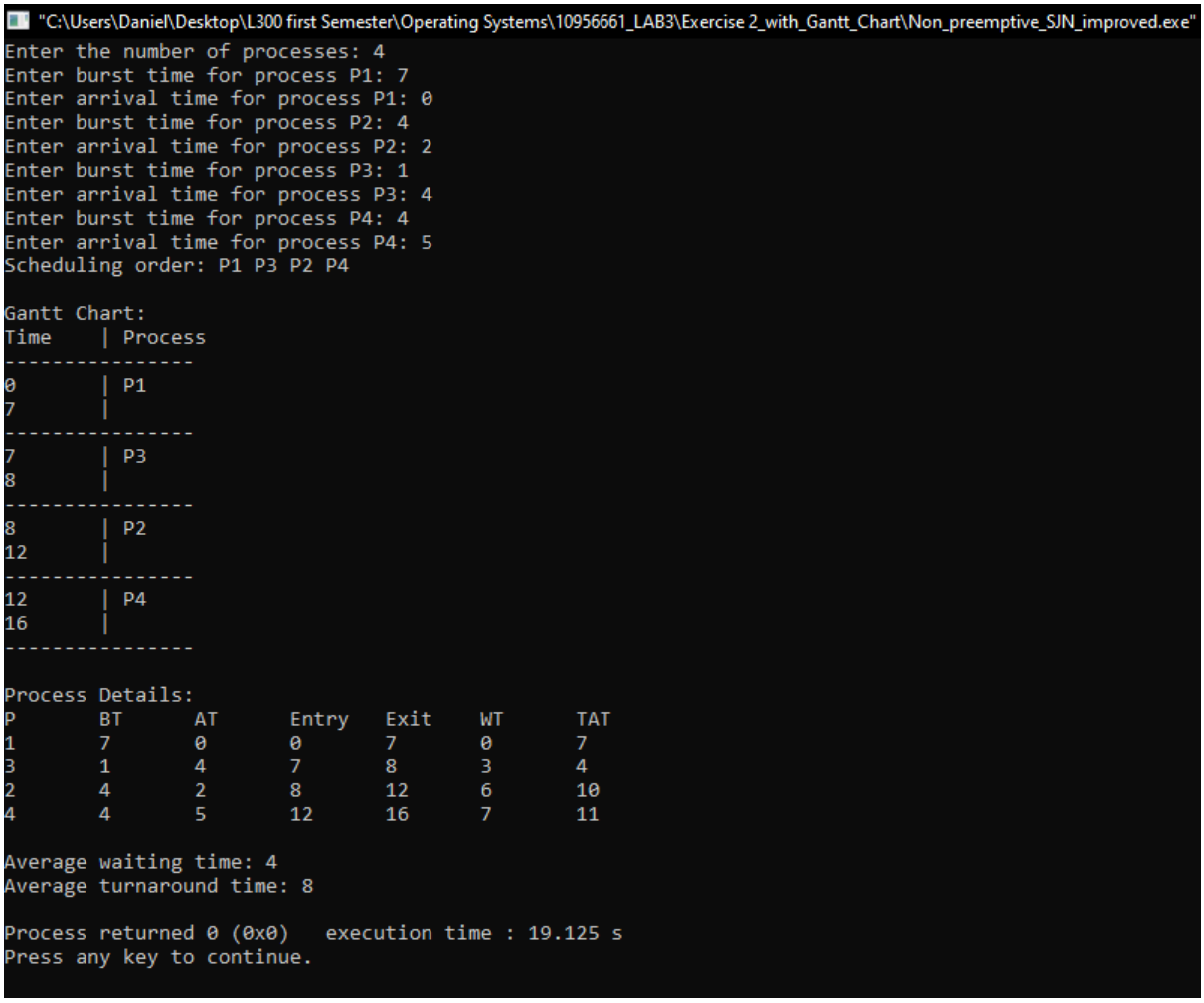


- Strengths: Simplicity.
- Weaknesses: Convoy effect leading to potential inefficiencies.

- **NON-PREEMPTIVE SHORTEST JOB NEXT (SJN)**

  The SJN algorithm, characterized by its focus on executing the shortest jobs first, is expounded through a detailed scheduling order and comprehensive average performance metrics.

  - Showed scheduling order and average metrics.

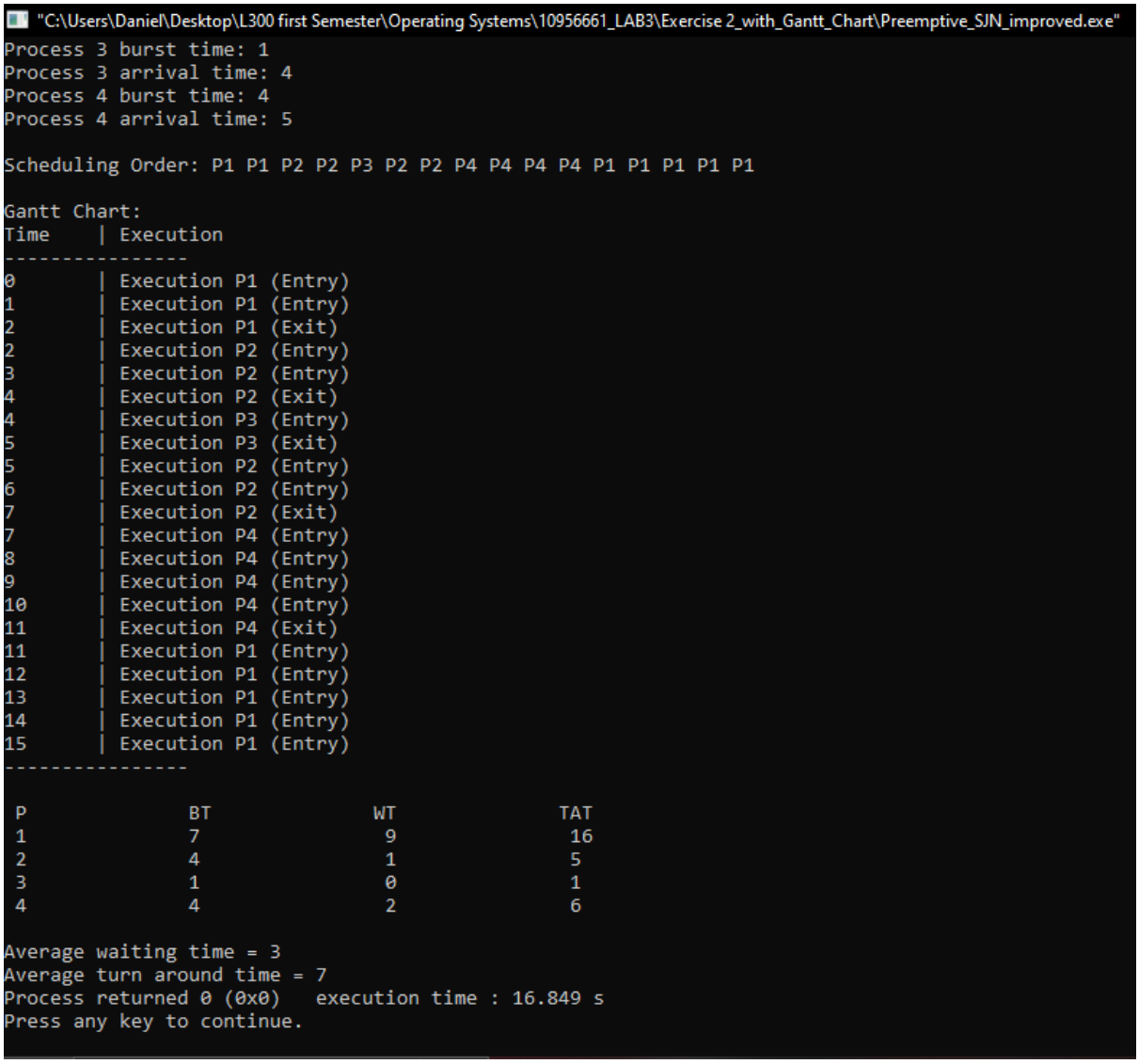


  - Strengths: Minimizes waiting time.
  - Weaknesses: Possibility of starvation for longer processes.

- **PREEMPTIVE SHORTEST JOB NEXT (PSJN)**

The PSJN algorithm seamlessly integrates the efficiency of SJN with preemptive capabilities, offering adaptability in a dynamic environment. The scheduling order is presented alongside average performance results.

- Display of scheduling order and average results.



- Strengths: Incorporates SJN with preemptive capabilities.
- Weaknesses: Introduces complexity and potential overhead.

CONCLUSION

This lab offered a comprehensive exploration of process scheduling algorithms, combining theoretical understanding with practical implementation. The results and discussions highlighted the nuances of FCFS, SJN, and PSJN, providing insights into their suitability for different scenarios. The Ghantt Chart visualization added a valuable dimension to the analysis, offering a clear representation of the scheduling order and process timelines.