CSE321 Theory Assignment 01

Research and **Explore** the CPU allocation fairness issues of Multi-Level Feedback Queue (MLFQ) CPU Scheduling Algorithm by analyzing the following key areas:

- Unfair CPU Allocation due to I/O-Bound Processes
- Quantitative Fairness Evaluation

Report Requirements:

Write a comprehensive analysis focusing on the following two key factors:

Unfair CPU Allocation due to I/O-Bound Processes:

- Describe how MLFQ scheduling dynamically adjusts process priorities based on CPU bursts and I/O wait times.
- Explain why I/O-bound processes tend to monopolize higher-priority queues while CPU-bound processes are often demoted to lower levels.
- Discuss how this imbalance can lead to **starvation** or **unfair CPU allocation** among processes.
- Evaluate possible fairness-improving mechanisms such as **aging**, **priority boosting**, or **time quantum adjustments** with examples.

Quantitative Fairness Evaluation:

- Define and explain the concept of **fairness** in CPU scheduling and its importance in multi-queue systems.
- Introduce a quantitative fairness metric, such as the **Fairness Index.**

$$Fairness\ Index\ =\ (\ (\Sigma\ T_i)^2\ )\ /\ (\ n \times \Sigma\ T_i^{\ 2}\ )$$

Here T_i represents the CPU time allocated to process i.

- Demonstrate how to evaluate fairness by applying this metric to a sample MLFQ workload (e.g., mix of short I/O-bound and long CPU-bound jobs).

- Analyze how changing the number of queues, quantum lengths, or aging intervals affects fairness scores and overall CPU distribution.

Submission guidelines: Can be found in the submission form given below.

Submission link

Deadline: ***13 November, 11:00 PM***

(Submissions outside the Google Form will be automatically rejected.)