CSEN 383 – Advanced Operating Systems
Project 3

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REPORT

Introduction:

The provided code simulates a scenario where concert tickets are sold simultaneously by multiple ticket sellers over a period of one hour. The simulation aims to mimic a realistic ticket selling environment, considering factors like customer arrivals, seller efficiency, and seat availability.

It begins by including necessary header files and defining constants such as the number of ticket sellers for different priority levels, the seating arrangement dimensions, and the simulation duration. Two structures are defined: `seller_struct` to represent ticket sellers and `customer_struct` to represent customers, each with relevant attributes. Global variables include `simulation_time` to track the current time, `N` for the number of customers per seller type, and `seat_alignment` to represent the concert seating. Mutex and condition variables are declared for thread synchronization. In the `main` function, command-line arguments are parsed to set the number of customers per seller type, and threads are created for each type of ticket seller. Threads are synchronized before starting the simulation. During simulation, each time slice is simulated by waking up seller threads at each tick until the simulation duration is reached. Finally, statistics such as customer counts, response times, and throughput are displayed. The code employs various functions to manage thread creation, queue operations, customer generation, and statistical calculations. Process synchronization mechanisms like mutex locks and condition variables ensure thread safety and data integrity, critical for a realistic simulation.

Adjustments for Realistic Simulation:

Several parameters were adjusted to make the simulation more realistic:
1. Simulation Duration: The duration of the simulation was set to one hour, reflecting the typical runtime of events like concerts.
2. Number of Sellers: Different types of ticket sellers (High, Medium, Low) were introduced in varying quantities to simulate the diversity in ticket selling capacities.
3. Customer Arrival Time: Customers arrive randomly within the simulation duration, emulating real-world scenarios where arrivals are not evenly distributed.

4. Seller Efficiency: Each type of seller (High, Medium, Low) has a different random wait time before serving the next customer, simulating variations in seller speed.
5. Seat Availability: The simulation checks for seat availability based on the seller type, considering factors like seat distribution within the venue.

Shared Data and Critical Regions:

Shared data includes the customer queues, seller queues, seat alignment matrix, and simulation time. Critical regions are areas of the code where shared data is accessed or modified, requiring synchronization to prevent race conditions. Critical regions include:
- Accessing and updating customer and seller queues to ensure thread safety.
- Modifying the seat alignment matrix to assign seats to customers without conflicts.
- Updating simulation time and coordinating clock ticks to synchronize thread activities.

Process Synchronization:

Process synchronization was achieved using mutex locks and condition variables to coordinate thread activities and prevent data races. Specifically:
- Mutex locks were used to control access to shared data structures like queues and the seat alignment matrix.
- Condition variables were employed to signal clock ticks and coordinate thread synchronization, ensuring that all threads proceed together in each time slice.
- Critical regions were protected using mutex locks to prevent multiple threads from accessing shared data simultaneously, ensuring data consistency and integrity.

Conclusion:

The software design effectively simulates a realistic ticket selling scenario by adjusting parameters, managing shared data, and implementing process synchronization techniques. Through careful design and synchronization, the simulation accurately models the dynamics of ticket selling operations, providing insights into customer response times, seller efficiency, and overall throughput.