

CSEN 383: Advanced Operating Systems

Group 3 Project 3 Report

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Objective: Write a multithreaded program that simulates ticket sellers simultaneously selling concert tickets during one hour.

Software Design: Our software design is a multi-threaded time-simulation. It has a main function that acts as a global clock and ten threads, each representing a ticket seller. The simulation occurs in one-minute intervals, where the main function synchronizes the ten threads using a condition variable. At the beginning of each minute, the function sends a signal to wake up all sellers so that they can sell their tickets for that minute. Each thread waits for the signal and checks its queue for customers whose arrival time matches the current simulation time. It serves the first customer and decreases the remaining service time. It gets a lock on the seats matrix, finds and reserves a seat, updates the matrix, and finally releases the lock.

- Parameter Adjustments: A parameter that was changed was N, the number of customers per seller. We ran simulations for N=5, N=10, and N=15. We had other parameters that we didn't need to adjust, since they remained the same for each simulation. These key parameters were total simulation time (fixed at 60 minutes), number of sellers (1 for high sellers, 3 for medium sellers, and 6 for low sellers), and service time (implemented as a random value within a specific range depending on the seller type).
- Data Shared & Critical Regions: The seats matrix was shared among the threads. This matrix represented the concert seating chart. All of the threads needed to read it to find empty seats and write to it to reserve them. The current time slice, which represented the simulation clock, was also shared and read by the threads to let them know if a customer arrived. Another shared data was the global statistical counters (response time and turn around time). These counters were updated by the threads. A critical region was when the threads needed to find an available seat to reserve for the customer. This region required threads to read the seats matrix and then write the customer ID to it. Another critical region was the global statistical counters.
- Process Synchronization: One process synchronization was the mutex used for the seats matrix. This lock guaranteed mutual exclusion so that only one thread could access the seating chart at any point in time. This ensured that no two sellers could assign the same seat to two different customers. Another process synchronization was the condition variable used to synchronize the simulation's clock. All of the threads waited on the condition variable until the main function signaled to them to continue. This process synchronization made sure that all sellers moved on to the next minute together at the same time.

Output: Below we attached individual outputs for each N value.

- N = 5:

Final Concert Seat Chart

H101	H102	H103	H104	H105	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
M201	M202	M301	M203	M204	M302	M101	M205	M102	M103	
M104	M303	M304	M105	M305	-	-	-	-	-	
-	-	L605	L105	L405	L305	L104	L203	L304	L604	
L404	L505	L303	L202	L403	L603	L504	L302	L402	L201	
L401	L503	L103	L102	L502	L602	L301	L601	L501	L101	

Multi-threaded Ticket Sellers

Input N = 05

	No of Customers	GotSeat	TurnAway	Throughput	
H	5	5	0	0.08	
M	15	15	0	0.25	
L	30	28	2	0.47	

	Avg Response Time	Avg Turnaround Time	
H	0.000000	32.60	
M	0.666667	29.13	
L	0.533333	30.47	

- N = 10:

- N = 15:

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Final Concert Seat Chart
*****
H101 H102 H103 H104 H105 H106 H107 H108 H109 H110
H111 H112 H113 H114 H115 M312 M212 L109 L309 L408
M110 M311 M111 M211 M112 L607 L208 L508 L108 L308
M309 M209 M109 M310 M210 L606 L507 L207 L407 L605
M107 M208 M108 M308 L107 L307 L406 L506 L206 L604
M101 M301 M201 M302 M102 M202 M303 M103 M104 M203
M105 M204 M106 M304 M205 M305 M206 M306 M207 M307
L306 L405 L106 L205 L505 L305 L603 L404 L204 L304
L105 L504 L602 L403 L203 L303 L104 L601 L503 L103
L402 L302 L202 L102 L502 L401 L301 L201 L101 L501

*****  

Multi-threaded Ticket Sellers  

Input N = 15  

*****  

-----| No of Customers | GotSeat | TurnAway | Throughput |  

-----| H | 15 | 15 | 0 | 0.25 |  

-----| M | 45 | 36 | 9 | 0.60 |  

-----| L | 90 | 49 | 41 | 0.82 |  

-----| Avg Response Time | Avg Turnaround Time |  

-----| H | 0.800000 | 26.80 |  

-----| M | 4.422222 | 26.76 |  

-----| L | 6.788889 | 18.14 |  

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