

Operating system

SEMESTER PROJECT

***FAST-NUCES***



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**Introduction:**

The objective of this project is to develop a multi-threaded program in C that implements the producer-consumer problem (efficiently finds prime numbers in a large 2D array) using pthreads and semaphores. The program will simulate a scenario where multiple producer and consumer threads interact with a shared buffer, demonstrating synchronization and mutual exclusion to prevent race conditions.

**Objectives:**

* Implement a multi-threaded program in C to solve the producer-consumer problem.
* Utilize pthreads library for thread creation and management.
* Employ semaphores to control access to shared resources and ensure proper synchronization between producer and consumer threads.
* Evaluate the performance and scalability of the program with different numbers of producer and consumer threads.

**Methodology:** The project will follow these key steps:

* Designing the program architecture to facilitate the interaction between producer and consumer threads.
* Implementing producer and consumer functions to generate and consume data, respectively.
* Integrating pthreads library to create and manage multiple threads efficiently.
* Using semaphores to coordinate access to the shared buffer, ensuring mutual exclusion and preventing race conditions.
* Testing the program with various configurations of producer and consumer threads to assess its performance and scalability.
* Analyzing the results to identify potential bottlenecks and optimizations for improving program efficiency.

**Expected Outcomes:**

* Development of a robust multi-threaded program in C that effectively solves the producer-consumer problem.
* Evaluation of the program's performance in terms of throughput, latency, and scalability with different thread configurations.
* Identification of best practices and strategies for implementing synchronization mechanisms in multi-threaded programs

**Resources:**

* C programming language
* pthreads library for multi-threading
* Semaphores for synchronization
* Development environment (e.g., Linux)
* Performance monitoring tools (e.g., time command for execution time measurement)

**Conclusion:**

This project aims to demonstrate the principles of concurrent programming and synchronization using the producer-consumer problem as a case study. By implementing a multi-threaded solution in C, we will explore the challenges and techniques involved in designing efficient and scalable concurrent programs.