

The Dining Philosophers Problem

Overview of the Solution:

In our solution, chopsticks are modeled by mutexes and philosophers are represented by POSIX Threads (Pthreads). For every philosopher, a thread is made that performs a sequence of routines that mimics thinking, reaching for food (picking up chopsticks), eating, and finally putting down the chopsticks.

Implementation

Thread Management:

A pthread represents each philosopher. These threads perform a routine that mimics the movements associated with thinking, picking up chopsticks, eating, and putting down chopsticks.

Synchronization Mechanism:

Mutexes stand for chopsticks. A philosopher can pick up a chopstick and unlock a mutex by putting it down. The chopsticks are only accessible through this mechanism.

```
void pickup_chopsticks(int id) {  
    ...  
}  
void return_chopsticks(int id) {  
    ...  
}
```

Random Time Generation:

We generated random time intervals for eating and thinking using exponential and uniform distributions. The unpredictability of these acts is simulated by this randomness.

```
double generate_random_time(int min_time, int max_time) {  
    ...  
}
```

Hunger Duration Measurement

Data Collection:

By timing each philosopher's attempt to pick up chopsticks and their successful start of eating, the length of time they are hungry is determined.

```
void pickup_chopsticks(int id) {  
    ...  
}  
void return_chopsticks(int id) {  
    ...  
}
```

Average and Standart Deviation Calculation:

Using the recorded durations, we compute the average hungry duration and its standard deviation for each philosopher.

```
void calculate_statistics() {  
    ...  
}
```

```
Philosopher 0 total hungry duration: 8570.94 ms  
Philosopher 0 - Average Hungry Time: 85.709382 ms, Standard Deviation: 24.495202 ms  
Philosopher 1 total hungry duration: 8803.00 ms  
Philosopher 1 - Average Hungry Time: 88.029974 ms, Standard Deviation: 24.549275 ms  
Philosopher 2 total hungry duration: 9067.00 ms  
Philosopher 2 - Average Hungry Time: 90.670045 ms, Standard Deviation: 28.647635 ms  
Philosopher 3 total hungry duration: 8851.79 ms  
Philosopher 3 - Average Hungry Time: 88.517893 ms, Standard Deviation: 25.874186 ms  
Philosopher 4 total hungry duration: 8725.73 ms  
Philosopher 4 - Average Hungry Time: 87.257331 ms, Standard Deviation: 24.866465 ms  
murat@murat-virtual-machine:~$
```

Conclusion

The program exhibits effective resource management and deadlock avoidance during execution. The efficacy of our random time generation and resource allocation strategy is demonstrated by the differences in the average and standard deviation of hungry times amongst philosophers.