**Dining Philosophers Problem Solution**

The Dining Philosophers Problem is a classic synchronization and concurrency problem, where philosophers must coordinate to avoid resource conflicts and deadlocks while thinking and dining. In this report, I will describe the implementation of a deadlock-free solution using Pthreads, mutex, and condition variables, meeting the specified requirements.

The implemented solution involves creating threads to represent philosophers and using mutexes and condition variables to synchronize access to the shared chopsticks. Each philosopher thread goes through a cycle of thinking, attempting to pick up chopsticks, eating, and putting down chopsticks. The randomness of thinking and dining times is achieved through the use of random number generation.

**> Random Value Generation**

Random values for thinking and dining times are generated based on the specified distribution (uniform or exponential). The random\_range function generates uniformly distributed random values between the given minimum and maximum values. For exponential distribution, the inverse transform method is used to generate values following an exponential distribution. If the generated value is not within the specified range, the process is repeated until a valid value is obtained.

**> Measurement of Hungry State Duration**

To measure the duration of the hungry state for each philosopher, timestamps are recorded before and after the philosopher picks up the chopsticks. The difference between these timestamps represents the hungry state duration for that philosopher.

**> Average Hungry State and Standard Deviation**

The average hungry state duration is calculated by summing up the hungry durations of all philosophers and dividing by the total number of philosophers. The standard deviation is then calculated based on these durations.

The implemented solution successfully addresses the Dining Philosophers Problem, providing a deadlock-free solution with maximum concurrency. The use of random value generation ensures variability in thinking and dining times, and the measurement of hungry state duration allows for an analysis of the performance of the solution. The average hungry state duration and standard deviation provide insights into the efficiency and fairness of the proposed solution.