<u>**Modified Dining Philosophers Problem**</u>

The modified dining philosophers problem is simulated with deadlock resolution through following techniques:

1. Strict ordering of resource request (with and without bowl)
    - Resource and primitives used
        - pthread_create() : to create threads for simulating each of the philosophers
        - pthread_join() : to join the threads created to main thread
    - Methodology Used
        - One philosopher is served at a time, and the one with least id is picked first
        - The serving logic goes in round robin fashion from least to highest id, and back again till all the EATING requests from philosophers are served
        - Since we have 2 bowls, so odd number bowl is used to serve philosopher with odd id, and even number bowl for even id philosopher

2. Utilization of semaphores for access to resources (with and without bowl)
    - Resource and primitives used
        - pthread_create() : to create threads for simulating each of the philosophers
        - pthread_join() : to join the threads created to main thread
        - sem_init() : to initialize unnamed semaphore for each of the shared forks and shared bowls(for part (b))
        - sem_wait() : decrements the semaphore and prevents other threads from accessing critical section(forks and bowl) simultaneously
        - sem_post() : increments the semaphore and releases the lock to allow other threads to access the critical section(forks and bowl)
    - Methodology used
        - To avoid deadlock, each philosopher first request fork with least id, and then takes the other fork
        - There is no deadlock due to bowl, but for optimal dining, first bowl is used for philosophers 1 and 2, and second bowl is used for philosophers 3, 4 and 5

Each philosopher is initially in THINKING state and transitions to WAITING state when they wish to eat and need access to 2 forks and a bowl(for part (b)). When a philosopher gains access to 2 forks and 1 bowl(for part (b)), he moves to EATING state and dines in. After he has completed eating, the philosopher moves back to THINKING state, allowing other waiting philosophers to eat.