

## Data Structures Used

- **Map:** To store the room details and guest details.
- **Set:** To store the room number and priority of the guest.
- **Mutex:** To lock the critical section.
- **Semaphore:** To lock the critical section.

## Set Work

- Create a priority queue to store the room number and priority of the guest.
- Sort the priority queue in increasing order of guest priority.
- If the guest priority is 0, the room is empty.
- If the guest priority is greater than 0, the room is occupied.
- A guest thread should check the first element of the priority queue.
- If the priority of the guest is 0 or all rooms are occupied, the thread should check for the guest with the lowest priority.
- If the guest with the lowest priority is found, the coming guest can book that room and the guest with the lowest priority is removed from the set.
- If the guest with the lowest priority is not found, the coming guest should wait for the room to be empty.
- If a room is occupied twice, the room is not inserted into the set.
- When all rooms are occupied twice, the set is empty and the guest thread should wait for the room to be clean.
- When a room is cleaned, the room is inserted into the set with the priority of 0.

## Mutex Work

- **Mutex in Guest thread**
  - Lock the set to check room availability.
- **Mutex in Cleaning thread**
  - Lock the set to check if the room is cleaned.
  - Lock the room size and increase it by 1.
- **Mutex in Print function**
  - Lock the print function to write the output to a file.

## Semaphore Work

- **Semaphore for Guest Thread**
  - Allows all guest threads to request for rooms and sleep in them simultaneously.
- **Semaphore for Cleaning Thread**
  - Allows all cleaning threads to request for rooms and clean them simultaneously.

## Workflow

- Main function initializes the mutex, semaphore, set and map.
- Main function creates the guest and cleaning threads.
- Guest thread checks the set for room availability.
  - If the room is available, the guest thread books the room and sleeps in it.
  - If the room is not available, the guest thread waits for the room to be empty.
- Cleaning thread checks the set for room cleaning.
  - If the room is not cleaned, the cleaning thread cleans the room.
  - If all the rooms are cleaned by the cleaning thread, the cleaning thread waits for the room to be dirty.
- When the guest thread wakes up, it checks the set for room availability.
  - If the room is available, the guest thread books the room and sleeps in it.
  - If the room is not available, the guest thread waits for the room to be empty.