BHARATIYA VIDYA BHAVAN
SARDAR PATEL INSTITUTE OF TECHNOLOGY
(Autonomous Institute Affiliated to University of Mumbai)
MUNSHI NAGAR, ANDHERI (WEST), MUMBAI – 400 058.
Department of Computer Science and Engineering – [MCA]

Class : F.Y.MCA   Semester : II   Academic Year : 2024-25
Course Name : Design and Analysis of Algorithm MC507
Subject Incharge : Prof.Nikhita Mangaonkar

Problem statement

A busy movie theater needs an efficient system to manage seat reservations and show schedules. The theater has multiple auditoriums, and each auditorium has a limited number of seats for every movie showing. Each movie has its own schedule, and the theater needs to manage showtimes, seat availability, and reservations efficiently. The theater staff requires a system that can:

● Allow users to reserve seats for the next available movie show.
● Ensure that the number of reserved seats does not exceed the capacity of the auditorium.
● Allow for flexible rescheduling of shows or seat reservations in case of last-minute changes or technical issues.
● Optimize seat allocation to minimize wasted seats and ensure maximum occupancy of each show.

Problem Constraints

● Each movie is shown in a specific auditorium with a fixed number of seats.
● Each auditorium has a set capacity, which should not be exceeded when making seat reservations.
● Reservations can be made only for available shows, and users can reserve multiple seats for a show.
● Users may cancel or modify their reservations, and the system should be able to reallocate seats accordingly.
● The system needs to allow for rescheduling of shows in case of unforeseen changes, such as technical problems or overbooking.
● The theater operates across multiple auditoriums with different capacities, and movies have specific schedules.
● The theater needs an efficient algorithm to manage seat reservations and show schedules to avoid any overbookings or seat wastage.

Task

1. **Seat Reservation Algorithm:**
   Develop an algorithm to reserve seats for customers. Each reservation should be

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allocated to the next available seat in the desired show while ensuring that the total number of reserved seats does not exceed the auditorium's capacity. The system should allow users to reserve seats for one or more people.

2. **Show Scheduling Algorithm:**
   Develop an algorithm to schedule movies across multiple auditoriums. Each movie should be assigned to the next available time slot, ensuring that there is no scheduling conflict in the same auditorium. The system should also consider customer demand when scheduling popular movies.

3. **Emergency Rescheduling Algorithm:**
   Develop an algorithm to handle emergencies, such as technical issues or overbookings. In these cases, the system should be able to reschedule a show to another time slot or auditorium while minimizing disruption to customers. If a show is canceled, customers with reservations should be notified and given the option to reschedule.

4. **Seat Allocation Optimization:**
   Develop an algorithm to optimize seat allocation and ensure that as many seats as possible are filled for each show. The system should minimize wasted seats and avoid overbooking. For example, the system could prioritize filling seats in the middle of the auditorium to improve the customer experience.

Challenges

- **Handling Emergency Situations:** Rescheduling a show or reallocating seats in case of last-minute changes while minimizing disruption to customers.
- **Efficient Seat Allocation:** Ensuring that seats are allocated efficiently across multiple shows and auditoriums, preventing empty seats and overbookings.
- **Time Complexity:** The system should be able to handle a large number of reservations, especially during peak times like weekends or holidays, without significant delays.
- **Multiple Audiences:** Managing reservations and scheduling for multiple auditoriums, each with different seat capacities and schedules.

The solution to this problem can be approached using strategies such as greedy algorithms, dynamic programming, and priority scheduling, with the goal of improving resource utilization and ensuring a smooth customer experience at the movie theater.