Bahria University
Discovering Knowledge

ASSIGNMENT 3 [CLO 3]

TOPICS:

- Z Specification

INSTRUCTIONS:

- Max Number of Students in a Group: 2
- Deadline: 15th Dec,2025
- Marks will be deducted for late submission

QUESTION # 1

CINEMA TICKET BOOKING SYSTEM

Design a cinema ticket booking system in Z. A cinema is developing an online **Ticket Booking System** that allows registered users to book seats for movie screenings. The system must manage seat availability, user bookings, and ensure that no double-booking occurs. The goal is to streamline the ticket reservation process, prevent conflicts, and maintain accurate records of which user has booked seat.

Key Functionalities:

1. **User Registration:**
   - Each user must register with a **unique username**.
   - Only registered users can make bookings.
2. **Seat Management:**
   - Each cinema hall has a fixed number of **uniquely identified seats** (e.g., A1, B2, C5).
   - Once a seat is booked for a particular show, it becomes unavailable for others.
   - The system should maintain **real-time seat availability** status.
3. **Show Information:**
   - Multiple **shows** are scheduled throughout the day for different movies.
   - Each show has a unique **show ID**, **start time**, and is associated with a specific cinema hall.
   - Bookings are made **per show**, i.e., the same seat may be booked for different shows.
4. **Ticket Booking:**

- A user can select a show and book one or more available seats. ○ The system must validate that the selected seats are available.
- Upon successful booking, the seat(s) will be assigned to the user and marked as booked.

5. **Cancel Booking:**
   - Users may cancel previously booked tickets before the show start time.
   - Cancelled seats should become available again for others to book.
6. **Booking History:**
   - The system should keep a **record of bookings** for reference, including user, show, and seat information.
7. **Error Handling:**
   - The system should return appropriate messages if:
     - The user tries to book already booked seats.
     - An unregistered user attempts to make a booking.
     - The booking is attempted for a past showtime.

Constraints & Rules:

- A seat can be booked by **only one user per show**.
- Users must log in before making a booking.
- Bookings must be confirmed with a **unique booking ID**.
- Admins may view or reset seat allocations if needed.

QUESTION # 2

UNIVERSITY COURSE REGISTRATION SYSTEM

The university has a centralized system that allows students to:

- Register and drop courses
- View prerequisites
- Handle limited seat availability
- Maintain records of student enrolments

The **system** is used by:

- **Student** : Register for courses, drop courses, complete prerequisites
- **Admin** : Add students, create new courses, set prerequisites and capacities

Business Rules and Constraints

1. **Course Enrolment** ○ A student must be registered in the university before enrolling. ○ A student must satisfy all prerequisites for a course.
   - A course has a maximum enrolment capacity.

2. **Prerequisites** ○ Each course may depend on other courses being completed first. ○ Students cannot bypass these requirements.

3. **Unique IDs** ○ Each student and course have a unique ID.

4. **Drop Policy** ○ A student may drop any course they're enrolled in. ○ If a student has no remaining courses, their entry in the registration table may be removed.

OPERATIONS

1. RegisterCourse
2. DropCourse
3. AddStudent
4. AddCourse

Write down the Z specification for the above specified scenario using the Z notation.

QUESTION # 3

Reasoning about loops (read about loop invariant):

Part 1

1. Write a loop to set sum = 1 + 2 + … + n and prove that it is correct.

Part 2

Trace through the program. What is the value of j when the loop exits? Do you recognize any pattern on the relationship of i and j?

(C) What is the loop invariant?

THE END
