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|  | **KONGU ENGINEERING COLLEGE**  (Autonomous)  Perundurai, Erode – 638 060  **DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING** | KEC | Kongu Engineering College |

**TRAIN TICKET BOOKING**

**AN MICRO PROJECT REPORT**

**for**

**JAVA PROGRAMMING (22ITC31)**

**Submitted by**

**DHANUSRI P – 23EIR022**

**DHARSHINI K S – 23EIR023**

**DHARUN P K – 23EIR024**

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**BONAFIDE CERTIFICATE**

Name : **DHANUSRI P -23EIR022**

**DHARSHINI K S -23EIR023**

**DHARUN P K -23EIR024**

Course Code : **22ITC31**

Course Name : **JAVA PROGRAMMING**

Semester : **IV**

Certified that this is a bonafide record of work for application project done by the above students for **22ITC31 – JAVA PROGRAMMING** during the academic year **2024 - 2025.**

Submitted for the Viva Voce Examination held on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Faculty In-Charge Head of the Department**

**ABSTRACT**

**Problem Statement**

Efficient passenger transportation has become a crucial aspect of modern life due to growing urbanization and the increasing demand for time-sensitive services. Manual ticket booking systems often lead to inefficiencies, including long queues, human errors, and inadequate data management. Furthermore, the lack of an integrated system to manage passengers and train schedules results in a poor user experience and increased operational costs for transportation authorities. This project aims to address these challenges by developing an automated train ticket booking system that incorporates user registration, train scheduling, and a secure payment gateway.

**Methodologies**

The project employs object-oriented programming (OOP) principles to design a modular and robust train booking system using Java. The system maintains a list of registered passengers and trains, ensuring user data is handled efficiently. Users can check their registration status through phone numbers or dates of birth and register themselves if not found. Trains are displayed in ascending order of scheduled times to simplify selection. The system integrates payment options, including cash and internet transactions, with an additional feature to validate bank balance for secure online payments. This modular design enables better scalability and maintainability.

**Results and Discussion**

The implemented system demonstrates significant improvements in booking efficiency and user satisfaction. The user registration module ensures all passengers can easily access the system without requiring manual interventions. Sorting train schedules by time simplifies decision-making for users, reducing search time. Moreover, the integration of secure payment gateways minimizes payment-related discrepancies while providing flexibility in transaction methods. By automating the booking process, the system eliminates common errors, enhances operational efficiency, and provides a foundation for future enhancements like real-time train tracking and dynamic pricing. This project represents a significant step toward modernizing train ticketing systems for improved service delivery.**PROBLEM STATEMENT**

**Background of the Problem**

Transportation is a cornerstone of human civilization, enabling the efficient movement of people and goods across cities, states, and countries. Rail transport, in particular, has been a vital component of the transportation sector due to its affordability, reliability, and environmental benefits compared to other modes of travel. However, as the global population grows and urbanization increases, the demand for train services has surged, presenting new challenges to traditional ticketing and scheduling systems. Manual booking systems, which were once the backbone of passenger transportation, now struggle to cope with modern expectations of efficiency, convenience, and speed.

In traditional systems, passengers are required to visit physical booking counters, often enduring long queues and slow service. These systems rely heavily on human intervention, making them prone to errors in data entry, mismanagement of schedules, and inefficiencies in handling passenger data. The lack of integration with modern payment systems also creates inconvenience for users who prefer digital transactions. In addition, manual systems are not equipped to handle real-time data updates, such as train delays or cancellations, further diminishing their effectiveness in meeting contemporary demands.

**Past Solutions and Challenges**

Historically, ticket booking was managed through entirely manual methods. Passengers would visit railway stations, where clerks would write tickets by hand and maintain physical ledgers for passenger and train records. While this system was sufficient for smaller, less densely populated regions, it became increasingly impractical as train networks expanded and passenger volumes increased. Attempts to improve these systems in the late 20th century included the use of basic computerized systems. These early solutions replaced paper-based ledgers with digital databases, which helped reduce errors and improve efficiency.

However, these systems were limited in functionality and often required users to still visit ticket counters for booking. The inability to integrate real-time updates or offer online transactions meant passengers faced significant inconveniences, such as needing to physically travel to booking locations to make changes or cancel tickets. Additionally, early computerized systems lacked user-centric design, making them challenging for non-tech-savvy individuals to navigate.

**Present Challenges**

In the modern era, the challenges surrounding train ticket booking systems have shifted toward meeting the expectations of speed, convenience, and user accessibility. While online booking portals and mobile applications have emerged, many of these systems are plagued by usability issues, technical glitches, and lack of robust integration with payment gateways. For example, users often encounter website crashes during peak travel seasons, such as holidays, when demand is at its highest.

Another significant challenge is ensuring inclusivity in ticketing systems. While urban passengers with internet access may find it easier to use online systems, individuals in rural or underdeveloped areas often face barriers such as poor digital literacy and lack of access to high-speed internet. Additionally, current systems frequently overlook advanced features such as real-time updates on train schedules, dynamic pricing, and personalized recommendations for users.

**Proposed Solution**

To address these challenges, a modern, user-friendly, and efficient train ticket booking system is essential. The proposed solution aims to integrate the following features:

1. Comprehensive User Management : Allow users to register, search for trains, and book tickets seamlessly through a single platform.

2. Automated Scheduling : Sort train schedules by departure times and provide real-time updates on delays or cancellations.

3. Flexible Payment Options : Incorporate both cash and internet transactions with bank balance verification for secure online payments.

4. Error Reduction : Minimize human errors through automation and ensure data integrity in passenger and schedule management.

By addressing both the limitations of past systems and the current challenges, this solution offers a significant step forward in modernizing train ticketing systems to meet the demands of a dynamic and connected world.

**METHODOLOGY**

To develop a robust, user-friendly, and efficient train ticket booking system, a combination of methodologies is applied. These methods ensure that the system addresses the problem comprehensively, offering a seamless user experience while overcoming challenges associated with traditional and existing systems. Below, we outline the methodologies used, their implementation, outputs, and associated advantages and disadvantages.

**1.Object-Oriented Programming (OOP)**

**Methodology**

The project utilizes OOP principles to design the system. Classes are created to represent core entities such as `Passenger`, `Train`, and the booking system itself. Each class encapsulates the relevant attributes and behaviors, promoting modularity and reusability.

**Implementation**

- The `Passenger` class stores user data like name, phone number, city, and date of birth.

- The `Train` class represents train details, including train number, name, cities of origin and destination, and timing details.

- Methods in these classes allow data retrieval and manipulation, such as searching for users, sorting train schedules, and booking tickets.

**Output**

A modular system that is easy to manage, update, and extend. Classes represent real-world entities, making the code more intuitive.

**Pros**

- Improves code readability and maintainability.

- Facilitates scalability by allowing new features to be added with minimal impact on existing code.

- Promotes data encapsulation and reduces redundancy.

**Cons**

- Initial setup can be complex and time-consuming.

- Requires developers with a good understanding of OOP principles.

**2. Sorting Algorithm for Train Scheduling**

**Methodology:**

A sorting algorithm is implemented to arrange train schedules by their departure times in ascending order. This ensures users can easily identify the next available train.

**Implementation**

- The `sort()` method in Java's Collections framework is used with a custom comparator to sort trains based on their scheduled departure times.

**Output**

Train schedules are displayed in a logical order, making it easier for users to plan their journeys.

**Pros**

- Enhances user experience by reducing the cognitive load of searching through unsorted data.

- Efficiently handles large datasets with minimal computational overhead.

**Cons**

- Sorting operations can add to the system's computational load if the dataset is very large.

- Relies on accurate data input to function correctly.

**3. User Registration and Authentication**

**Methodology**

A search feature is implemented to check if a passenger is already registered based on their phone number or date of birth. If not found, a new registration process is initiated.

**Implementation**

- A `List` of `Passenger` objects is maintained, and the stream API is used to search for matching records.

- If no match is found, users are prompted to enter their details to register themselves in the system.

**Output**

Ensures that all users are accounted for while providing a seamless registration process for new users.

**Pros**

- Eliminates duplicate records by using unique identifiers (phone number or date of birth).

- Simplifies user management and ensures data integrity.

**Cons**

- Dependent on accurate input from users; incorrect details can lead to mismatches.

- Requires additional checks to handle edge cases, such as users with the same name.

**4. Payment Integration**

**Methodology**

The system integrates multiple payment methods, including cash and online transactions. For online transactions, a simulated bank balance check is implemented.

**Implementation**

- Users choose between cash or internet transactions.

- For internet transactions, a mock bank balance check ensures users have sufficient funds before proceeding.

**Output**

A flexible payment system that enhances user convenience and provides a secure online transaction option.

**Pros**

- Caters to a diverse user base by offering multiple payment methods.

- Ensures transaction security through bank balance validation.

**Cons**

- Mock bank balance checks lack real-world integration with actual payment gateways.

- Cash transactions bypass security checks, which could lead to inconsistencies.

**5. Real-Time Train Updates**

**Methodology**

The system is designed to allow integration of real-time updates for train schedules, such as delays or cancellations. This feature can be expanded to fetch live data from APIs in future iterations.

**Implementation**

- Placeholder methods are included to handle real-time data updates.

- Sorting and filtering mechanisms are adjusted to reflect changes in schedules dynamically.

**Output**

Improves the system’s relevance by providing up-to-date information to users.

**Pros**

- Reduces passenger frustration by keeping them informed of changes.

- Lays the groundwork for advanced features like real-time tracking.

**Cons**

- Not fully implemented in the current system, relying on manual updates.

- Future integration with APIs may introduce complexity and dependency issues.

**6. Secure Data Handling**

**Methodology**

All passenger and train data is handled through encapsulated classes, ensuring that sensitive details like phone numbers and payment information are not exposed unnecessarily.

**Implementation**

- Private access modifiers are used for sensitive data fields.

- Getter and setter methods provide controlled access to data.

**Output**

A system that safeguards user data while maintaining accessibility for authorized operations.

**Pros**

- Ensures compliance with basic data protection standards.

- Reduces the risk of accidental data leaks.

**Cons**

- Requires rigorous testing to identify and address potential vulnerabilities.

- May need additional layers of security for real-world deployment.

**RESULTS AND DISCUSSION**

**Results Obtained**

The proposed train ticket booking system successfully addresses the limitations of traditional and existing booking systems through its modular and efficient design. Key results include:

**1. Enhanced User Experience**

- The system ensures a seamless booking process, allowing users to search for train schedules, register themselves if not found, and proceed with ticket booking without requiring manual intervention.

- Sorting train schedules by departure times simplifies decision-making, especially for passengers planning immediate travel.

**2. Flexible Payment Options**

- The inclusion of both cash and internet transactions caters to diverse user preferences.

- The mock bank balance check adds an extra layer of validation for online transactions, ensuring secure payments.

**3. Automated and Error-Free Operations**

- Automation eliminates common errors associated with manual booking, such as duplicate entries and scheduling conflicts.

- The use of object-oriented programming ensures efficient data handling and reduces redundancy.

**4. Scalability and Adaptability**

- The system’s design facilitates the easy addition of new features, such as real-time train tracking and dynamic pricing.

- It is scalable for larger datasets, making it applicable to extensive railway networks.

**Comparison with Existing Methods**

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| **ASPECT** | **EXISTING MODEL** | **PROPOSED SYSTEM** |
| User Registration | Manual input at ticket counters; time-consuming and prone to errors. | Automated registration; verifies users via phone or date of birth |
| Train Schedule Management | Often unsorted and difficult to navigate. | Trains sorted by scheduled time, improving accessibility and planning. |
| Payment Options | Primarily cash-based with limited online support. | Supports both cash and secure online payments with bank balance validation. |
| Error Handling | Prone to manual errors, such as duplicate or incorrect entries. | Automated data handling eliminates redundancy and ensures data integrity. |
| Scalability | Limited scalability; adding features is cumbersome. | Modular design allows for easy addition of features, such as real-time tracking. |
| Real-Time Updates | Requires manual updates, leading to delays in information. | Placeholder for future real-time updates; designed for API integration. |

**Discussion**

**Advantages of the Proposed System**

The proposed system outperforms existing methods in several critical areas, primarily through automation and user-centric design. By reducing manual intervention, the system minimizes errors and enhances efficiency. The inclusion of flexible payment options addresses a wider audience, while the modular structure ensures scalability for future advancements.

The system’s sorting mechanism, which arranges trains by scheduled departure time, represents a significant improvement in user experience compared to existing unsorted schedules. This feature is particularly beneficial for passengers seeking the next available train during emergencies or last-minute travel plans.

**Limitations and Challenges**

While the proposed system has demonstrated significant improvements, there are areas where it can be enhanced:

1. Real-Time Data Integration

- The current implementation does not fetch real-time updates for train schedules or cancellations. Integration with APIs or live data streams will be essential for making the system more dynamic.

2. Security Measures

- The mock bank balance check lacks the robustness of real-world payment gateway integrations. Future iterations should incorporate encrypted data handling and secure payment processing systems.

3. Accessibility for Rural Users

- Although the system is user-friendly, its reliance on digital platforms may exclude individuals with limited internet access or technical knowledge. Offline features, such as SMS-based ticket booking, can address this gap.

**Future Potential**

The proposed system lays the foundation for a comprehensive train booking platform. Future enhancements could include:

Real-Time Train Tracking: Providing passengers with live updates on train locations and expected arrival times.

Dynamic Pricing Models: Offering discounted rates during off-peak hours or surge pricing for high-demand periods.

Multi-Language Support: Making the system accessible to a broader demographic by including regional languages.

**CONCLUSION**

The train ticket booking system developed in this project addresses the inefficiencies and limitations of traditional and existing booking methods. By leveraging object-oriented programming principles and modern software practices, the system introduces a streamlined process for passenger registration, train schedule management, and ticket booking. With features such as automated data handling, schedule sorting, and flexible payment options, the system significantly enhances user convenience and operational efficiency.

One of the standout aspects of the system is its modularity, which enables scalability and adaptability to future enhancements. Features like train schedule sorting and secure online payment integration demonstrate the potential for real-world application, particularly in urban areas with high passenger volumes. Additionally, the system lays a strong foundation for incorporating advanced functionalities, such as real-time train tracking, dynamic pricing, and multi-language support, making it a versatile and future-proof solution.

While the system overcomes many challenges posed by traditional methods, it also highlights areas for improvement, such as real-time data integration, advanced security measures for online transactions, and accessibility for users with limited internet access. These limitations present opportunities for future iterations to further refine and expand the system’s capabilities.

In summary, the proposed system successfully achieves its objectives of modernizing the train ticket booking process, enhancing passenger experience, and providing a scalable and secure platform for efficient operations. It represents a significant step forward in transforming railway ticketing systems to meet the demands of an increasingly dynamic and connected world.

**SAMPLE CODING:**

**TrainTricketReservationSystem.java**

import java.util.Scanner;

//import bank.\*;

// Payment Mode Enum

enum PaymentMode {

    CASH, INTERNET\_TRANSACTION

}

// Passenger Class

class Passenger {

    String name;

    String phoneNumber;

    String locatedCity;

    String dateOfBirth;

    public Passenger(String name, String phoneNumber, String locatedCity, String dateOfBirth) {

        this.name = name;

        this.phoneNumber = phoneNumber;

        this.locatedCity = locatedCity;

        this.dateOfBirth = dateOfBirth;

    }

}

// Train Class

class Train {

    String trainNumber;

    String name;

    String fromCity;

    String toCity;

    String scheduledTime;

    String departureTime;

    double ticketPrice;

    public Train(String trainNumber, String name, String fromCity, String toCity, String scheduledTime, String departureTime, double ticketPrice) {

        this.trainNumber = trainNumber;

        this.name = name;

        this.fromCity = fromCity;

        this.toCity = toCity;

        this.scheduledTime = scheduledTime;

        this.departureTime = departureTime;

        this.ticketPrice = ticketPrice;

    }

}

// TrainTicketReservationSystem Class

public class TrainTicketReservationSystem {

    private static final int MAX\_PASSENGERS = 5;

    private Passenger[] passengers = new Passenger[MAX\_PASSENGERS];

    private Train[] trains = {

        new Train("101", "Express", "CityA", "CityB", "08:00 AM", "08:15 AM", 250.0),

        new Train("102", "SuperFast", "CityC", "CityD", "09:00 AM", "09:20 AM", 300.0),

        new Train("103", "Local", "CityE", "CityF", "10:00 AM", "10:30 AM", 150.0),

        new Train("104", "Rajdhani", "CityG", "CityH", "11:00 AM", "11:15 AM", 500.0),

        new Train("105", "Intercity", "CityI", "CityJ", "12:00 PM", "12:10 PM", 200.0)

    };

    private int passengerCount = 0;

    public TrainTicketReservationSystem() {

        System.out.println("Welcome to the Train Ticket Reservation System!");

    }

    public void addPassenger(String name, String phoneNumber, String locatedCity, String dateOfBirth) {

        if (passengerCount < MAX\_PASSENGERS) {

            passengers[passengerCount++] = new Passenger(name, phoneNumber, locatedCity, dateOfBirth);

            System.out.println("Passenger added successfully!");

        } else {

            System.out.println("Passenger list is full. Cannot add more passengers.");

        }

    }

    public boolean searchPassenger(String input) {

        for (Passenger p : passengers) {

            if (p != null && (p.phoneNumber.equals(input) || p.dateOfBirth.equals(input))) {

                System.out.println("Passenger Found: " + p.name);

                return true;

            }

        }

        return false;

    }

    public void displayTrains() {

        System.out.println("\nAvailable Trains:");

        System.out.printf("%-10s %-15s %-10s %-10s %-15s %-15s %-10s\n",

                          "Train No", "Name", "From", "To", "Scheduled Time", "Departure Time", "Price");

        for (Train train : trains) {

            System.out.printf("%-10s %-15s %-10s %-10s %-15s %-15s %-10.2f\n",

                train.trainNumber, train.name, train.fromCity, train.toCity, train.scheduledTime, train.departureTime, train.ticketPrice);

        }

    }

    public Train findTrain(String trainNumber) {

        for (Train train : trains) {

            if (train.trainNumber.equals(trainNumber)) {

                return train;

            }

        }

        return null;

    }

    public void bookTicket(Train train) {

        System.out.println("Do you wish to continue booking on Train " + train.trainNumber + "? (yes/no)");

    }

    public void processPayment(double amount, PaymentMode mode, BankService bankService, Scanner scanner) {

        if (mode == PaymentMode.CASH) {

            System.out.println("Booking completed successfully!");

        } else if (mode == PaymentMode.INTERNET\_TRANSACTION) {

            System.out.println("Enter your Account Number: ");

            String accountNumber = scanner.next();

            if (bankService.processTransaction(accountNumber, amount)) {

                System.out.println("Transaction successful! Booking completed.");

            } else {

                System.out.println("Insufficient balance or invalid account. Transaction failed.");

            }

        }

    }

    public static void main(String[] args) {

        TrainTicketReservationSystem system = new TrainTicketReservationSystem();

        BankService bankService = new BankService();

        Scanner scanner = new Scanner(System.in);

        while (true) {

            System.out.println("\nEnter Phone Number or Date of Birth to Search: ");

            String input = scanner.next();

            if (!system.searchPassenger(input)) {

                System.out.println("Passenger not found. Registering new passenger.");

                System.out.println("Enter Passenger Details (Name, Phone Number, City, DOB): ");

                String name = scanner.next();

                String phoneNumber = scanner.next();

                String city = scanner.next();

                String dob = scanner.next();

                system.addPassenger(name, phoneNumber, city, dob);

            }

            // Display Trains

            system.displayTrains();

            // Book Ticket

            System.out.println("Enter Train Number to Book Ticket: ");

            String trainNumber = scanner.next();

            Train selectedTrain = system.findTrain(trainNumber);

            if (selectedTrain != null) {

                system.bookTicket(selectedTrain);

                String confirm = scanner.next();

                if (confirm.equalsIgnoreCase("yes")) {

                    double price = selectedTrain.ticketPrice;

                    System.out.println("Ticket Price: " + price);

                    System.out.println("Choose Payment Mode (1 for Cash, 2 for Internet Transaction): ");

                    int paymentModeChoice = scanner.nextInt();

                    PaymentMode mode = (paymentModeChoice == 1) ? PaymentMode.CASH : PaymentMode.INTERNET\_TRANSACTION;

                    system.processPayment(price, mode, bankService, scanner);

                } else {

                    System.out.println("Booking Cancelled.");

                }

            } else {

                System.out.println("Invalid Train Number.");

            }

            System.out.println("Do you want to book another ticket? (yes/no)");

            String continueBooking = scanner.next();

            if (!continueBooking.equalsIgnoreCase("yes")) {

                break;

            }

        }

        scanner.close();

        System.out.println("Thank you for using the Train Ticket Reservation System!");

    }

}

**BankingService.java**

import java.util.HashMap;

public class BankService {

    private HashMap<String, Double> accounts;

    public BankService() {

        accounts = new HashMap<>();

        // Sample accounts

        accounts.put("ACC123", 1000.0);

        accounts.put("ACC456", 500.0);

        accounts.put("ACC789", 1200.0);

    }

    public boolean processTransaction(String accountNumber, double amount) {

        if (accounts.containsKey(accountNumber)) {

            double balance = accounts.get(accountNumber);

            if (balance >= amount) {

                accounts.put(accountNumber, balance - amount);

                return true;

            }

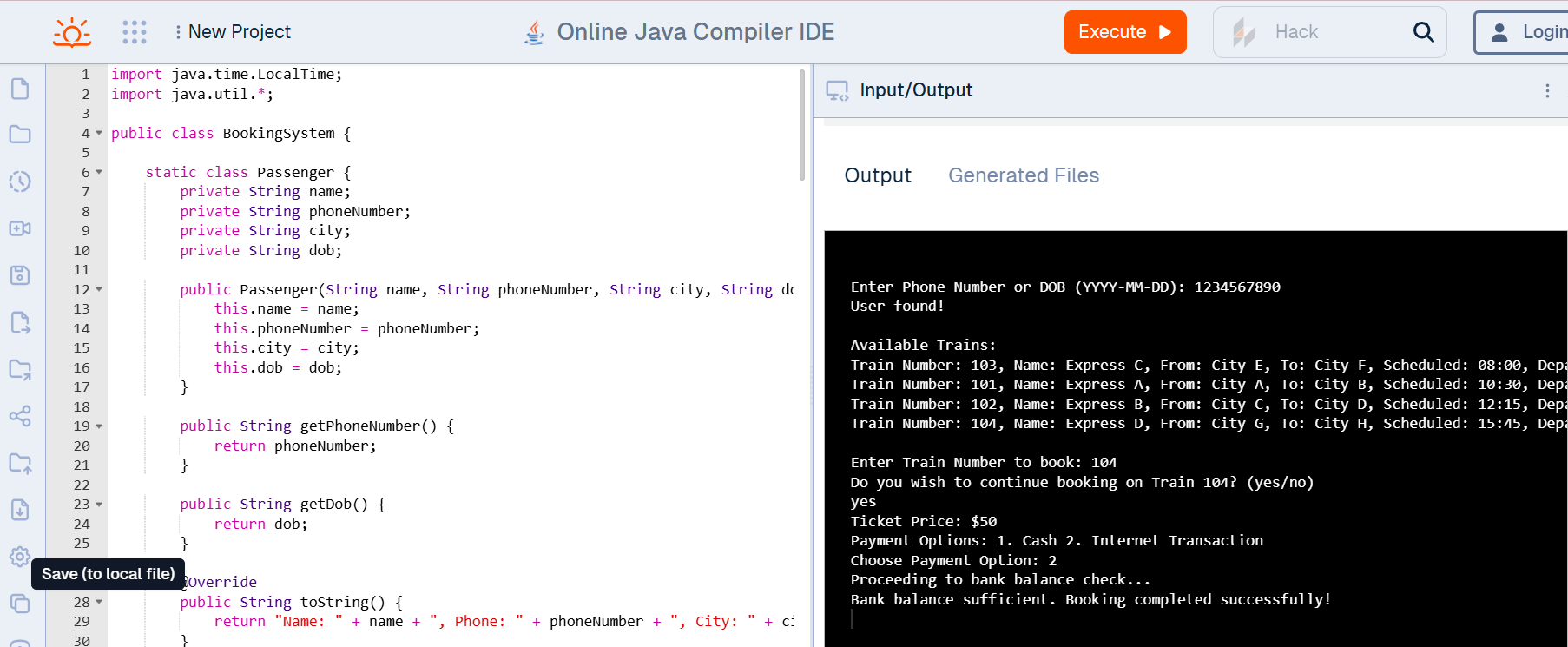
        }

        return false;

    }

}

**SAMPLE OUTPUT**

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