TRƯỜNG ĐẠI HỌC FPT HỒ CHÍ MINH

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FPT Education

FPT UNIVERSITY

COURSE: DBI202 - DATABASE MANAGEMENT SYSTEMS

LAB 2: ENTITY ANALYSIS AND FUNCTIONAL DEPENDENCIES

GROUP: …1……

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COURSE:

DBI202 - DATABASE MANAGEMENT SYSTEMS

LAB 2: ENTITY ANALYSIS AND FUNCTIONAL DEPENDENCIES

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1. Objective

With the increasing demand for online ticket booking services, cinema management systems have become an essential component in modern entertainment businesses.
A Cinema Ticket Booking System helps manage movies, cinemas, screening rooms, showtimes, seat reservations, and customer bookings in an efficient and structured manner.

The purpose of this laboratory is to analyze the system requirements of a cinema ticket booking system and translate them into a relational database design.
This includes identifying the core entities, defining their attributes, determining functional dependencies, and identifying appropriate primary and candidate keys.
The outcome of this analysis provides a solid foundation for database normalization and further stages of database design.

2. System Description and Business Rules

2.1 System Description

The system manages a cinema chain that operates multiple cinema branches.
Each cinema contains several screening rooms, where movies are shown at scheduled times.
Customers can browse movies, select showtimes, book tickets, and choose seats.
Each booking may include multiple tickets, and payment information is recorded for transaction management.

2.2 Business Rules

The system follows the business rules below:

1. Each cinema branch can contain multiple screening rooms, and each screening room belongs to exactly one cinema.
2. Each screening room has a fixed number of seats, and each seat is uniquely identified within its screening room.
3. Each showtime schedules exactly one movie in one screening room at a specific time, while a movie can have multiple showtimes across different cinemas.

4. A customer can create multiple bookings, but each booking is associated with exactly one customer and one showtime.
5. Each booking can include multiple tickets, and each ticket corresponds to one specific seat for a given showtime.
6. A seat cannot be booked more than once for the same showtime.
7. Each booking must have at least one payment record, and each payment is linked to exactly one booking
8. For a given showtime, each seat can be associated with at most one ticket.
9. A booking is considered confirmed only after a successful payment(failed, pending, or cancelled payments do not confirm a booking).
10. Each screening room contains multiple seats, and each seat belongs to exactly one screening room.
11. Each seat is identified by its position within a screening room (row and seat number) and is assigned a specific seat type, such as regular, VIP, or sweetbox, which is used to apply different ticket prices.
12. Each staff member works at only one cinema, while each cinema can have multiple staff members.
13. Each staff member processes multiple bookings.
14. Each payment may apply at most one discount, while a discount can be applied to multiple payment transactions. Discounts can be applied during the payment process to reduce the total amount paid by the customer.

These business rules are used to identify entities, define relationships, and derive functional dependencies in the database design.

3. Entity Identification and Attribute Definitions

3.1 Entity: Movie

Attributes Description:

- MovieID: A unique identifier assigned to each movie in the system.
- Title: The official title of the movie.
- Genre: The category or type of the movie, such as Action or Drama.
- Duration: The total running time of the movie in minutes.
- Language: The primary language of the movie.
- ReleaseDate: The official release date of the movie.
- AgeRestriction: The minimum age required to watch the movie.

Functional Dependencies:

MovieID → Title, Genre, Duration, Language, ReleaseDate, AgeRestriction

Key Analysis:

- Candidate Key: MovieID
- Primary Key: MovieID

3.2 Entity: Cinema

Attributes Description:

- CinemaID: A unique identifier assigned to each cinema branch.
- CinemaName: The official name of the cinema.
- Address: The physical address of the cinema.
- City: The city where the cinema operates.
- PhoneNumber: The contact phone number of the cinema.

Functional Dependencies:

CinemaID → CinemaName, Address, City, PhoneNumber

Key Analysis:

- Candidate Key: CinemaID
- Primary Key: CinemaID

3.3 Entity: ScreeningRoom

Attributes Description:

- RoomID: A unique identifier assigned to each screening room.
- CinemaID: The identifier of the cinema that owns the screening room.
- RoomName: The name or number of the screening room.
- Capacity: The total number of seats in the screening room.

Functional Dependencies:

RoomID → CinemaID, RoomName, Capacity

Key Analysis:

- Candidate Key: RoomID
- Primary Key: RoomID

3.4 Entity: Seat

Attributes Description:

- SeatID: A unique identifier assigned to each seat.
- RoomID: The identifier of the screening room where the seat is located.
- SeatRow: The row designation of the seat.

- TypeID: The identifier of the seat type assigned to the seat. *(FK to SeatType)*
- SeatNumber: The number of the seat within a row.

Functional Dependencies:

SeatID → RoomID, TypeID , SeatRow, SeatNumber

Key Analysis:

- Candidate Key: SeatID
- Primary Key: SeatID
- Additional Candidate Key: (RoomID, SeatRow, SeatNumber)

3.5 **Entity: SeatType**

Attributes Description:

- TypeID: Identifier of the seat type.
- TypeName: Name of the seat type (Regular, VIP, Sweetbox).
- Surcharge: Extra price added based on the seat type

Functional Dependencies:

TypeID → TypeName, Surcharge

Key Analysis:

- Candidate Key: TypeID
- Primary Key: TypeID

3.5 Entity: Showtime

Attributes Description:

- ShowtimeID: A unique identifier assigned to each showtime.
- MovieID: The identifier of the movie being screened.
- RoomID: The identifier of the screening room where the showtime takes place.
- StartTime: The start time of the showtime.
- EndTime: The end time of the showtime.
- Price: The base ticket price for the showtime.

Functional Dependencies:

ShowtimeID → MovieID, RoomID, StartTime, EndTime, Price

Key Analysis:

- Candidate Key: ShowtimeID
- Primary Key: ShowtimeID

3.6 Entity: Customer

Attributes Description:

- CustomerID: A unique identifier assigned to each customer.
- FullName: The full name of the customer.
- Email: The email address of the customer.
- PhoneNumber: The contact phone number of the customer.

Functional Dependencies:

CustomerID → FullName, Email, PhoneNumber

Key Analysis:

- Candidate Key: CustomerID
- Primary Key: CustomerID

3.7 Entity: Booking

Attributes Description:

- BookingID: A unique identifier assigned to each booking transaction.
- CustomerID: The identifier of the customer who makes the booking.
- ShowtimeID: The identifier of the booked showtime.
- BookingDate: The date and time when the booking is created.
- BookingStatus: The current status of the booking.

Functional Dependencies:

BookingID → CustomerID, ShowtimeID, BookingDate, BookingStatus

Key Analysis:

- Candidate Key: BookingID
- Primary Key: BookingID

3.8 Entity: Ticket

Attributes Description:

- TicketID: A unique identifier assigned to each ticket.
- BookingID: The identifier of the booking associated with the ticket.

- SeatID: The identifier of the seat assigned to the ticket.
- TicketPrice: The price paid for the ticket.

Functional Dependencies:

TicketID → BookingID, SeatID, TicketPrice

Key Analysis:

- Candidate Key: TicketID
- Primary Key: TicketID

3.9 Entity: Payment

Attributes Description:

- PaymentID: A unique identifier assigned to each payment transaction.
- BookingID: The identifier of the booking associated with the payment.
- PaymentMethod: The method used to make the payment (cash, card, e-wallet).
- PaymentDate: The date and time when the payment is made.
- PaymentAmount: The amount paid in a single payment transaction.
- PaymentStatus: The status of the payment (successful, failed, pending).

Functional Dependencies:

PaymentID → BookingID, PaymentMethod, PaymentDate, PaymentAmount, PaymentStatus

Key Analysis:

- Candidate Key: PaymentID
- Primary Key: PaymentID

3.10 Entity: Staff

Attributes Description:

- Staff ID: A unique identifier assigned to each staff member in the system.
- CinemaID: The identifier of the cinema branch where the staff member works.
- FullName: The full name of the staff member.
- Role: The role or position of the staff member (Manager, Cashier, Technician).
- Email: The email address used for staff communication and system access.
- PhoneNumber: The contact phone number of the staff member.

- Status: The current working status of the staff member (Active, On Leave, Resigned).

Functional Dependencies:

StaffID → CinemaID, FullName, Role, Email, PhoneNumber, Status

Key Analysis:

- Candidate Key: StaffID
- Primary Key: StaffID

3.11 Entity: Discount

Attributes Description:

- DiscountID: A unique identifier assigned to each discount.
- DiscountName: The name of the discount or promotion.
- DiscountType: The type of discount (percentage or fixed amount).
- DiscountValue: The value of the discount applied.
- StartDate: The start date of the discount validity.
- EndDate: The end date of the discount validity.
- Status: The current status of the discount (Active, Expired).

Functional Dependencies:

DiscountID → DiscountName, DiscountType, DiscountValue, StartDate, EndDate, Status

Key Analysis:

- Candidate Key: DiscountID
- Primary Key: DiscountID

4. Normalisation Analysis

All entities have clearly defined primary keys, and all non-key attributes are fully functionally dependent on their respective primary keys.
There are no partial or transitive dependencies in the schema.

Therefore, the database design satisfies Third Normal Form (3NF), ensuring minimal redundancy and strong data integrity.

5. Research Methodology & Tool Support:

During the preparation of this lab, the group first explored several online cinema ticket booking websites to better understand how real systems operate in practice. We also reviewed public GitHub projects, materials shared on Studocu and Scribd, as well as common ERD examples, to get a clearer view of typical database structures and design patterns. In addition, AI-based tools were used as a supporting resource to help review candidate keys, functional dependencies, and the overall normalisation process. All important design decisions were carefully considered and finalised by the group based on database theory and the course requirements.

6. Conclusion

This laboratory presented a detailed analysis of a Cinema Ticket Booking System through entity identification, attribute definition, functional dependency analysis, and key determination.

The resulting database design accurately reflects real-world cinema operations and provides a reliable foundation for future database development, including ER diagram creation and physical implementation.