Advanced Databases - HW2 - Entity Relation Models

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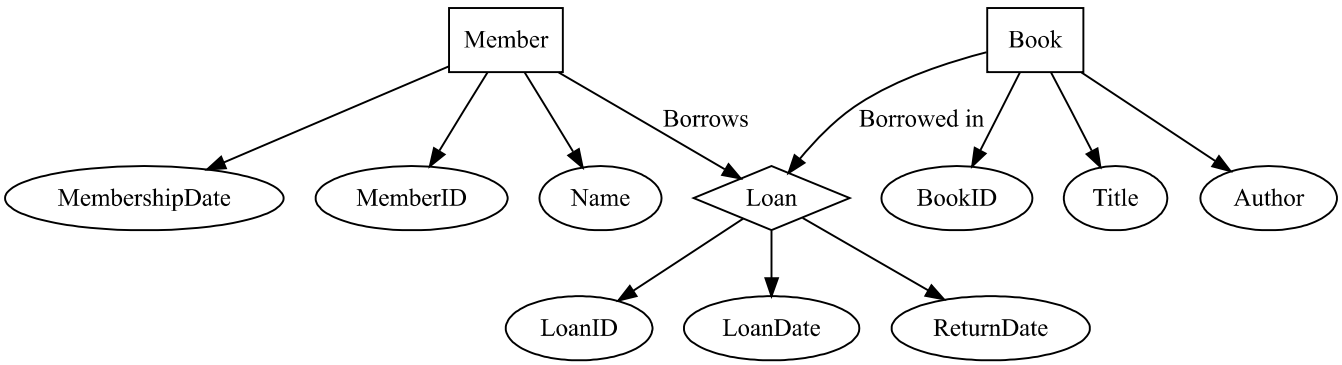
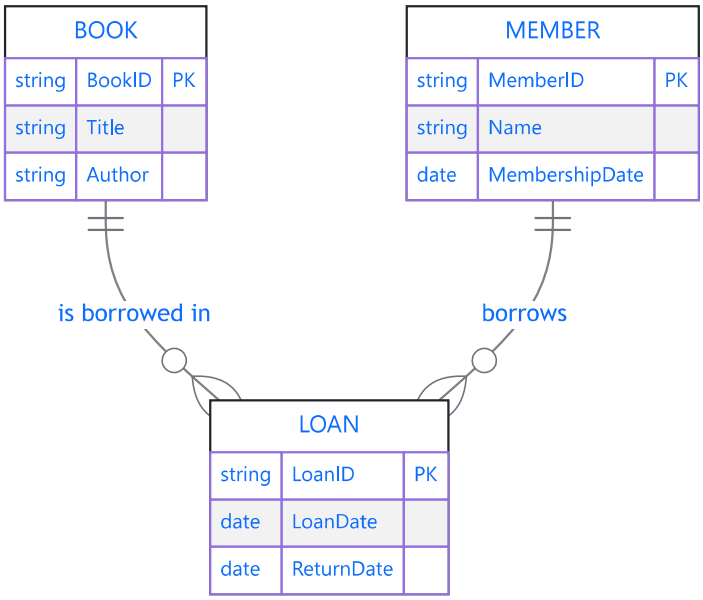
1. Library Management System

Picture a library that needs to manage books, members, and loans. Each book has a book ID, title, and author. Members have a member ID, name, and membership date. Loans have a loan ID, loan date, and return date. A member can borrow multiple books, and each book can be borrowed by multiple members over time. Each loan is associated with a single member borrowing a single book.

Graphviz (Chen Notation)



Mermaid (Crow's Foot Notation)



A Library Management System (LMS) is a structured database-driven solution designed to handle books, members, and loan transactions efficiently. The system models entities such as **Book**, **Member**, and **Loan** to track borrowing activities and enforce constraints such as due dates and member eligibility.

Entities and Relationships

- **Book**: Stores details about books in the library.
- **Member**: Stores details about library members.
- **Loan**: Represents the borrowing of a book by a member.

Relation Set Schema

Book

```
Book(BookID, Title, Author)
```

- `BookID (PK)`: Unique identifier for each book.
- `Title`: Name of the book.
- `Author`: Author of the book.

Member

```
Member(MemberID, Name, MembershipDate)
```

- `MemberID (PK)`: Unique identifier for each member.
- `Name`: Name of the member.
- `MembershipDate`: Date the member joined the library.

Loan

```
Loan(LoanID, LoanDate, ReturnDate, MemberID [FK], BookID [FK])
```

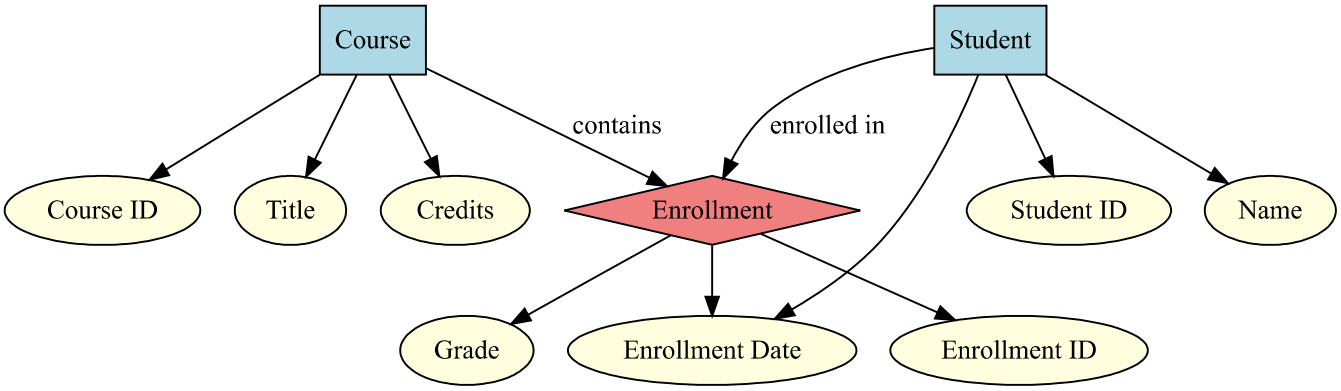
- `LoanID (PK)`: Unique identifier for each loan.
- `LoanDate`: Date the book was borrowed.
- `ReturnDate`: Date the book is expected to be returned.
- `MemberID (FK)`: The member who borrowed the book (references Member).
- `BookID (FK)`: The book being borrowed (references Book).

Each loan entry connects a member with a book, allowing multiple books to be borrowed by a member over time.

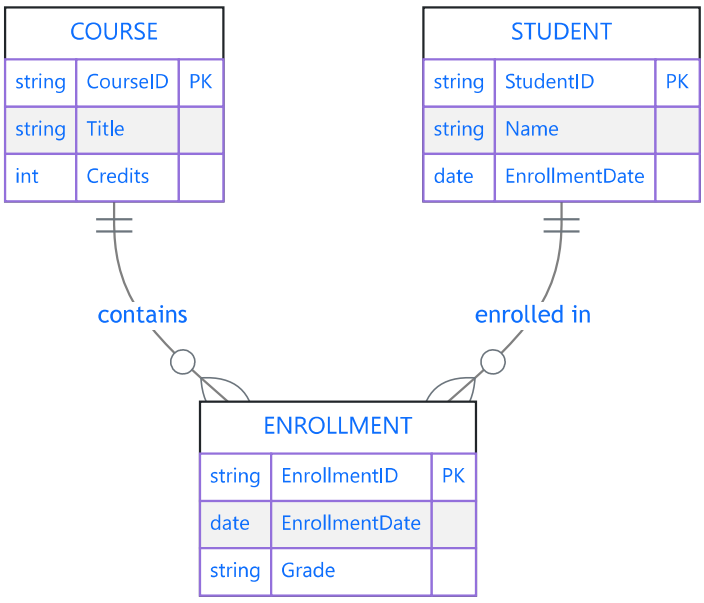
2. School Course Enrollment System

Imagine a school that needs to manage courses, students, and enrollments. Each course has a course ID, title, and credits. Students have a student ID, name, and enrollment date. Enrollments have an enrollment ID, enrollment date, and grade. A student can enroll in multiple courses, and each course can have multiple students. Each enrollment is associated with a single student enrolling in a single course.

Graphviz (Chen Notation)



Mermaid (Crow's Foot Notation)



School Course Enrollment System

A School Course Enrollment System is designed to manage student-course relationships in an academic institution. The core database model consists of **Student**, **Course**, and **Enrollment** to track student enrollments, manage grades, and schedule courses efficiently while maintaining data integrity through foreign key constraints.

Entities and Relationships

- **Course**: Represents courses offered by the school.
- **Student**: Represents students enrolled in the school.
- **Enrollment**: Tracks which students have enrolled in which courses.

Relation Set Schema

Course

```
Course(CourseID, Title, Credits)
```

- `CourseID (PK)`: Unique identifier for each course.
- `Title`: Name of the course.
- `Credits`: Number of credits awarded for completing the course.

Student

```
Student(StudentID, Name, EnrollmentDate)
```

- `StudentID (PK)`: Unique identifier for each student.
- `Name`: Name of the student.
- `EnrollmentDate`: Date the student enrolled in the school.

Enrollment

```
Enrollment(EnrollmentID, EnrollmentDate, Grade, StudentID [FK], CourseID [FK])
```

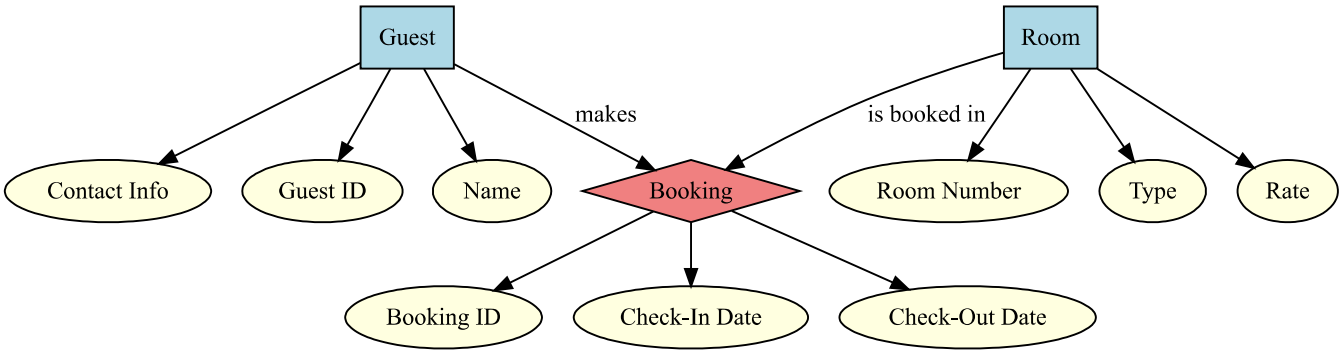
- `EnrollmentID (PK)`: Unique identifier for each enrollment record.
- `EnrollmentDate`: Date the student enrolled in the course.
- `Grade`: Grade received in the course.
- `StudentID (FK)`: The student who enrolled (references Student).
- `CourseID (FK)`: The course being enrolled in (references Course).

Each student can enroll in multiple courses, and each course can have multiple students. The **Enrollment** entity serves as a many-to-many bridge between students and courses.

3. Hotel Booking System

Consider a hotel that wants to manage rooms, guests, and bookings. Each room has a room number, type, and rate. Guests have a guest ID, name, and contact information. Bookings have a booking ID, check-in date, and check-out date. A guest can make multiple bookings, and each room can be booked multiple times over different dates. Each booking is associated with one guest and one room.

Graphviz (Chen Notation)



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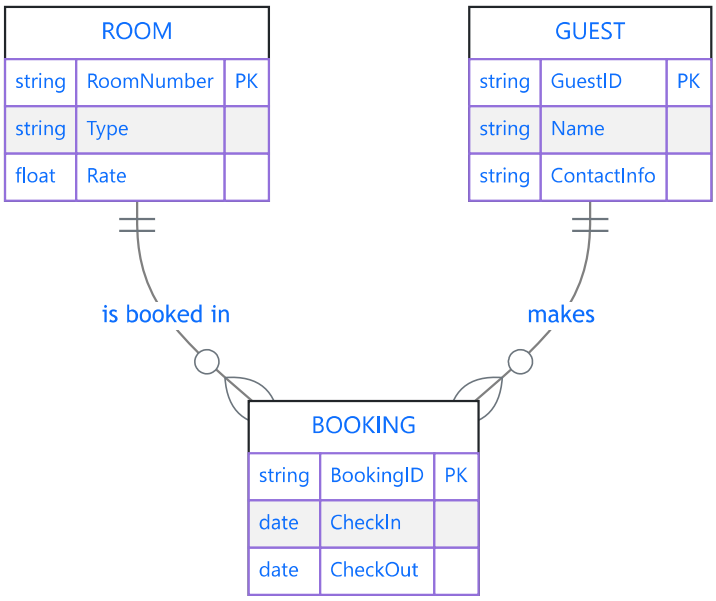

Hotel Booking System

A Hotel Booking System is a relational database application designed to track room reservations and guest management. The key entities include **Room**, **Guest**, and **Booking** to ensure optimized room allocation, prevent double bookings, and enhance guest experience through data-driven availability tracking.

Entities and Relationships

- **Room**: Represents the rooms available in the hotel.
- **Guest**: Represents guests who stay at the hotel.
- **Booking**: Tracks room reservations by guests.

Relation Set Schema

Room

```
Room(RoomNumber, Type, Rate)
```

- `RoomNumber (PK)`: Unique number assigned to each room.
- `Type`: Type of room (e.g., single, double, suite).
- `Rate`: Cost per night for the room.

Guest

```
Guest(GuestID, Name, ContactInfo)
```

- `GuestID (PK)`: Unique identifier for each guest.
- `Name`: Name of the guest.
- `ContactInfo`: Contact details of the guest.

Booking

```
Booking(BookingID, CheckIn, CheckOut, GuestID [FK], RoomNumber [FK])
```

- `BookingID (PK)`: Unique identifier for each booking.
- `CheckIn`: Check-in date for the guest.
- `CheckOut`: Check-out date for the guest.
- `GuestID (FK)`: The guest who made the booking (references Guest).
- `RoomNumber (FK)`: The room booked (references Room).

Each guest can book multiple rooms over time, and each room can be booked multiple times by different guests. The **Booking** entity manages these relationships efficiently.