

## **1. Design an ER Diagram for a Library Management System.**

In your ER diagram, include the following entities and their relationships:

1. **Books** – Each book has a unique ID, title, author(s), publication year, and ISBN number.
2. **Members** – A member is someone who borrows books. Each member has a unique member ID, name, address, phone number, and email.
3. **Authors** – An author can write multiple books. Each author has a unique author ID, name, and biography.
4. **Loans** – A loan tracks the borrowing of a book by a member. Each loan has a loan ID, the date the book was borrowed, and the date it is due back.
5. **Librarians** – A librarian manages the library and is responsible for registering books and members, and processing loans. Each librarian has a unique ID, name, and contact details.
6. **Categories** – Each book belongs to a specific category or genre (e.g., fiction, non-fiction, science, etc.).
7. **Reservations** – A member can reserve a book that is currently on loan. Each reservation has a reservation ID, date reserved, and expected date of availability.

### **Relationships:**

- A book can be written by one or more authors.
- A member can borrow multiple books, but a book can be borrowed by only one member at a time.
- A librarian registers books and members, and processes loans.
- A book can belong to only one category, but each category can have multiple books.
- A member can reserve a book, and a reservation is associated with a specific book.
- A loan can involve only one member and one book, but a member can have multiple loans at the same time.

### **Tasks:**

1. **Draw the ER Diagram** for the Library Management System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** for each entity or relationship that you think are important.
4. **Provide a brief explanation** of how the ER diagram handles real-world scenarios, such as handling overdue books or the process of reserving a book.

## **2. Design an ER Diagram for an E-Commerce Platform.**

In your ER diagram, include the following entities and their relationships:

1. **Customers** – A customer can place orders on the platform. Each customer has a unique customer ID, name, email address, phone number, and shipping address.
2. **Products** – Each product is sold on the platform. Each product has a unique product ID, name, description, price, stock quantity, and category.
3. **Orders** – An order is placed by a customer and contains one or more products. Each order has a unique order ID, order date, status (e.g., pending, shipped, delivered), and total amount.
4. **Order\_Items** – This represents the specific products in an order. Each entry includes the order ID, product ID, quantity of the product ordered, and price at the time of order.
5. **Payments** – A payment is made for an order. Each payment has a unique payment ID, payment method (credit card, PayPal, etc.), payment date, and payment status.
6. **Categories** – Products can belong to one or more categories (e.g., electronics, clothing, etc.). Each category has a unique category ID and name.
7. **Shopping Cart** – A shopping cart holds products that a customer intends to purchase. The cart can hold multiple products, and each cart entry has a quantity for each product.
8. **Reviews** – Customers can leave reviews for products. Each review includes a unique review ID, rating (1-5 stars), review text, and date of submission.
9. **Shipping** – Shipping information is associated with each order. It includes shipping ID, shipping address, shipping method, and shipping status.

### **Relationships:**

- A customer can place many orders, but each order is placed by one customer.
- An order can contain multiple products, and a product can appear in multiple orders.
- A customer can leave multiple reviews for different products, but each review is for only one product.
- An order can have only one payment, but a payment can be linked to one or more orders (in case of partial payments).
- A product can belong to one or more categories, and a category can contain multiple products.
- A shopping cart can contain many products, and a product can appear in many shopping carts.
- A shipping record is associated with a specific order, and each order can have only one shipping record.

### **Tasks:**

1. **Draw the ER Diagram** for the E-Commerce Platform based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship.

4. **Provide a brief explanation** of how the ER diagram handles key features of the E-Commerce Platform, such as handling multiple payment methods, managing product categories, or tracking the status of an order.

### 3. Design an ER Diagram for a Hospital Management System.

In your ER diagram, include the following entities and their relationships:

1. **Patients** – A patient is someone receiving treatment in the hospital. Each patient has a unique patient ID, name, age, gender, contact information, and medical history.
2. **Doctors** – A doctor provides treatment to patients. Each doctor has a unique doctor ID, name, specialization (e.g., cardiology, pediatrics), contact information, and working hours.
3. **Appointments** – An appointment is made by a patient to see a doctor. Each appointment has a unique appointment ID, date, time, and appointment status (e.g., scheduled, completed, canceled).
4. **Departments** – Doctors are assigned to specific departments in the hospital (e.g., Emergency, Cardiology). Each department has a unique department ID, name, and location.
5. **Nurses** – Nurses assist doctors and take care of patients. Each nurse has a unique nurse ID, name, and contact information.
6. **Medications** – Patients are prescribed medications by doctors. Each medication has a unique medication ID, name, dosage, and instructions.
7. **Prescriptions** – A prescription is issued by a doctor for a patient. Each prescription has a unique prescription ID, the date issued, and the details of the medications prescribed.
8. **Rooms** – A room is assigned to a patient for their treatment. Each room has a unique room ID, room type (e.g., ICU, general ward), and room capacity.
9. **Bills** – A bill is generated for a patient based on the treatments, medications, and services received. Each bill has a unique bill ID, date issued, total amount, and payment status.
10. **Surgeries** – A surgery is performed on a patient. Each surgery has a unique surgery ID, type of surgery, date, and cost.
11. **Tests** – Patients may undergo various tests (e.g., blood tests, X-rays). Each test has a unique test ID, test name, date conducted, and result.

#### Relationships:

- A patient can have multiple appointments, but each appointment is for one specific patient.
- A doctor can see many patients through appointments, but each appointment is with one specific doctor.
- A doctor belongs to one department, and each department can have multiple doctors.
- A nurse assists multiple patients, and each patient may be assisted by multiple nurses.
- A patient can be prescribed multiple medications, and each medication is associated with one prescription.
- A patient may be assigned to multiple rooms, but each room is associated with one patient at a time.

- A patient can receive multiple bills, and each bill is for one patient.
- A patient can undergo multiple tests, and each test is associated with one patient.
- A patient may undergo one or more surgeries, but each surgery is for one specific patient.
- A prescription can include multiple medications, and a medication can be included in multiple prescriptions.
- A surgery may require multiple tests before it is performed, and a test can be associated with multiple surgeries.

**Tasks:**

1. **Draw the ER Diagram** for the Hospital Management System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship.
4. **Provide a brief explanation** of how the ER diagram handles key features of the Hospital Management System, such as patient treatment, medication management, and billing.

#### **4. Design an ER Diagram for an Employee Management System.**

In your ER diagram, include the following entities and their relationships:

1. **Employees** – Each employee has a unique employee ID, name, date of birth, gender, contact information, hire date, and salary.
2. **Departments** – Employees are assigned to departments within the company. Each department has a unique department ID, name, and location.
3. **Managers** – Managers oversee the employees in the organization. Each manager is an employee but with additional responsibilities. A manager has a unique manager ID (which is also an employee ID), and manages one or more employees.
4. **Positions** – Employees hold specific positions or job titles (e.g., software engineer, HR specialist, etc.). Each position has a unique position ID, title, and salary grade.
5. **Projects** – Employees can be assigned to projects. Each project has a unique project ID, name, start date, end date, and budget.
6. **Work Assignments** – A work assignment links employees to specific projects. It records the hours worked, role on the project, and the start and end dates for the assignment.
7. **Payroll** – Employees are paid according to the payroll system. Each payroll record has a unique payroll ID, payment date, salary amount, and payment method (e.g., direct deposit, check).
8. **Skills** – Employees have different skills. Each skill has a unique skill ID, name, and description.
9. **Training Programs** – Employees can attend training programs to improve their skills. Each training program has a unique training ID, name, duration, and content.
10. **Attendance** – Employee attendance is tracked. Each attendance record includes the employee ID, date, status (e.g., present, absent, sick leave), and the time clocked in and out.

## **Relationships:**

- An employee can belong to only one department, but a department can have multiple employees.
- An employee can hold one position at a time, but each position can be held by multiple employees.
- An employee can work on multiple projects, and a project can have multiple employees.
- A manager manages one or more employees, but each employee reports to one manager (this could be a self-referential relationship).
- An employee can have multiple work assignments, but each work assignment is specific to one employee and one project.
- An employee can receive multiple payroll records, but each payroll record is associated with only one employee.
- Employees can have multiple skills, and each skill can be associated with multiple employees.
- An employee can attend multiple training programs, and each training program can have multiple employees enrolled.
- An employee can have multiple attendance records, and each attendance record is associated with one employee.

## **Tasks:**

1. **Draw the ER Diagram** for the Employee Management System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship.
4. **Provide a brief explanation** of how the ER diagram handles key features of an Employee Management System, such as payroll management, attendance tracking, and employee skills development.

## **5. Design an ER Diagram for a Hotel Booking System.**

In your ER diagram, include the following entities and their relationships:

1. **Guests** – A guest is a person who books a room. Each guest has a unique guest ID, name, contact information, and check-in/check-out history.
2. **Rooms** – The hotel has multiple rooms. Each room has a unique room ID, room type (e.g., single, double, suite), room price, and availability status.
3. **Bookings** – A booking is made by a guest for one or more rooms. Each booking has a unique booking ID, check-in date, check-out date, and booking status (e.g., confirmed, canceled, pending).
4. **Payments** – A payment is made by a guest for the booking. Each payment has a unique payment ID, payment amount, payment method (e.g., credit card, cash), and payment date.

5. **Employees** – Employees manage the hotel and assist guests. Each employee has a unique employee ID, name, job title, contact information, and department (e.g., front desk, housekeeping).
6. **Services** – The hotel provides additional services (e.g., spa, laundry, room service). Each service has a unique service ID, name, description, and price.
7. **Service\_Requests** – Guests can request additional services during their stay. Each service request has a unique request ID, request date, and service status (e.g., pending, completed).
8. **Rooms\_Services** – A relationship between rooms and services indicating which services are available to each room. This helps track which services are associated with a particular room (e.g., spa in a suite).
9. **Reviews** – After their stay, guests can leave reviews about the hotel and rooms. Each review has a unique review ID, rating (1-5 stars), review text, and submission date.
10. **Hotel** – The hotel entity includes hotel-specific details like name, address, location, and the number of rooms available.

### **Relationships:**

- A guest can make multiple bookings, but each booking is made by one specific guest.
- A booking can include one or more rooms, and each room can be booked multiple times by different guests, but only for different dates.
- A booking may have multiple payments (in case of installment payments), but each payment is linked to only one booking.
- An employee can handle multiple bookings or services, but each booking is handled by one employee.
- A guest can request multiple services during their stay, and each service can be requested by multiple guests.
- A room can be associated with multiple services (e.g., spa service available in the suite), and each service can be available in multiple rooms.
- A guest can leave multiple reviews, but each review is for one specific room or service.
- Each room belongs to a specific hotel, but a hotel can have multiple rooms.
- Each service request is associated with one specific room, and each service can be requested by multiple rooms.

### **Tasks:**

1. **Draw the ER Diagram** for the Hotel Booking System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., payment method, service status).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Hotel Booking System, such as room availability, service requests, guest reviews, and payment tracking.

## **6. Design an ER Diagram for an Inventory Management System.**

In your ER diagram, include the following entities and their relationships:

1. **Products** – Each product has a unique product ID, name, description, price, and stock quantity.
2. **Suppliers** – A supplier provides products to the inventory. Each supplier has a unique supplier ID, name, contact information (address, phone number, email), and payment terms.
3. **Categories** – Products are grouped into categories (e.g., electronics, furniture, clothing). Each category has a unique category ID and category name.
4. **Customers** – Customers place orders for products. Each customer has a unique customer ID, name, address, phone number, and email.
5. **Orders** – An order is placed by a customer for one or more products. Each order has a unique order ID, order date, delivery date, and order status (e.g., pending, shipped, delivered).
6. **Order\_Items** – This represents the specific products in an order. Each entry includes the order ID, product ID, quantity ordered, and price at the time of the order.
7. **Stock\_Transactions** – This tracks all inventory transactions, such as product stock additions or removals. Each stock transaction has a unique transaction ID, product ID, quantity, and transaction type (e.g., stock-in, stock-out).
8. **Payments** – Payments are made by customers for orders. Each payment has a unique payment ID, payment amount, payment method (e.g., credit card, bank transfer), and payment date.
9. **Warehouses** – The inventory is stored in different warehouses. Each warehouse has a unique warehouse ID, name, location, and capacity.
10. **Employees** – Employees manage inventory and order fulfillment. Each employee has a unique employee ID, name, job title, and contact information.

### **Relationships:**

- A product can belong to only one category, but each category can have multiple products.
- A supplier can supply multiple products, and each product can be supplied by multiple suppliers (many-to-many relationship).
- A customer can place multiple orders, but each order is associated with one customer.
- An order can contain multiple products, and each product can appear in multiple orders (many-to-many relationship through the order\_items table).
- A customer can make multiple payments, and each payment is linked to one order.
- A stock transaction involves one product, but each product can have multiple stock transactions.
- An employee can manage multiple stock transactions and orders, but each transaction is managed by one employee.
- A product is stored in one or more warehouses, and each warehouse can store multiple products.

- A warehouse can hold many products, and each product can be stored in multiple warehouses (many-to-many relationship).
- A product's stock quantity is updated based on stock transactions (e.g., stock-in or stock-out).

**Tasks:**

1. **Draw the ER Diagram** for the Inventory Management System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., stock expiration dates, payment status).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Inventory Management System, such as stock tracking, order fulfillment, supplier management, and payment processing.

## 7. Design an ER Diagram for a Social Media Platform.

In your ER diagram, include the following entities and their relationships:

1. **Users** – A user is someone who registers on the platform. Each user has a unique user ID, name, email address, username, password, and profile information (e.g., bio, profile picture).
2. **Posts** – A user can create posts, which can be text, images, or videos. Each post has a unique post ID, content (text, media URL), timestamp, and the ID of the user who created it.
3. **Comments** – Users can comment on posts. Each comment has a unique comment ID, content, timestamp, and is associated with one specific post and one user.
4. **Likes** – Users can like posts and comments. Each like has a unique like ID, timestamp, and is associated with either a post or a comment, and a user.
5. **Friends** – Users can connect with other users as friends. Each friendship has a unique friendship ID, and includes two users (user A and user B), along with the status of the friendship (e.g., pending, accepted).
6. **Messages** – Users can send private messages to each other. Each message has a unique message ID, content, timestamp, and is associated with the sender and receiver (both users).
7. **Groups** – Users can create or join groups. Each group has a unique group ID, group name, description, and group type (e.g., public, private).
8. **Group Posts** – Users can post content in groups. Each group post has a unique post ID, content, timestamp, and is associated with one group and one user.
9. **Notifications** – Users receive notifications for activities related to their posts, comments, likes, or friends. Each notification has a unique notification ID, type (e.g., like, comment, friend request), timestamp, and is associated with a specific user.

10. **Media** – Users can upload images, videos, or other media. Each media file has a unique media ID, media type (e.g., image, video), URL, and is associated with posts, comments, or messages.

### **Relationships:**

- A user can create multiple posts, but each post is created by one user.
- A post can have multiple comments, but each comment is associated with only one post.
- A comment can be liked by multiple users, and a user can like multiple comments.
- A user can have multiple friends, and a friendship involves two users. A friendship can have two statuses: pending or accepted.
- A user can send multiple messages, and each message is sent from one user to another.
- A user can join or create multiple groups, and a group can have multiple users.
- A group can have multiple group posts, and each group post is created by one user.
- A user can receive multiple notifications, and each notification is associated with one user.
- A post or a comment can have multiple media files (images, videos), but each media file is linked to one post, comment, or message.
- A user can have multiple media files uploaded, and each media file can be associated with multiple posts, comments, or messages.

### **Tasks:**

1. **Draw the ER Diagram** for the Social Media Platform based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., privacy settings, media file size, notification read status).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Social Media Platform, such as user interactions, content creation, and social connections.

## **8. Design an ER Diagram for an Online Banking System.**

In your ER diagram, include the following entities and their relationships:

1. **Customers** – A customer is someone who has an account in the bank. Each customer has a unique customer ID, name, address, phone number, email, and date of birth.
2. **Accounts** – Each customer has one or more accounts. Each account has a unique account ID, account type (e.g., savings, checking), balance, and date of opening.
3. **Transactions** – Transactions represent the movement of money between accounts. Each transaction has a unique transaction ID, transaction type (e.g., deposit, withdrawal, transfer), amount, date, and is associated with a source and destination account.

4. **Employees** – Employees manage customer accounts and transactions. Each employee has a unique employee ID, name, job title, department (e.g., teller, loan officer), and contact information.
5. **Loans** – Customers can apply for loans. Each loan has a unique loan ID, loan type (e.g., home, car, personal), loan amount, interest rate, payment schedule, and the customer who applied for the loan.
6. **Payments** – Payments are made by customers to repay loans. Each payment has a unique payment ID, payment date, amount, and is associated with one specific loan.
7. **Branches** – The bank has multiple branches, each with unique branch ID, name, location, and branch manager (an employee).
8. **Credit\_Cards** – Customers can apply for credit cards. Each credit card has a unique card number, credit limit, and due date for payments.
9. **Card\_Transactions** – Card transactions represent purchases made by customers using their credit card. Each card transaction has a unique transaction ID, transaction type (e.g., purchase, payment), amount, and date.
10. **Bills** – Customers can pay their utility bills through their bank accounts. Each bill has a unique bill ID, bill type (e.g., electricity, water, internet), amount, and due date.

### **Relationships:**

- A customer can have multiple accounts, but each account is associated with one specific customer.
- An account can have multiple transactions, but each transaction is associated with one source and one destination account.
- An employee can manage multiple accounts or transactions, but each transaction or account is handled by a specific employee.
- A customer can apply for multiple loans, but each loan is linked to only one customer.
- A loan can have multiple payments, but each payment is associated with one loan.
- A customer can have one or more credit cards, and each credit card is linked to only one customer.
- A credit card can have multiple card transactions, and each card transaction is associated with one card.
- A branch can have multiple employees, and each employee works at one branch.
- A customer can pay multiple bills through their bank account, but each bill is associated with one customer and one payment.

### **Tasks:**

1. **Draw the ER Diagram** for the Online Banking System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., transaction status, loan approval date, card expiration date).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Online Banking System, such as account management, transactions, loan repayment, and credit card usage.

## 9. Design an ER Diagram for a Movie Database System.

In your ER diagram, include the following entities and their relationships:

1. **Movies** – Each movie has a unique movie ID, title, release date, genre, language, and description.
2. **Actors** – Actors perform in movies. Each actor has a unique actor ID, name, date of birth, and gender.
3. **Directors** – Directors direct movies. Each director has a unique director ID, name, date of birth, and gender.
4. **Producers** – Producers are responsible for producing movies. Each producer has a unique producer ID, name, and contact information.
5. **Genres** – Each movie belongs to one or more genres (e.g., Action, Comedy, Drama, etc.). Each genre has a unique genre ID and genre name.
6. **Reviews** – Users can write reviews for movies. Each review has a unique review ID, rating (1-5 stars), review text, and date of submission.
7. **Users** – Users are registered to write reviews for movies. Each user has a unique user ID, name, email, and registration date.
8. **Cinemas** – Movies are shown in cinemas. Each cinema has a unique cinema ID, name, location, and seating capacity.
9. **Showings** – Movies are shown at specific times and locations in cinemas. Each showing has a unique showing ID, date, time, cinema ID, and movie ID.
10. **Awards** – Movies can win awards. Each award has a unique award ID, award name, and year it was given.

### Relationships:

- A movie can have multiple actors, and each actor can act in multiple movies (many-to-many relationship).
- A movie can have only one director, but a director can direct multiple movies (one-to-many relationship).
- A movie can have multiple producers, and each producer can produce multiple movies (many-to-many relationship).
- A movie can belong to multiple genres, and each genre can be associated with multiple movies (many-to-many relationship).
- A movie can have multiple reviews, but each review is associated with one movie and one user.
- A user can write multiple reviews, and each review is written by one user (one-to-many relationship).
- A movie can have multiple showings, but each showing is for one specific movie at a particular cinema at a particular time (one-to-many relationship).
- A cinema can host multiple showings, but each showing is associated with one cinema.
- A movie can win multiple awards, and each award is associated with one or more movies (many-to-many relationship).

### Tasks:

1. **Draw the ER Diagram** for the Movie Database System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., movie duration, show time, review helpfulness).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Movie Database System, such as movie ratings, multiple genres, showings, and reviews.

## 10. Design an ER Diagram for a Restaurant Management System.

In your ER diagram, include the following entities and their relationships:

1. **Customers** – A customer is someone who visits the restaurant. Each customer has a unique customer ID, name, contact information (phone, email), and membership status (e.g., regular, VIP).
2. **Reservations** – Customers can make reservations in advance. Each reservation has a unique reservation ID, date, time, and the number of people attending.
3. **Tables** – The restaurant has multiple tables. Each table has a unique table ID, seating capacity, and status (e.g., available, reserved, occupied).
4. **Menus** – The restaurant offers a variety of dishes. Each menu has a unique menu ID, name (e.g., appetizers, main course), and description.
5. **Menu\_Items** – Each menu contains multiple menu items. Each menu item has a unique item ID, name, description, price, and is associated with one or more menus.
6. **Orders** – Customers can place orders for food during their visit. Each order has a unique order ID, order date, and total amount.
7. **Order\_Items** – An order can consist of multiple menu items. Each order item has a unique order item ID, quantity, and price at the time of order.
8. **Payments** – Payments are made by customers to pay for their orders. Each payment has a unique payment ID, payment amount, payment method (e.g., cash, card), and payment date.
9. **Staff** – Staff members work in the restaurant, such as chefs, servers, and managers. Each staff member has a unique staff ID, name, role, and contact information.
10. **Shifts** – Staff members work in shifts. Each shift has a unique shift ID, start time, end time, and is associated with one or more staff members.
11. **Reviews** – Customers can leave reviews for the restaurant. Each review has a unique review ID, rating (1-5 stars), review text, and submission date.
12. **Suppliers** – The restaurant sources ingredients and supplies from suppliers. Each supplier has a unique supplier ID, name, contact information, and type of supplies (e.g., vegetables, meats, beverages).

### Relationships:

- A customer can make multiple reservations, but each reservation is associated with one specific customer.

- A reservation is linked to one table, and each table can have multiple reservations over time.
- A reservation is for one specific date and time, and a customer can make multiple reservations.
- A table can be associated with multiple orders, but each order is linked to one specific table.
- A customer can place multiple orders, but each order is associated with one specific customer.
- A menu can have multiple menu items, but each menu item belongs to one menu.
- A menu item can be included in multiple orders, and each order item refers to one menu item.
- A customer can make multiple payments, but each payment is associated with one specific order.
- A staff member works in one or more shifts, and each shift is assigned to multiple staff members.
- A staff member can handle multiple orders, and each order is managed by one or more staff members.
- A review is associated with one customer and one restaurant, but each customer can leave multiple reviews.
- A supplier can supply multiple ingredients, and each ingredient is linked to one or more suppliers.

**Tasks:**

1. **Draw the ER Diagram** for the Restaurant Management System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., staff salary, payment status).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Restaurant Management System, such as order management, reservation handling, staff scheduling, and review collection.

## 11. Design an ER Diagram for a Bookstore System.

In your ER diagram, include the following entities and their relationships:

1. **Books** – Each book has a unique book ID, title, author, genre, publication year, price, and stock quantity.
2. **Authors** – Each author has a unique author ID, name, biography, and date of birth.
3. **Customers** – A customer is someone who buys books. Each customer has a unique customer ID, name, contact information (email, phone number), and membership status (e.g., regular, premium).

4. **Orders** – Customers place orders for books. Each order has a unique order ID, order date, total amount, and order status (e.g., completed, pending, canceled).
5. **Order\_Items** – An order can contain multiple books. Each order item includes the book ID, order ID, quantity, and price at the time of the order.
6. **Payments** – Payments are made by customers for their orders. Each payment has a unique payment ID, payment amount, payment method (e.g., credit card, cash), and payment date.
7. **Categories** – Books are categorized into different categories (e.g., Fiction, Non-fiction, Science, Literature). Each category has a unique category ID and category name.
8. **Suppliers** – Books are supplied by suppliers. Each supplier has a unique supplier ID, name, contact information, and the types of books they provide.
9. **Staff** – Staff members manage the bookstore, handle orders, and assist customers. Each staff member has a unique staff ID, name, role (e.g., cashier, manager), and contact information.
10. **Discounts** – The bookstore offers discounts on books. Each discount has a unique discount ID, discount percentage, start date, and end date.
11. **Reviews** – Customers can leave reviews for books. Each review has a unique review ID, rating (1-5 stars), review text, and submission date.
12. **Shippers** – Orders are shipped by shippers. Each shipper has a unique shipper ID, name, and contact information.

### **Relationships:**

- A book can be written by one or more authors, and each author can write multiple books (many-to-many relationship).
- A book can belong to one category, but a category can have multiple books (one-to-many relationship).
- A customer can place multiple orders, but each order is associated with one specific customer.
- An order can have multiple order items, and each order item is linked to one book.
- A customer can make multiple payments, but each payment is linked to one specific order.
- A supplier can provide multiple books, and each book can be supplied by one or more suppliers (many-to-many relationship).
- A staff member manages one or more orders, but each order is managed by one specific staff member.
- A customer can leave multiple reviews, but each review is linked to one book and one customer.
- A book can have multiple reviews, but each review is associated with only one book.
- An order can have only one shipper, but each shipper can ship multiple orders (one-to-many relationship).
- A book can have multiple discounts over time, and each discount applies to multiple books (many-to-many relationship).

### **Tasks:**

1. **Draw the ER Diagram** for the Bookstore System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., order shipping address, discount conditions, payment status).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Bookstore System, such as book management, order fulfillment, customer feedback, and shipping.

## 12. Design an ER Diagram for a Food Delivery System.

In your ER diagram, include the following entities and their relationships:

1. **Customers** – A customer is someone who places food orders for delivery. Each customer has a unique customer ID, name, contact information (phone number, email, address), and membership status (e.g., regular, premium).
2. **Restaurants** – The system has multiple restaurants offering various cuisines. Each restaurant has a unique restaurant ID, name, location, and contact details.
3. **Menus** – Each restaurant has a menu that lists the available dishes. Each menu has a unique menu ID and is associated with one restaurant.
4. **Menu\_Items** – A menu contains multiple menu items (e.g., pizza, pasta). Each menu item has a unique item ID, name, description, price, and is linked to one menu.
5. **Orders** – Customers place orders through the system. Each order has a unique order ID, order date, order status (e.g., pending, in progress, delivered), total cost, and is associated with one customer.
6. **Order\_Items** – An order can consist of multiple menu items. Each order item includes the order ID, item ID, quantity, and price at the time of the order.
7. **Payments** – Customers make payments for their orders. Each payment has a unique payment ID, payment amount, payment date, and payment method (e.g., credit card, cash, online payment).
8. **Delivery\_Partners** – Delivery partners (drivers) are responsible for delivering the food. Each delivery partner has a unique partner ID, name, vehicle type (e.g., bike, car), and contact information.
9. **Deliveries** – Each order is assigned to a delivery partner for delivery. Each delivery has a unique delivery ID, delivery date, delivery time, delivery status (e.g., dispatched, in transit, delivered), and is linked to one order and one delivery partner.
10. **Reviews** – Customers can leave reviews for the restaurant and its food. Each review has a unique review ID, rating (1-5 stars), review text, and is associated with one restaurant and one customer.
11. **Promotions** – The system offers promotions and discounts on food orders. Each promotion has a unique promotion ID, promotion type (e.g., percentage off, fixed discount), start date, end date, and is linked to one or more menu items.
12. **Addresses** – Customers can have multiple delivery addresses. Each address has a unique address ID, type (e.g., home, office), and location (street, city, zip code).

## **Relationships:**

- A customer can place multiple orders, but each order is linked to one customer.
- A restaurant can have multiple menus, and each menu is linked to one restaurant.
- A menu can contain multiple menu items, but each menu item belongs to one menu.
- An order can contain multiple order items, and each order item is linked to one menu item.
- A customer can make multiple payments, but each payment is linked to one specific order.
- A delivery partner can deliver multiple orders, and each order is linked to one delivery partner.
- An order can have one delivery, but each delivery is linked to one specific order.
- A restaurant can have multiple reviews, and each review is linked to one restaurant and one customer.
- A promotion can apply to multiple menu items, and each menu item can be associated with multiple promotions (many-to-many relationship).
- A customer can have multiple addresses, but each address is associated with one customer.

## **Tasks:**

1. **Draw the ER Diagram** for the Food Delivery System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., delivery charges, special instructions, promotion conditions).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Food Delivery System, such as order management, restaurant listings, delivery tracking, and customer reviews.

## **13.Design an ER Diagram for a Sports Tournament System.**

In your ER diagram, include the following entities and their relationships:

1. **Tournaments** – A tournament is an event where teams compete. Each tournament has a unique tournament ID, name, start date, end date, location, and tournament type (e.g., league, knockout).
2. **Teams** – A team participates in tournaments. Each team has a unique team ID, name, coach, and home country or city.
3. **Players** – Players are part of teams and participate in tournaments. Each player has a unique player ID, name, date of birth, nationality, position, and team ID (linking the player to a team).

4. **Matches** – A match takes place between two teams in a tournament. Each match has a unique match ID, tournament ID, date, time, team1 ID, team2 ID, score1, score2, and match status (e.g., scheduled, completed, postponed).
5. **Scores** – The score for each match is recorded, which is associated with the two competing teams. Each score has a unique score ID, match ID, team ID, and score value.
6. **Referees** – Referees officiate matches during the tournament. Each referee has a unique referee ID, name, nationality, and contact details.
7. **Match\_Officials** – A match can have multiple officials (e.g., referees, assistants) overseeing it. Each match\_official has a unique ID and is associated with one referee and one match.
8. **Venues** – Venues are the locations where matches are held. Each venue has a unique venue ID, name, location, and seating capacity.
9. **Sponsors** – Sponsors provide financial support for tournaments and teams. Each sponsor has a unique sponsor ID, name, contact details, and type of sponsorship (e.g., cash, equipment).
10. **Tickets** – Tickets are sold to spectators for matches. Each ticket has a unique ticket ID, price, match ID, venue ID, and customer information (customer ID, name, contact).
11. **Fans** – Fans attend matches and purchase tickets. Each fan has a unique fan ID, name, contact information, and associated fan club (if applicable).
12. **Prize\_Money** – Tournaments often offer prize money to winners. Each prize has a unique prize ID, tournament ID, prize amount, and winner team.

### **Relationships:**

- A tournament can have multiple teams, but each team participates in one or more tournaments (many-to-many relationship).
- A team can have multiple players, but each player belongs to one team.
- A match takes place between two teams, and each match belongs to one tournament. A tournament can have multiple matches (one-to-many relationship).
- A match can have multiple referees, and each referee officiates multiple matches (many-to-many relationship).
- A match takes place at one venue, but a venue can host multiple matches (one-to-many relationship).
- A team can have multiple sponsors, and each sponsor can sponsor multiple teams (many-to-many relationship).
- A fan can purchase multiple tickets, and each ticket is associated with one fan (one-to-many relationship).
- A tournament can have one or more prize money awards, and each prize is linked to one tournament (one-to-many relationship).
- Each match has a score, which is linked to two teams, recording the score for each team in the match (one-to-one relationship between match and score).

### **Tasks:**

1. **Draw the ER Diagram** for the Sports Tournament System based on the entities and relationships described above.

2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., match duration, referee qualifications, ticket types).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Sports Tournament System, such as tournament management, team participation, scoring, and ticket sales.

## 14. Design an ER Diagram for a Job Portal System.

In your ER diagram, include the following entities and their relationships:

1. **Job Seekers** – A job seeker is a person searching for employment. Each job seeker has a unique seeker ID, name, email, contact information, qualifications, experience, resume (linked to a document), and a preferred job type (e.g., full-time, part-time, freelance).
2. **Employers** – Employers post job openings and hire candidates. Each employer has a unique employer ID, company name, company contact information, industry, and company profile.
3. **Jobs** – Employers post job listings on the portal. Each job has a unique job ID, job title, description, required skills, location, salary range, job type (e.g., full-time, part-time, internship), and is linked to one employer.
4. **Applications** – A job seeker can apply for multiple jobs, and an employer can receive multiple applications for a single job. Each application has a unique application ID, job ID, seeker ID, application date, application status (e.g., pending, shortlisted, rejected), and any additional documents (e.g., cover letter).
5. **Interviews** – Employers may schedule interviews with job seekers for shortlisted applications. Each interview has a unique interview ID, job ID, seeker ID, interview date, interview time, interview location (e.g., office, virtual), and interview status (e.g., scheduled, completed).
6. **Resumes** – A job seeker can upload one or more resumes to the portal. Each resume has a unique resume ID, file format (e.g., PDF, DOCX), and is linked to one job seeker.
7. **Job Categories** – Jobs can be categorized into different types (e.g., IT, Marketing, Sales). Each category has a unique category ID and category name.
8. **Skills** – Jobs require certain skills. Each skill has a unique skill ID and skill name (e.g., Python, communication, project management). Each job can require one or more skills, and each job seeker can possess multiple skills.
9. **Job Alerts** – Job seekers can create job alerts to receive notifications about relevant job openings. Each job alert has a unique alert ID, job type preference, category preference, and notification method (e.g., email, SMS).
10. **Job Offers** – Once a job seeker is selected for a role, they may receive a job offer. Each offer has a unique offer ID, offer date, salary details, and job seeker ID (linked to a specific job offer).
11. **Reviews** – Job seekers can leave reviews for employers. Each review has a unique review ID, rating (e.g., 1-5 stars), review text, and is linked to one job seeker and one employer.

12. **Admin** – The system is managed by an admin. The admin has a unique admin ID, name, email, and manages the platform by overseeing job listings, user accounts, and system data.

### **Relationships:**

- A job seeker can apply for multiple jobs, and each job can receive multiple applications (many-to-many relationship between job seekers and jobs).
- An application is linked to one job and one seeker (many-to-one relationship between applications and jobs, applications and seekers).
- A job seeker can schedule and attend multiple interviews, and each interview is linked to one job and one seeker (many-to-one relationship between interviews and jobs, interviews and seekers).
- A resume is linked to one job seeker, but each job seeker can have multiple resumes (one-to-many relationship between job seekers and resumes).
- A job belongs to one category, but each category can have multiple jobs (one-to-many relationship between categories and jobs).
- A job requires multiple skills, and a skill can be required by multiple jobs (many-to-many relationship between jobs and skills).
- A job seeker can create multiple job alerts, and each job alert is linked to one job seeker (one-to-many relationship between job seekers and job alerts).
- A job offer is linked to one job seeker and one job (many-to-one relationship between offers and seekers, offers and jobs).
- A job seeker can leave multiple reviews for different employers, but each review is linked to one job seeker and one employer (many-to-one relationship between reviews and job seekers, reviews and employers).
- A system admin can oversee many job listings, job seekers, employers, and applications (one-to-many relationships between admin and platform data).

### **Tasks:**

1. **Draw the ER Diagram** for the Job Portal System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., application deadline, interview feedback, job alert frequency).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Job Portal System, such as job applications, employer reviews, skill matching, and job alerts.

## **15. Design an ER Diagram for a Transportation System.**

In your ER diagram, include the following entities and their relationships:

1. **Passengers** – A passenger is a person who uses the transportation system to travel. Each passenger has a unique passenger ID, name, contact information, and payment method (e.g., credit card, cash, e-wallet).
2. **Vehicles** – Vehicles are used for transporting passengers. Each vehicle has a unique vehicle ID, vehicle type (e.g., bus, train, car), license plate number, capacity, and status (e.g., available, in service, under maintenance).
3. **Routes** – A route represents a predefined path that a vehicle follows to transport passengers. Each route has a unique route ID, route name, start point, endpoint, distance, and duration.
4. **Trips** – A trip is an instance of a vehicle traveling along a specific route. Each trip has a unique trip ID, route ID, vehicle ID, departure time, arrival time, and trip status (e.g., scheduled, completed, delayed).
5. **Tickets** – Passengers purchase tickets to travel on a trip. Each ticket has a unique ticket ID, trip ID, passenger ID, seat number, price, and ticket status (e.g., booked, canceled, confirmed).
6. **Bookings** – A passenger can make multiple bookings. Each booking has a unique booking ID, booking date, booking status (e.g., confirmed, pending), and is associated with one or more tickets.
7. **Drivers** – Drivers operate the vehicles. Each driver has a unique driver ID, name, contact details, license type, and is assigned to one or more vehicles.
8. **Stations** – Stations are the locations where vehicles pick up and drop off passengers. Each station has a unique station ID, name, location (e.g., city, address), and type (e.g., bus station, train station).
9. **Payments** – Payments are made by passengers for their tickets. Each payment has a unique payment ID, payment amount, payment method (e.g., credit card, PayPal), and payment status (e.g., completed, failed).
10. **Schedules** – Schedules define the timing of trips. Each schedule has a unique schedule ID, trip ID, departure time, arrival time, and is associated with a specific vehicle and route.
11. **Promotions** – The system may offer promotions or discounts on ticket prices. Each promotion has a unique promotion ID, promotion type (e.g., percentage off, fixed amount), start date, end date, and applies to one or more routes or trips.
12. **Maintenance** – Vehicles undergo periodic maintenance to ensure safety. Each maintenance record has a unique maintenance ID, vehicle ID, maintenance type (e.g., engine check, tire replacement), date, and cost.

### **Relationships:**

- A passenger can book multiple tickets, and each ticket is associated with one passenger (one-to-many relationship between passengers and tickets).
- A ticket is associated with one trip, and each trip can have multiple tickets (one-to-many relationship between trips and tickets).

- A trip is associated with one route, and each route can have multiple trips (one-to-many relationship between routes and trips).
- A trip is assigned to one vehicle, and each vehicle can be used for multiple trips (one-to-many relationship between vehicles and trips).
- A driver is assigned to one or more vehicles, and each vehicle is operated by one driver at a time (one-to-many relationship between drivers and vehicles).
- A vehicle can undergo multiple maintenance records, but each maintenance record is linked to one specific vehicle (one-to-many relationship between vehicles and maintenance).
- A station can serve multiple trips, and each trip can start and end at different stations (many-to-many relationship between trips and stations).
- A passenger can make multiple bookings, and each booking can contain multiple tickets (one-to-many relationship between bookings and tickets).
- A passenger can make multiple payments, and each payment is linked to one specific ticket (one-to-many relationship between passengers and payments).
- A promotion can apply to multiple trips, and each trip can have multiple promotions (many-to-many relationship between promotions and trips).

### **Tasks:**

1. **Draw the ER Diagram** for the Transportation System based on the entities and relationships described above.
2. **Define the cardinality** for each relationship (one-to-one, one-to-many, many-to-many).
3. **Describe any additional attributes** that would be useful for each entity or relationship (e.g., booking date, payment status, vehicle condition, schedule times).
4. **Provide a brief explanation** of how the ER diagram handles key features of the Transportation System, such as ticket booking, trip scheduling, vehicle maintenance, and payment processing.