**Entitles relations and cardinalities**

**Entities and keys**

1. **Book**

**Attributes:** ISBN (Primary Key), Title, Author, Genre, Publication Date, Price, Quantity Available, Weight, Description, Cover Image, Rating, Category, Subcategory .

1. **Customer**

**Attributes:** Customer ID (Primary Key), First Name, Last Name, Email, Shipping Address, Contact Number, Account Preferences, password.

1. **Order**

**Attributes:** Order ID (Primary Key), Customer ID (Foreign Key), Order Date, Total Amount, Payment Status, Shipping Address.

1. **Order Item**

**Attributes:** Order Item ID (Primary Key), Order ID (Foreign Key), ISBN (Foreign Key), Quantity, Price, Discount.

1. **Review**

**Attributes:** Review ID (Primary Key), ISBN (Foreign Key), Customer ID (Foreign Key), Rating, Review Text, Review Date.

1. **Wish List**

**Attributes:** Wish List ID (Primary Key), Customer ID (Foreign Key), ISBN (Foreign Key).

1. **Shipping**

**Attributes:** Shipping ID (Primary Key), Order ID (Foreign Key), Shipping Address, Delivery Status, Tracking Number, Estimated Delivery Date.

1. **Invoice**

**Attributes:** Invoice ID (Primary Key), Order ID (Foreign Key), Invoice Date, Total Amount.

1. **Preferences**

**Attributes:** Preference ID (Primary Key), Customer ID (Foreign Key), Favorite Genres, Favorite Authors, Recommendations.

**Cardinalities:**

**1. Book to Order Item**

**Cardinality**: **One-to-Many**

A **Book** can appear in many **Order Items** (as it can be purchased multiple times in different orders).

Each **Order Item** refers to one **Book** (each order item contains a specific book).

**2. Customer to Order**

**Cardinality**: **One-to-Many**

A **Customer** can place many **Orders**.

Each **Order** belongs to one **Customer**.

**3. Order to Order Item**

* **Cardinality**: **One-to-Many**

An **Order** can contain multiple **Order Items** (representing the different books purchased in one order).

Each **Order Item** refers to one **Order**.

**4. Customer to Review**

* **Cardinality**: **One-to-Many**

A **Customer** can write many **Reviews**.

Each **Review** is written by one **Customer**.

**5. Book to Review**

* **Cardinality**: **One-to-Many**

A **Book** can have many **Reviews** (from different customers).

Each **Review** is associated with one **Book**.

**6. Customer to Wish List**

* **Cardinality**: **One-to-Many**

A **Customer** can add many books to their **Wish List**.

Each **Wish List** item is associated with one **Customer** and one **Book**.

**7. Book to Wish List**

* **Cardinality**: **One-to-Many**

A **Book** can appear in the **Wish List** of many **Customers** (as multiple customers might add the same book to their wish list).

Each **Wish List** item is associated with one **Book**.

**8. Order to Shipping**

* **Cardinality**: **One-to-One**

Each **Order** has one associated **Shipping** record.

Each **Shipping** record is associated with one **Order**.

**9. Order to Invoice**

* **Cardinality**: **One-to-One**

Each **Order** generates one **Invoice**.

Each **Invoice** is associated with one **Order**.

**10. Customer to Preferences**

* **Cardinality**: **One-to-One**

Each **Customer** has one set of **Preferences** (which could include favorite genres, authors, and recommendations).

Each **Preferences** entry is associated with one **Customer**.

**Before Normalization**

**Book**:

ISBN (PK), Title, Author, Genre, Publication Date, Price, Quantity Available, Weight, Description, Cover Image, Rating, Category, Subcategory

**Customer**:

Customer ID (PK), First Name, Last Name, Email, Shipping Address, Contact Number, Account Preferences, Password

**Order**:

Order ID (PK), Customer ID (FK) → **Customer**, Order Date, Total Amount, Payment Status, Shipping Address

**Order Item**:

Order Item ID (PK), Order ID (FK) → **Order**, ISBN (FK) → **Book**, Quantity, Price, Discount

**Review**:

Review ID (PK), ISBN (FK) → **Book**, Customer ID (FK) → **Customer**, Rating, Review Text, Review Date

**Wish List**:

Wish List ID (PK), Customer ID (FK) → **Customer**, ISBN (FK) → **Book**

**Shipping**:

Shipping ID (PK), Order ID (FK) → **Order**, Shipping Address, Delivery Status, Tracking Number, Estimated Delivery Date

**Invoice**:

Invoice ID (PK), Order ID (FK) → **Order**, Invoice Date, Total Amount

**Preferences**:

Preference ID (PK), Customer ID (FK) → **Customer**, Favorite Genres, Favorite Authors, Recommendations

**After Normalization**

**Book**:

ISBN (PK), Title, Publication Date, Price, Quantity Available, Weight, Description, Cover Image, Rating

**Author**:

Author ID (PK), Name

**Book\_Author**:

ISBN (FK) → **Book**, Author ID (FK) → **Author**

**Category**:

Category ID (PK), Name

**Subcategory**:

Subcategory ID (PK), Category ID (FK) → **Category**, Name

**Book\_Category**:

ISBN (FK) → **Book**, Subcategory ID (FK) → **Subcategory**

**Customer**:

Customer ID (PK), First Name, Last Name, Email, Password

**Customer\_Contact**:

Contact ID (PK), Customer ID (FK) → **Customer**, Contact Number

**Customer\_Address**:

Address ID (PK), Customer ID (FK) → **Customer**, Address

**Order**:

Order ID (PK), Customer ID (FK) → **Customer**, Order Date, Total Amount, Payment Status

**Order Item**:

Order Item ID (PK), Order ID (FK) → **Order**, ISBN (FK) → **Book**, Quantity, Price, Discount

**Review**:

Review ID (PK), ISBN (FK) → **Book**, Customer ID (FK) → **Customer**, Rating, Review Text, Review Date

**Wish List**:

Wish List ID (PK), Customer ID (FK) → **Customer**, ISBN (FK) → **Book**

**Shipping**:

Shipping ID (PK), Order ID (FK) → **Order**, Address ID (FK) → **Customer\_Address**, Delivery Status, Tracking Number, Estimated Delivery Date

**Invoice**:

Invoice ID (PK), Order ID (FK) → **Order**, Invoice Date, Total Amount

**Preferences**:

Preference ID (PK), Customer ID (FK) → **Customer**

**Genre Preference**:

Preference ID (FK) → **Preferences**, Genre

**Author Preference**:

Preference ID (FK) → **Preferences**, Author ID → **Author**

**Recommendations**:

Recommendation ID (PK), Preference ID (FK) → **Preferences**, ISBN (FK) → **Book**