Problem 1: ER Diagram

You have been hired to develop an account management system for a company. The company sells packages that allow consumers to download books in either text or audio format. Draw the database ER diagram with the following information:

- A *package* allows the consumer to download a given number of books or audiobooks a month, depending on the package type.
- Each *package* has a unique *id*.
- Each *package* also must have a *type*, noting what kind of downloads it provides: either books or audiobooks but not both.
- Each *package* also must have a *tier*, representing the number of monthly downloads allowed by this package (e.g. “Tier10” means 10 monthly downloads are allowed, "Tier50" means 50 monthly downloads are allowed, etc.)
- Each *account* has a unique *id*.
- Each *account* has one or more *packages*.
- Each *account* is associated with one or more *credit cards*
- Each *credit card* is associated with exactly one *account*.
- Each *credit card* must have a short nickname to identify it to its account (e.g. “card1”, “visa”), a *credit card number*, and an *expiration date*
- Each *account* is owned by exactly one *customer*
- Each *customer* must have a customer *id*, a *name*, and one contact *email*, and may also specify one contact *phone number*.

Problem 2: ER Diagram continued

Answer the following questions based on your diagram from Problem 1:

1. Would expiration date be a good key for the Credit Card entity? Why or why not?
2. For the Package entity, which attributes must not be null? What about for the Customer entity?
3. There are two types of packages: book and audiobook. Using your knowledge of subclassing, introduce these as two new entities in the ER diagram. Add a reasonable attribute to each of the new entities. Can we eliminate the type attribute of the Package entity? Just redraw the relevant part of the diagram that needs to change.

Problem 3: ER Diagram translation

Answer the following questions based on your original diagram from Problem 1:

1. Translate the ER diagram from Problem 1 to a relational design. Try to minimize the number of relations your solution has, and merge relations where appropriate. Don't forget to specify the keys.
2. Translate the ER diagram from Problem 2 question 3 (only the Package entity and the two new entities) to a relational design using OO, ER, and NULL value approaches. Don't forget to specify the keys.

Problem 4: SQL commands - table and field definitions

Answer the following questions based on your relational design from Problem 3. The response to each question should be a valid SQL command:

1. Write the SQL command that would define each table. Your definition must include appropriate data types with reasonable sizes for each field, key and unique declarations, and NULL constraints for fields:
    1. Customer
    2. Account
    3. Credit Card
    4. Package
2. Insert one tuple into the Customer table. You can choose arbitrary values for the data fields of your tuple but they must conform to the table's defined constraints.
3. Rename the nickname field in the Credit Card table to cardID.
4. Change the type field in the Package table to have a default value of book, represented by the value 'B'.