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**Answer the following questions:**

**Total marks [60]**

**First question: [10 Marks]**

a) Define the following terms:

Database, DBMS, Database catalog, and Database schema. [4 M]

b) What is the difference between two-tier and three-tier client/server architectures? [4 M]

c) Discuss the differences between database systems and information retrieval systems. [2 M]

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**Second question: [14 Marks]**

Consider the following relations for a database that keeps track of guests, which booked rooms in the hotels.

Hotel (hotelNo, hotelName, city)

Room (roomNo, hotelNo, type, price)

Booking (hotelNo, guestNo, dateFrom, dateTo, roomNo)

Guest (guestNo, guestName, guestAddress)

a) Identify the foreign keys in this schema. [5 M]

b) Differentiate between super key, primary key, and candidate key. Give an example for each of these keys in this schema. [5 M]

c) Explain how the entity and referential integrity rules apply to these relations. [4 M]

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**Third question: [14 Marks]**

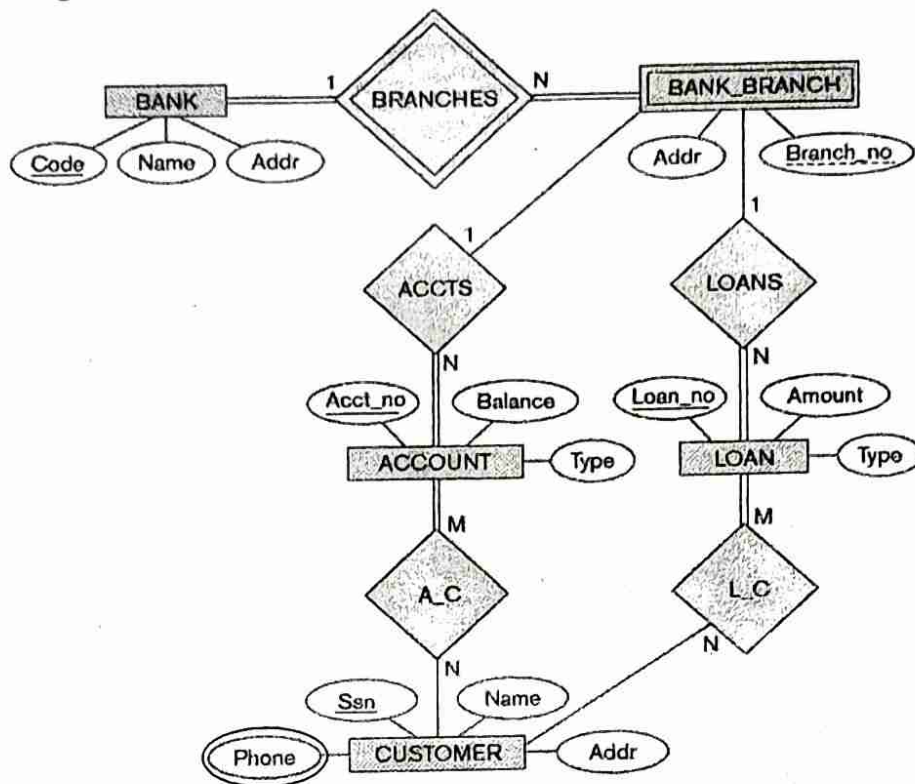
Model the following mini-world of an international wholesale supplier in ER diagram. The wholesale supplier has customers that place orders. Identify the keys and give the functionalities of all relationships.

- Orders are placed on a particular date and have a total price, current status, and an order number.
- Customers have a name, an address, a phone number, and a customer number and they come from a certain nation.
- Suppliers have a name, an address, a phone number, and supplier number and they come from a certain nation.
- Nation is from a particular region (of the world)
- Product have a brand, a size, and a retail price.
- In each order, a customer can order several products, each in a different quantity and at a (possibly discounted) price. We also want to model the date on which each of the products has been sent.

- The products are provided by suppliers. Each product may be provided by several suppliers and customers may order the same product of different suppliers in the same order, but in this case, they may have different (retail) prices.

**Fourth question: [10 Marks]**

Map the following ER diagram into a logical schema.



**Fifth question: [12 Marks]**

Consider the following relational schema describing the data for a grade book of a particular instructor.

CATALOG (Cno, Ctitle)

STUDENTS (Sid, Fname, Lname, Minit)

COURSES (Term, Sec no, Cno)

ENROLLS (Sid, Term, Sec no)

Specify the following queries using the Relational Algebra.

- Retrieve the names of students enrolled in the classes during the 'fall 2009' term. [3 M]
- Retrieve the Sid values of students who have enrolled in catalog numbers 'CSc226' and 'CSc227'. [3 M]
- Retrieve the names of students who have not enrolled in any class. [3 M]
- Retrieve the names of students who have enrolled in all courses in the CATALOG table. [3 M]

*With my best wishes*