Databases-Week02

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BASIC TASKS

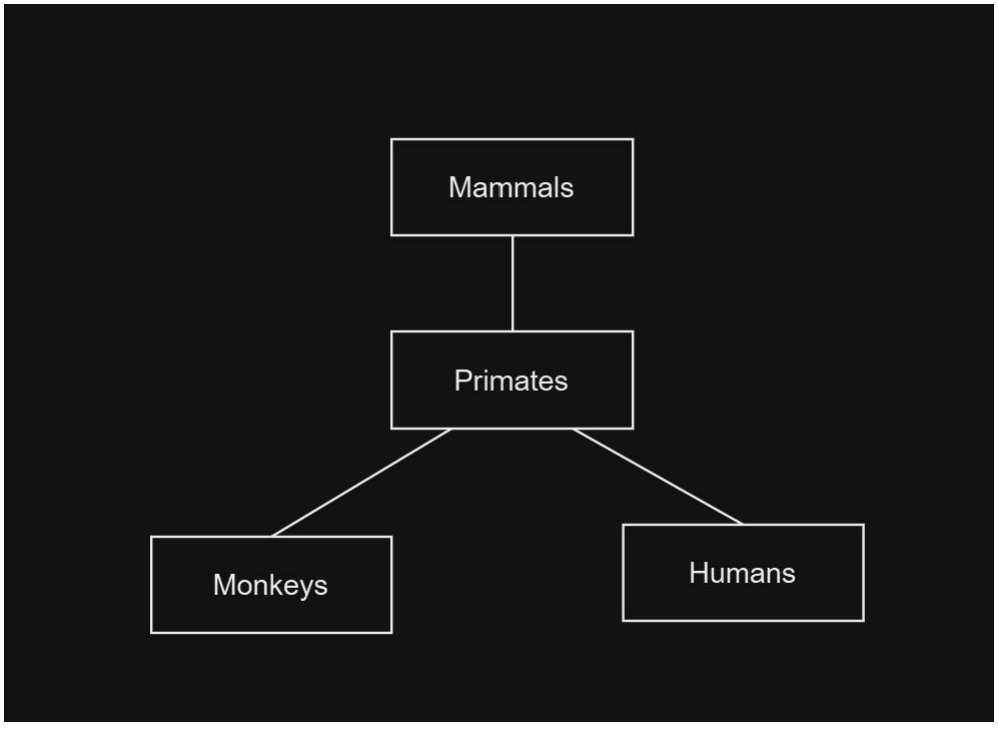
Task 1.

Question:

1. For each of the following set of terms produce a hierarchy of abstraction:
    a. Humans, Mammals, Monkeys, Primates
    b. Linux, Oracle, Software System, Operating System, Database management system, Mysql, Windows, Chrome

The answer:

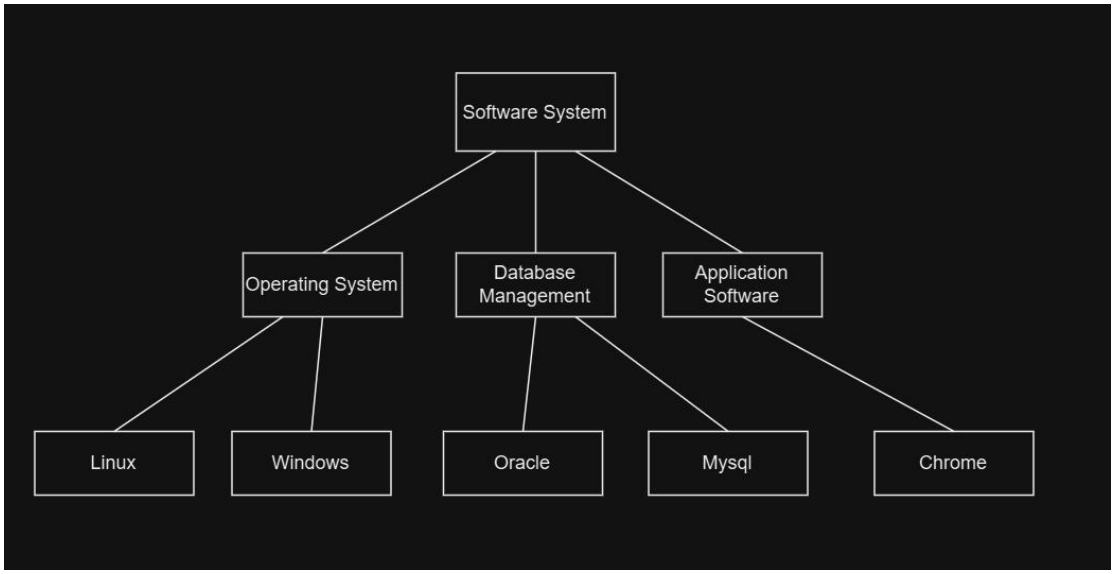
a. Hierarchy of abstraction:
    - Mammals
        - Primates
            - Monkeys
            - Humans



b. Hierarchy of abstraction:

Software System

- Operating System
  - Linux
  - Windows
- Database Management System
  - Oracle
  - Mysql
- Application Software
  - Chrome



Task 2.

Question:

2. In the context of the Entity Relationship (ER) Model, define the following terms:
   a. Entity
   b. Entity type
   c. Entity instance
   d. Optional
   e. Mandatory
   f. Cardinality

The answer:

a. Entity: An entity is a distinct object or thing in the real world that has independent existence.

b. Entity Type: An entity type is a collection of entities that share the same attributes.

c. Entity Instance: An entity instance is a specific occurrence of an entity type.

a. Optional: In the context of an entity relationship, optional means that the participation of an entity in the relationship is not mandatory, and it may or may not participate.

b. Mandatory: In the context of an entity relationship, mandatory means that the participation of an entity in the relationship is required, and it must participate.

c. Cardinality: Cardinality represents the quantitative relationship between two entities, such as one-to-one, one-to-many, or many-to-many.

Task 3.

Question:

3. Define the term data model and give three reasons why data modelling is important

The answer:

Data Model: A data model is an abstract representation of data in the real world, including the structure, relationships, and constraints of the data. Three reasons why data modeling is important are:

1. Accurately Represent Business Requirements: A data model helps to accurately understand and represent business requirements, ensuring that the database design matches the actual business processes.

2. Ensure Data Quality: By defining the integrity and consistency rules of the data, data modeling can improve the quality and reliability of the data.

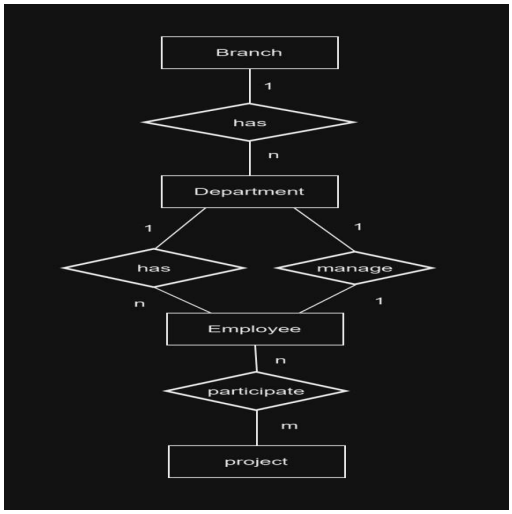
3. Optimize Database Performance: A reasonable data model can optimize the storage and query performance of the database, improving the efficiency of data processing.

Task 4.

Question:

4. Develop an ER diagram which represents a firm and the relationships between entities such as a branch, department, employee and project:
    a. Describe in plain English the situation (scenario) it is designed to represent.
    b. Add cardinality and participation (obligatory/optional) constraints to the ER diagram, given the following rules:
        i. An employee may be a member of one department only, and a department has at least one member.
        ii. An employee may manage at most one department. A department is must be managed by one employee only.
        iii. A branch has at least one department. A department belongs to one branch only.
        iv. An employee may participate in many projects. A project must have at least one employee.

The answer:



Task5.

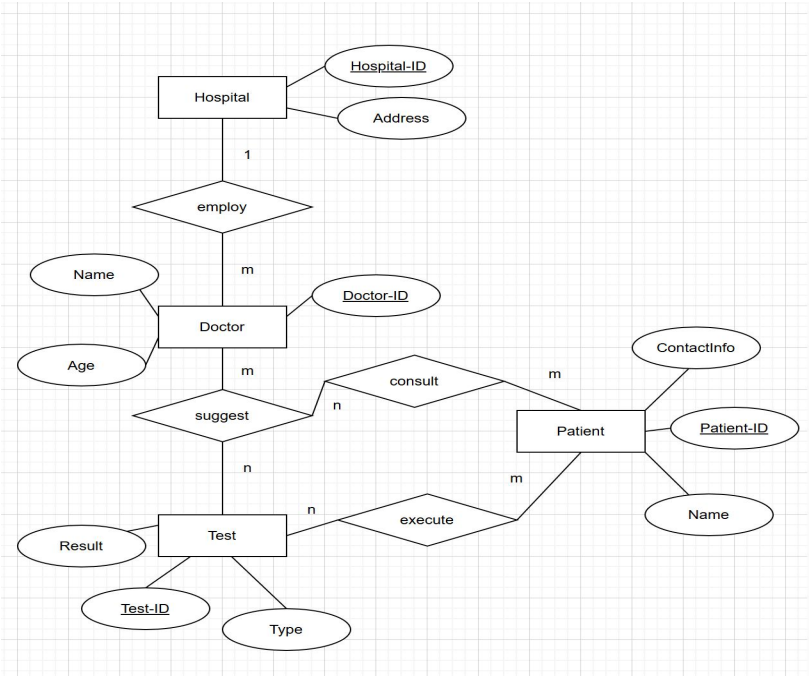
Question:

5. Consider the following scenario for a hospital as below:

   a. A hospital has doctors and patients
   b. Patients visit the hospital to get a consultation from the doctor
   c. The doctor may suggest tests for the patient to identify the medical condition of the patient

First, identify the four entities. Next, identify possible attributes for each of the entities. Finally, produce a conceptual ER diagram using Chen's notation showing the entities, attributes and relationships for the given scenario

The answer:



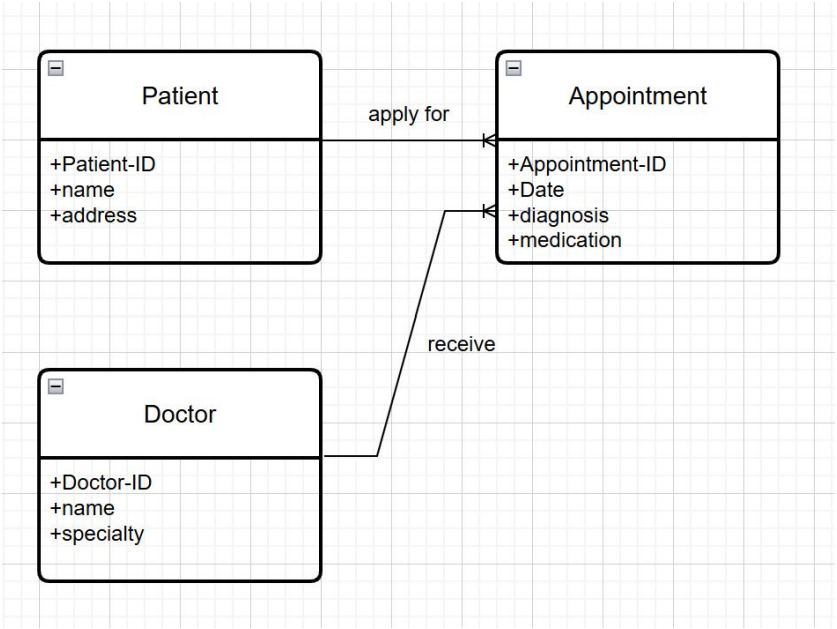
Medium Tasks

Task6.

Question:

6. Consider the following scenario as below:
    a. In a surgery, a patient can make an appointment with one doctor only
    b. A doctor may see many patients
    c. A patient is identified by patientNo and has attributes name, DOB and address
    d. A doctor is identified by doctorId and has attributes name and specialty
    e. There is a need to hold the date of the appointment, the diagnosis and the medication that result from that appointment.

The answer:

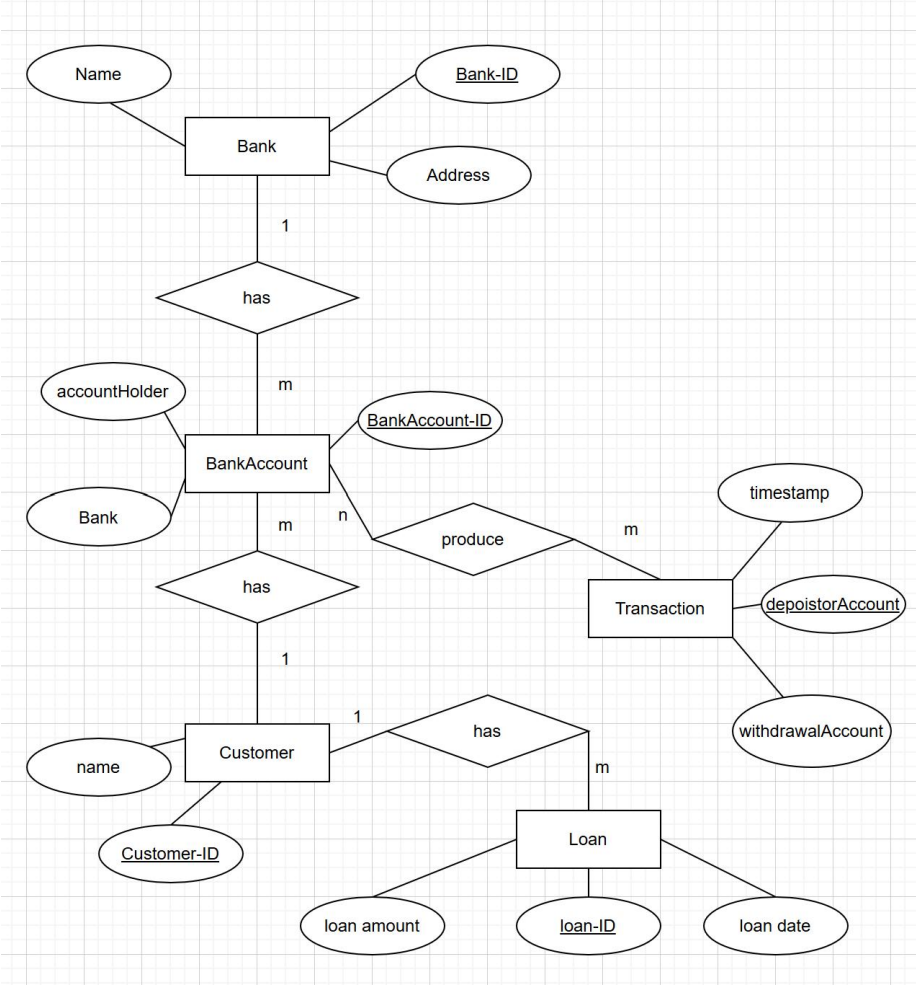


Task7.

Question:

7. Consider the following scenario for a banking system as below:
    a. Bank: each bank is identified by name within each of which there are a number of bank accounts
    b. Bank Account: each account is identified by the bank and accountHolder, which will calculate the balance of an account. Each account is owned by a customer and has more than one transaction
    c. Customer: each customer is identified by customerId and has a name. A customer can have many hobbies
    d. Transaction: each transaction is identified by depoistorAccount, withdrawalAccount and timestamp. It also has information about the currency and amount for each transaction. Each transaction may be associated with more than one bank account. Each bank account can request more than one transaction
    e. Loan: each loan is identified by loanId and has the information about the amount of the loan and the date on which the loan is taken out by the customer. Each customer can take up more than one loan.

The answer:



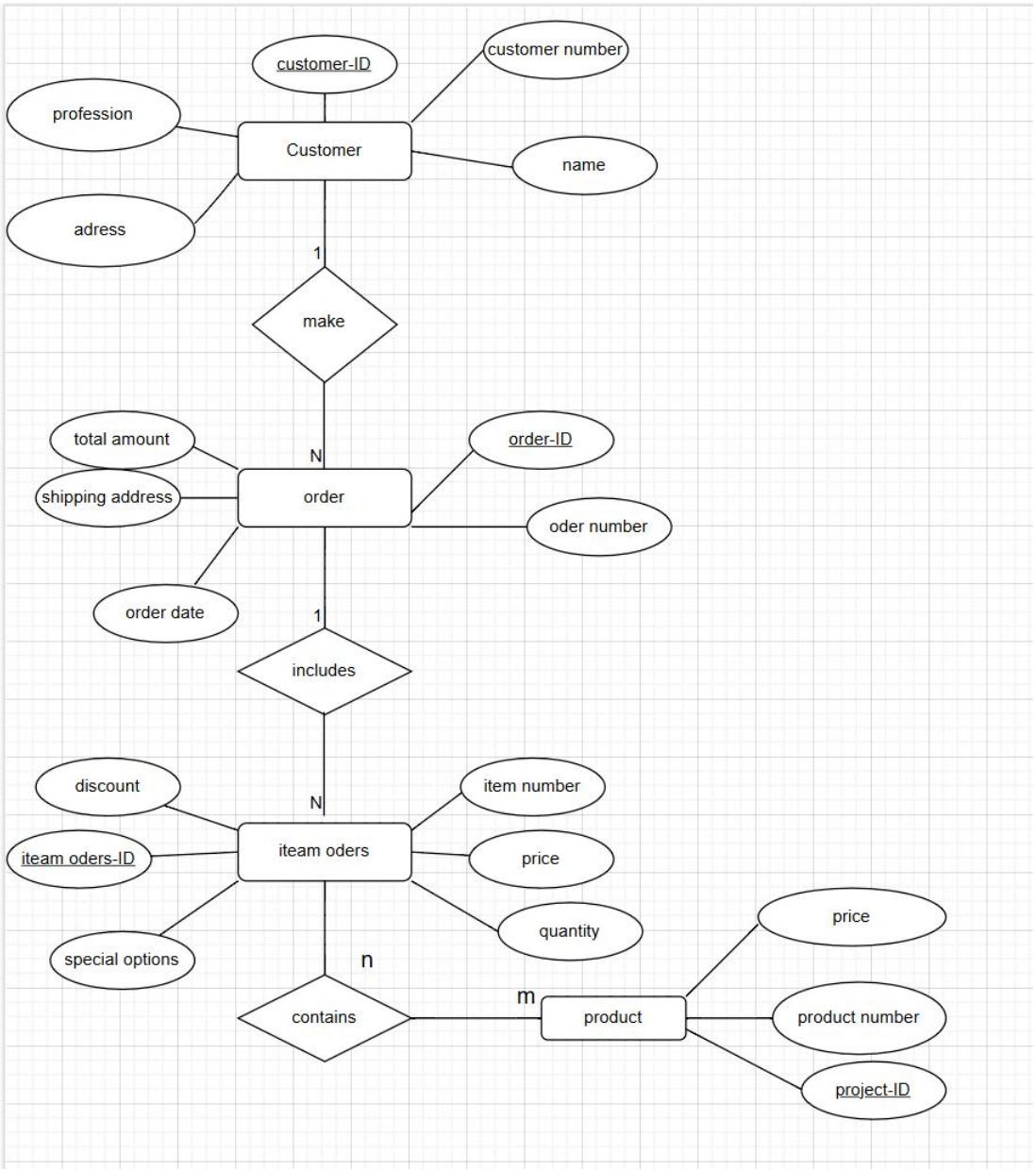
ADVANCED TASKS

Task8.

Question:

8. Develop an ER model in Chen's notation based on the Customer Order system requirements:
    a. A customer has a customer number, name, address and may have more than one profession (such as a lecturer and lawyer). Each customer can place more than one order
    b. Each order has a number for the order placed by a customer, the date of the order with the shipping address as well as the total amount for the order
    c. Each order contains a number of items ordered by a customer. Each item ordered has a unique number for that order and information of price, quantity, special options and discount (if applicable)
    d. A list of products are available to customers for browsing and orders. Each product has a product number, description and price

The answer:



Task9.

Question:

9. After completing Task 8, develop an ER diagram in Chen's notation for the extended Customer Order system requirements below:
    a. A product is associated with a particular category (e.g. clothing, electronics) and may be supplied by more than one supplier
    b. Each supplier has a supplier number, name, contact telephone number and email address. A supplier may provide the stock for multiple products.
    c. A category has a category number and name

The answer: