

[CLO1: Describe the storage and retrieval mechanism in different databases]
 [CLO2- Design a conceptual model using (E)ER diagrams for an enterprise]

1. Consider the following statements.
 - A .Conceptual schema that is the result of conceptual design is a logical description of all data elements and their relationships.
 - B. Internal level of the database architecture consists of the physical view of the database.
 - C. External level of the database architecture provides the user view of the database.

With respect to the three level database architecture, which of the above is/are correct?

 - a. Only A
 - b. Only B
 - c. Only C
 - d. Only A and B
 - e. Only B and C
2. Which of the following best describes a database catalog or data dictionary?
 - a. A repository of metadata that stores definitions of database objects such as schemas, tables, constraints, data types, and relationships.
 - b. A temporary memory allocation structure used by the DBMS to store frequently accessed data for faster retrieval and optimized performance.
 - c. A logical construct used exclusively for transaction logging and recovery operations, ensuring atomicity and durability.
 - d. A security module within the DBMS that contains encrypted user credentials, access policies, and audit logs.
 - e. All of the above.
3. Which of the following properties must hold for a relation in the Relational Model?
 - a. The order of tuples (rows) is significant, meaning that changing the order alters the meaning of the relation.
 - b. Each column (attribute) must have a unique data type to ensure integrity constraints are enforced at the schema level.
 - c. Every attribute must be atomic, meaning it should store a single, indivisible value.
 - d. A relation can have multiple primary keys, allowing redundancy across multiple columns to improve retrieval efficiency.
 - e. Tuple duplication is allowed, ensuring that redundant records are stored to optimize query performance.
4. In the three-schema architecture of a DBMS, which of the following statements is TRUE regarding the conceptual schema?
 - a. The conceptual schema defines the internal storage format of the database, including indexes and memory allocation policies.
 - b. It acts as a bridge between the physical database storage and the user views, ensuring logical data independence.
 - c. It is directly manipulated by end-users to retrieve data without requiring access to external or internal schemas.
 - d. The conceptual schema contains only metadata and does not include any relationships or constraints between entities.
 - e. Unlike external and internal schemas, the conceptual schema is not maintained by the DBMS, but by application developers.

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5. Which of the following is NOT a primary function of the DBMS?
 - a. Ensuring data consistency by enforcing ACID (Atomicity, Consistency, Isolation, Durability) properties in transactions. ✗
 - b. Providing an optimized query execution engine that translates high-level queries into efficient low-level operations. ✗
 - c. Automatically detecting and correcting logical errors in application queries before execution.
 - d. Offering a security layer to manage authentication, authorization, and access control for multiple users. ✗
 - e. Handling concurrent data access to prevent issues such as deadlocks and race conditions.
6. Which ACID property ensures that a transaction's changes are permanent once committed, even in the event of a system failure?
 - a. Atomicity, which ensures that either all operations in a transaction are executed or none at all.
 - b. Consistency, which ensures that transactions bring the database from one valid state to another while maintaining constraints.
 - c. Isolation, which prevents concurrent transactions from interfering with one another.
 - d. Durability, which guarantees that committed changes are saved permanently and are recoverable after a crash.
 - e. Concurrency, which allows multiple transactions to execute simultaneously without degrading performance.
7. Which of the following best describes the role of metadata in a database system?
 - a. Metadata stores actual data values alongside their corresponding table structures to ensure faster query execution.
 - b. Metadata refers to data about data, including details such as attribute names, data types, relationships, and constraints.
 - c. Metadata is a special type of database table used only for indexing and query optimization.
 - d. Metadata is stored separately from the database and is manually updated every time a new record is inserted.
 - e. Metadata contains only primary key information, which helps establish relationships between tables in a database.
8. In the three-level database architecture, which level is responsible for presenting a customized view of the database to individual users?
 - a. Internal level, as it defines how data is stored physically on disk.
 - b. Conceptual level, as it defines the global logical structure of the entire database.
 - c. External level, as it provides different users with customized views of data.
 - d. Physical level, as it ensures data is optimized for fast retrieval.
 - e. Database buffer level, as it manages the transfer of data between memory and disk.
9. Which of the following statements about the hierarchical database model is FALSE?
 - a. It organizes data in a tree-like structure, with records linked using parent-child relationships.
 - b. A record in the hierarchical model can have only one parent but multiple children. ✗
 - c. Data retrieval in a hierarchical database requires navigating predefined paths, limiting flexibility.
 - d. The hierarchical model is best suited for many-to-many relationships, as it provides flexibility for complex data relationships. ?
 - e. Updates and deletions in a hierarchical database can lead to cascading changes throughout the structure. ✗
10. Which of the following is NOT a major component of a relational database system?
 - a. Data manipulation language (DML), which is used to query and update records.

- b. Transaction management system, which ensures atomicity, consistency, isolation, and durability (ACID).
 - c. File system manager, which provides low-level direct access to files without requiring schema definitions.
 - d. Metadata repository, which stores data definitions, relationships, and access controls.
 - e. Query optimizer, which improves the efficiency of SQL queries by selecting the best execution plan.
11. Which of the following is the main advantage of the relational model over older database models like hierarchical and network models?
- a. The relational model eliminates redundancy completely, making data duplication impossible.
 - b. The relational model supports dynamic schema changes without requiring updates to existing records.
 - c. The relational model uses mathematical foundations such as set theory and relational algebra, making it more flexible and robust.
 - d. The relational model does not require indexes, as it retrieves data more efficiently than hierarchical and network models.
 - e. The relational model ensures that all queries are executed in constant time complexity, regardless of data size.
12. Which of the following best describes the conceptual level in the three-schema architecture?
- a. It provides a global view of the database while hiding physical storage details.
 - b. It defines how data is physically stored, including indexing and file organization. *
 - c. It determines user-specific views by controlling what data each user can access. *
 - d. It directly manages query execution and ensures optimization strategies. *
 - e. It eliminates the need for transactions, as it only deals with schema definitions.
13. In a three-tier database architecture, which layer is responsible for enforcing business rules and processing user requests?
- a. Presentation layer, which handles user interface design and client interactions.
 - b. Application layer, which processes logic, business rules, and communicates with the database.
 - c. Database layer, which manages data storage, indexing, and query execution.
 - d. Data warehouse layer, which provides analytical processing and reporting capabilities.
 - e. Cache layer, which improves performance by storing frequently accessed data.
14. Which of the following is a key disadvantage of file-based data storage systems compared to a DBMS?
- a. File-based systems cannot store large amounts of data, while DBMS can. *
 - b. File-based systems do not support indexing or query optimization, leading to inefficient data retrieval.
 - c. File-based systems always store data in structured formats, whereas DBMS does not. *
 - d. File-based systems support concurrent access better than DBMS due to a simpler architecture. *
 - e. File-based systems allow easier enforcement of data integrity rules compared to DBMS. *
15. Which of the following is a core feature of a DBMS that helps ensure data consistency in multi-user environments?
- a. Transaction management to ensure all operations within a transaction are completed. *
 - b. Data independence to protect applications from changes to the data model.
 - c. Indexing to speed up data retrieval without compromising consistency.
 - d. Database backup and recovery to restore data in case of failures.
 - e. Data replication to keep multiple copies of data for fault tolerance.
16. Which of the following best describes the term "data integrity" in the context of a DBMS?

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- a. The ability to ensure that data is stored in a highly compressed format to optimize storage space.
- b. The ability to preserve the accuracy, consistency, and reliability of data throughout its lifecycle.
- c. The process of regularly backing up data to prevent data loss in case of system failures.
- d. The method by which data is indexed and partitioned to improve query performance.
- e. The ability to replicate data across multiple locations for increased system availability.
17. In which situation would the NoSQL database model be preferred over the relational database model?
- a. When the data follows a clear and well-defined relational structure.
- b. When high data consistency and normalization are crucial for transaction processing.
- c. When the application requires fast performance with large volumes of unstructured or semi-structured data.
- d. When the database design requires complex queries and joins across multiple tables.
- e. When referential integrity and strict relationships between tables need to be maintained.
18. Which of the following is a characteristic of data redundancy in databases?
- a. Data redundancy occurs when different data tables store identical information, leading to unnecessary duplication.
- b. Data redundancy improves database performance by storing frequently accessed data in multiple locations.
- c. Data redundancy eliminates the need for foreign keys by storing related data in the same table.
- d. Data redundancy refers to storing data in a compressed format to save space.
- e. Data redundancy ensures data integrity by keeping multiple copies of data in different systems.
19. Which of the following is NOT a valid representation of cardinality in an ERD when dealing with a one-to-many (1:M) relationship between entity A and entity B?
- a. Entity A has a single line connecting it to the relationship, while entity B has multiple lines connecting it to the relationship.
- b. Entity A has one line connecting it to the relationship, and entity B has a single line that also connects it to the relationship, indicating each instance of A can relate to multiple instances of B.
- c. Entity A has a single line connecting to the relationship, and entity B has a line with a crow's foot symbol indicating "many."
- d. Entity A has a single line connecting it to the relationship, and entity B has a dashed line indicating optional participation.
- e. Entity A and entity B are connected by multiple lines from both entities to the relationship, indicating a many-to-many cardinality.
20. In an employee database, an "Employee" entity can be a "Manager" or a "Worker," but not both. Each Manager supervises multiple Workers. Which of the following best describes this scenario in an EERD?
- a. A generalization hierarchy with "Employee" as the supertype and "Manager" and "Worker" as disjoint subtypes.
- b. A separate entity for Manager and Worker with no relationship to Employee.
- c. A one-to-one (1:1) relationship between Manager and Worker since they are mutually exclusive.
- d. A weak entity for Worker and a strong entity for Manager.

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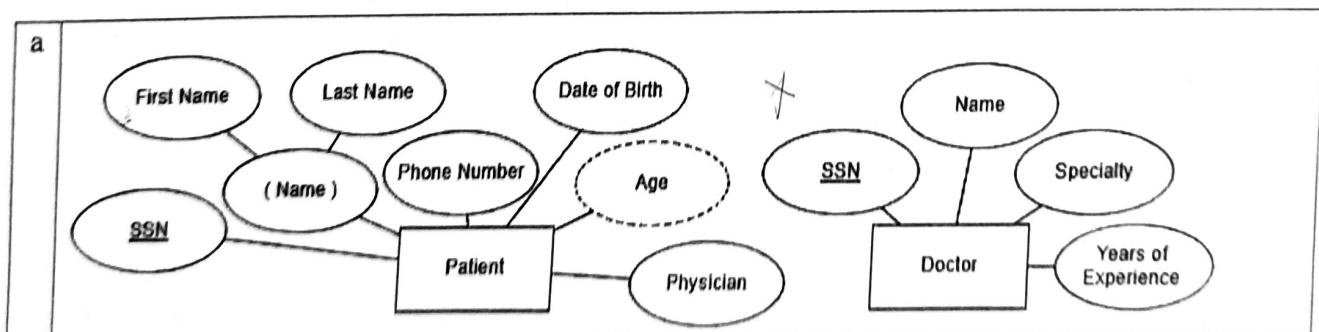
- e. A many-to-many (M:N) relationship between Manager and Worker with Employee as an intersection entity.
21. In an online shopping database, the system tracks Customers, Orders, and Products. Each Order can contain multiple Products, and each Product can be in multiple Orders. How should this be modeled in an ERD?
- A many-to-many (M:N) relationship between Order and Product, with an associative entity "OrderDetails" that stores additional attributes like Quantity and Price.
- b. A direct one-to-one (1:1) relationship between Order and Product, where each Order can have only one Product.
- c. A one-to-many (1:M) relationship between Customer and Product, ignoring Order as a separate entity.
- d. A weak entity structure where Product depends on Order.
- e. A ternary relationship between Customer, Order, and Product to track purchases.
22. In an EERD (Enhanced Entity-Relationship Diagram), which of the following correctly describes the concept of "Generalization"?
- A higher-level entity type is formed by combining multiple lower-level entity types that share common attributes.
- An entity type is split into two or more specialized subtypes based on unique attributes.
- represents a relationship between multiple entities and is shown using a diamond symbol.
- Generalization is only applicable in hierarchical databases and not in relational models.
- is a process used exclusively for defining weak entities and their owners.
23. In the context of a DBMS, what does data independence mean?
- a. The data can be accessed by multiple users at the same time without any restrictions.
- Data can be stored in different formats, but the DBMS remains independent of those formats.
- The data schema can be modified without affecting the application programs that access the data.
- The data can be manipulated independently of the hardware and network infrastructure.
- Data can be encrypted independently of the DBMS's security protocols.
24. Which of the following statements accurately describes the function of the Internal Schema in a DBMS?
- It defines the user views and logical representation of the database.
- It specifies the access rights of users to the data stored in the database.
- It organizes and manages how data is stored physically in the system.
- d. It manages how data is represented in the application user interfaces.
- e. It ensures compliance with regulatory standards by encrypting sensitive data.
25. What does ACID stand for in the context of transaction management in DBMS?
- Atomicity, Consistency, Isolation, Durability
- b. Authority, Consistency, Integrity, Durability
- c. Atomicity, Concurrency, Integrity, Durability
- d. Authentication, Consistency, Integrity, Durability
- e. Atomicity, Consistency, Independence, Durability
26. What does logical data independence refer to?
- The ability to change the database's physical storage without affecting the application layer.
- The ability to change the conceptual schema without affecting external views.
- The ability to change the hardware architecture without impacting the database.
- The ability to separate user views from business logic.

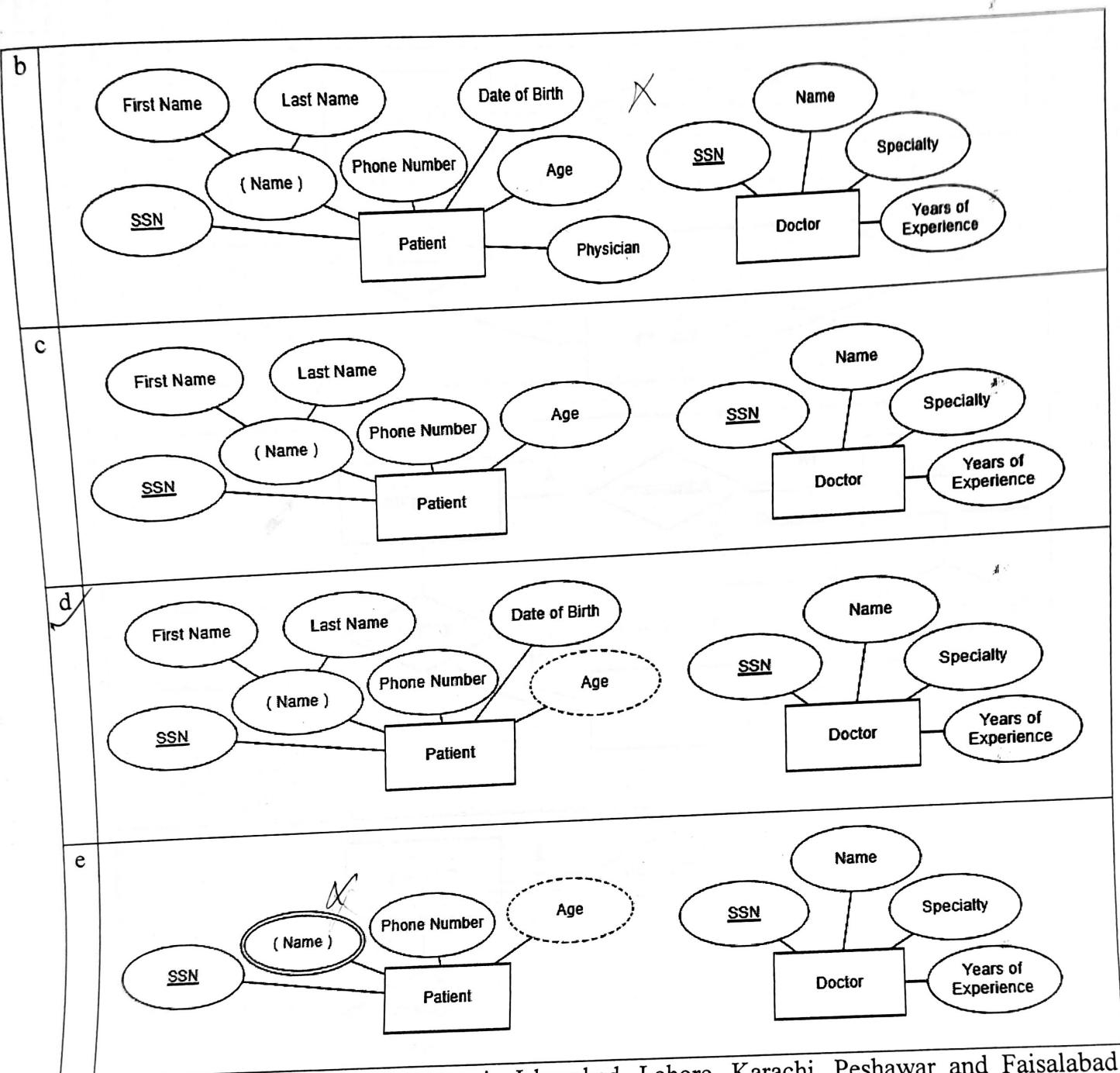
- e. The ability to hide database redundancy from users.
27. Which of the following best defines physical data independence?
- Changes to the database schema don't affect external views.
 - Changes to physical storage don't affect the logical schema ✓
 - Changes to the application layer affect data storage.
 - Users can access data from multiple sources seamlessly.
 - Changes in hardware can change user views.
28. Which of the following is an End User likely to do with a database?
- Create and modify tables and indexes. ✗
 - Perform backups and recovery procedures. ✗
 - Execute stored procedures to process transactions ✗
 - Query the database and generate reports. ✓
 - Optimize database performance. ✗
29. Which of the following statements is TRUE about DDL vs. DML commands?
- DDL commands modify database structure, while DML commands manipulate data.
 - DDL commands cannot be rolled back, while DML commands can be rolled back.
 - DDL includes commands like CREATE and DROP, while DML includes SELECT and INSERT.
 - All of the above.
 - None of the above.
30. An Active Data Dictionary differs from a Passive Data Dictionary in that:
- It is always stored externally from the database.
 - It helps in ensuring that the database design is always consistent with its actual implementation.
 - It only stores schema information and cannot store relationship data.
 - It is never updated after the initial setup.
 - It does not store any information related to constraints or security.

PART B

Select correct Entity Relationship Diagram (ERD) for the given scenarios. [Q31-38 (8x2=16 marks)]

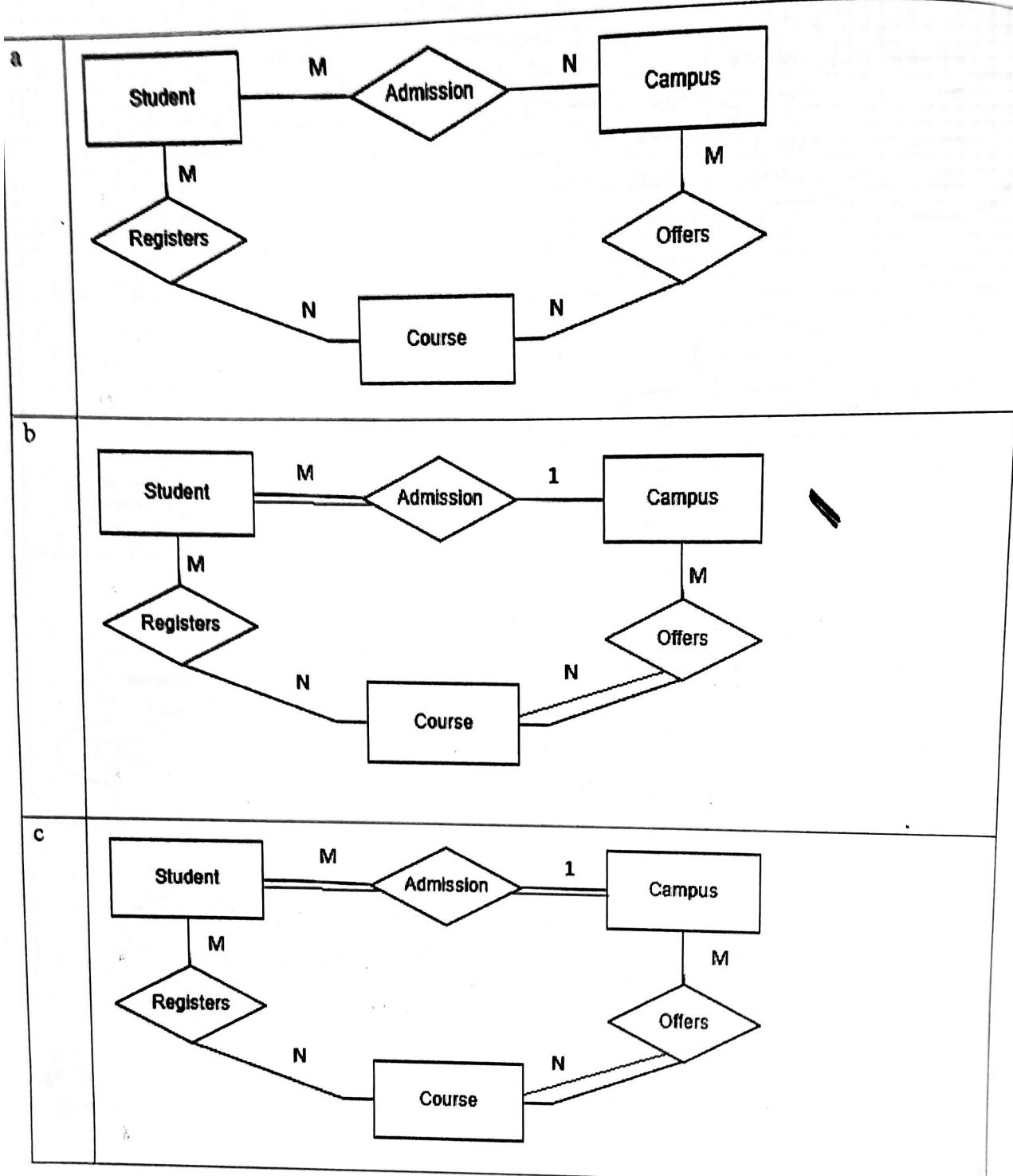
31. Patients are identified by an SSN, and their names, addresses, and ages must be recorded. Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded. Every patient has a primary physician.

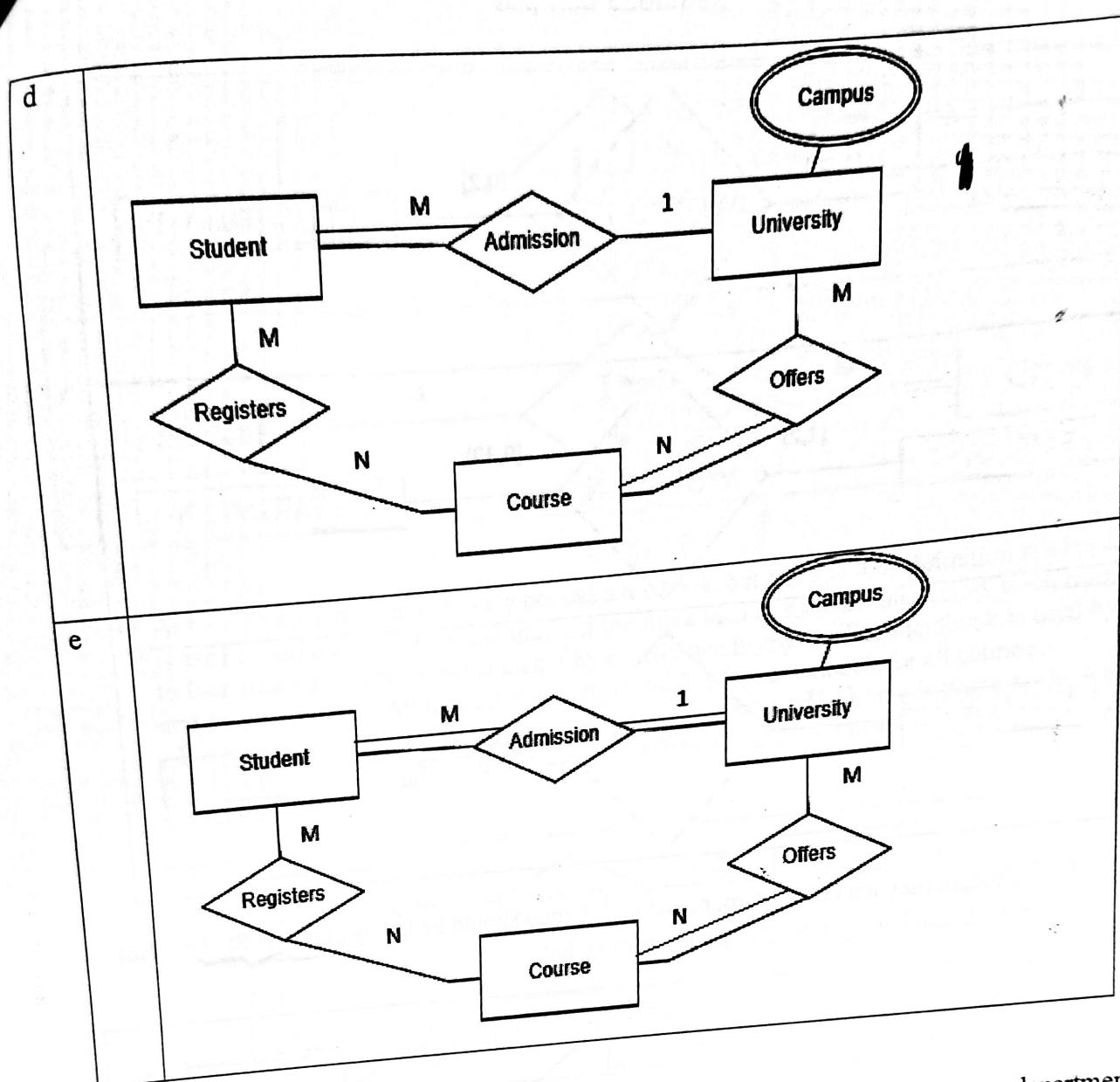




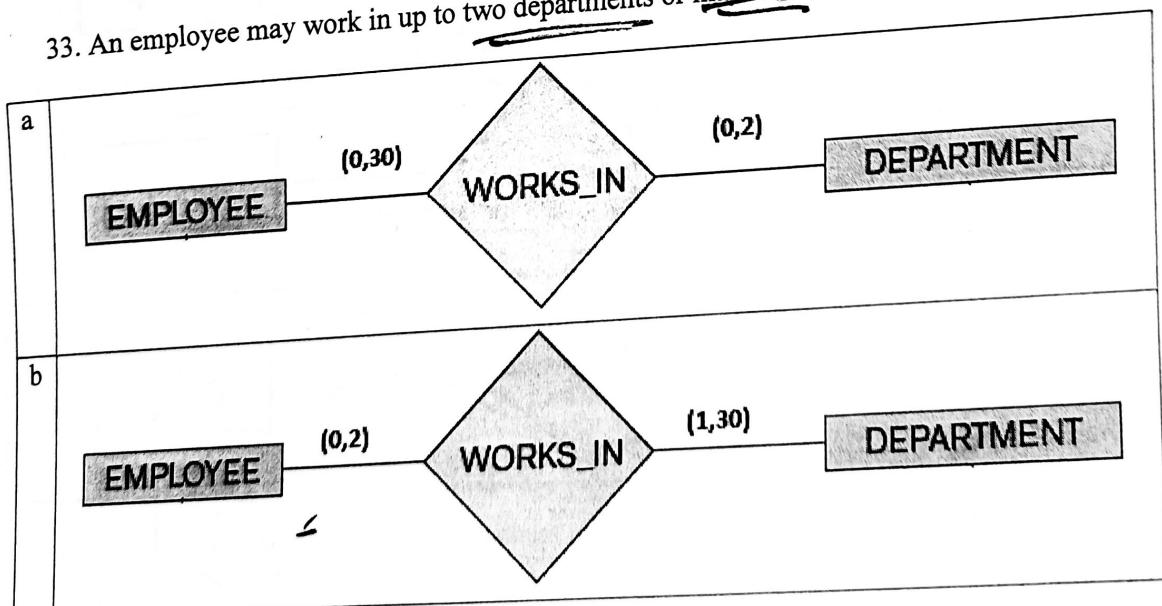
32. FAST university has campuses in Islamabad, Lahore, Karachi, Peshawar and Faisalabad. Student can take admission in any campus of FAST. Student can also take course(s) in any campus.

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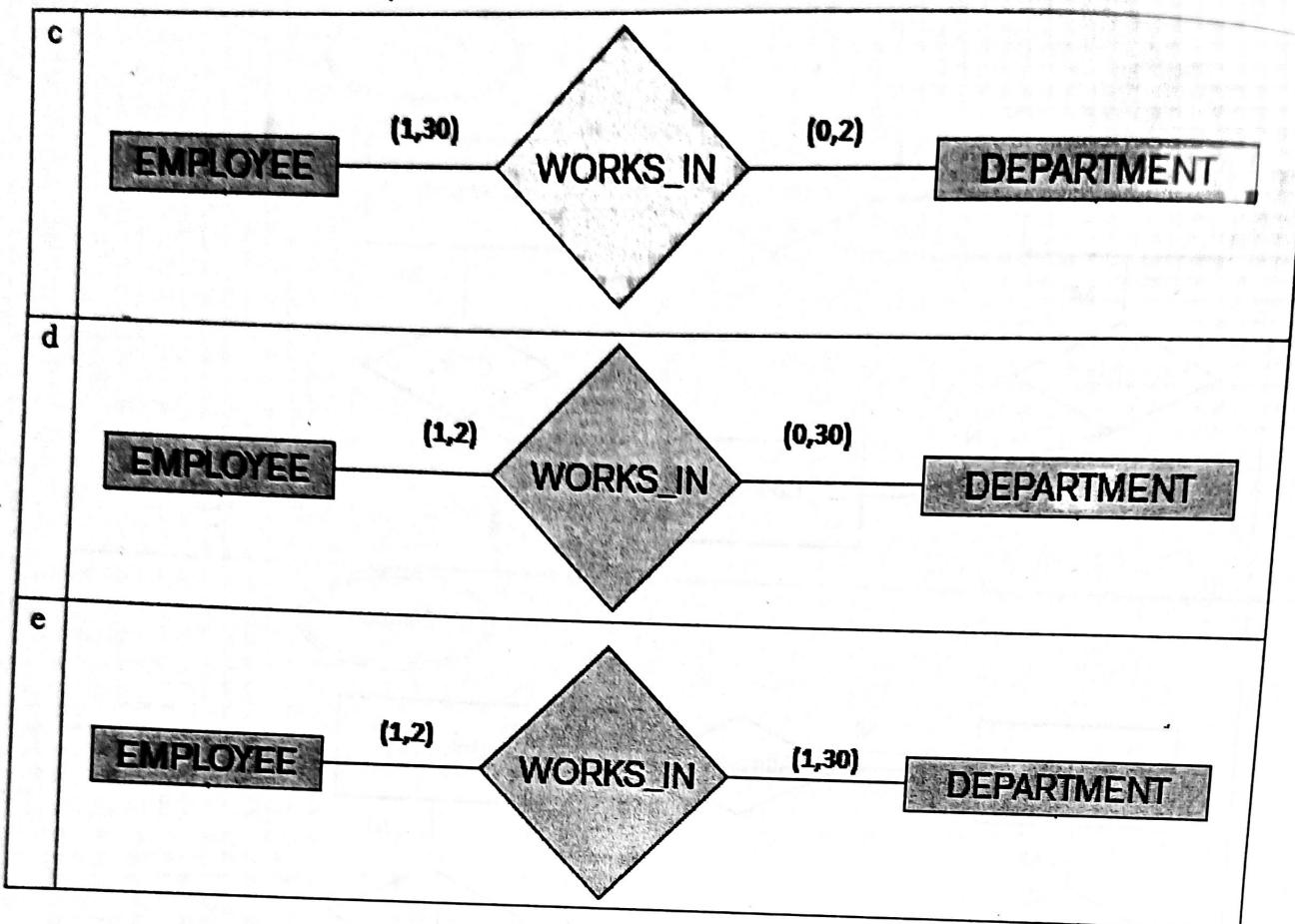




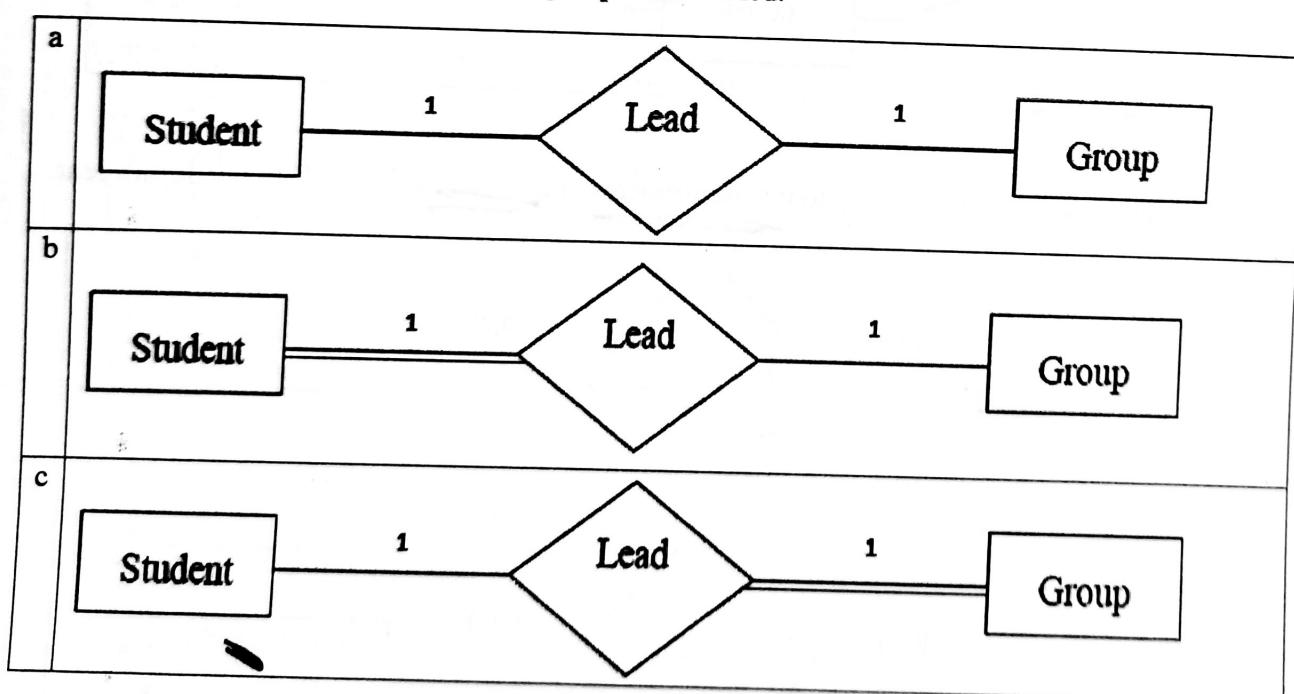
33. An employee may work in up to two departments or may not be assigned to any department.

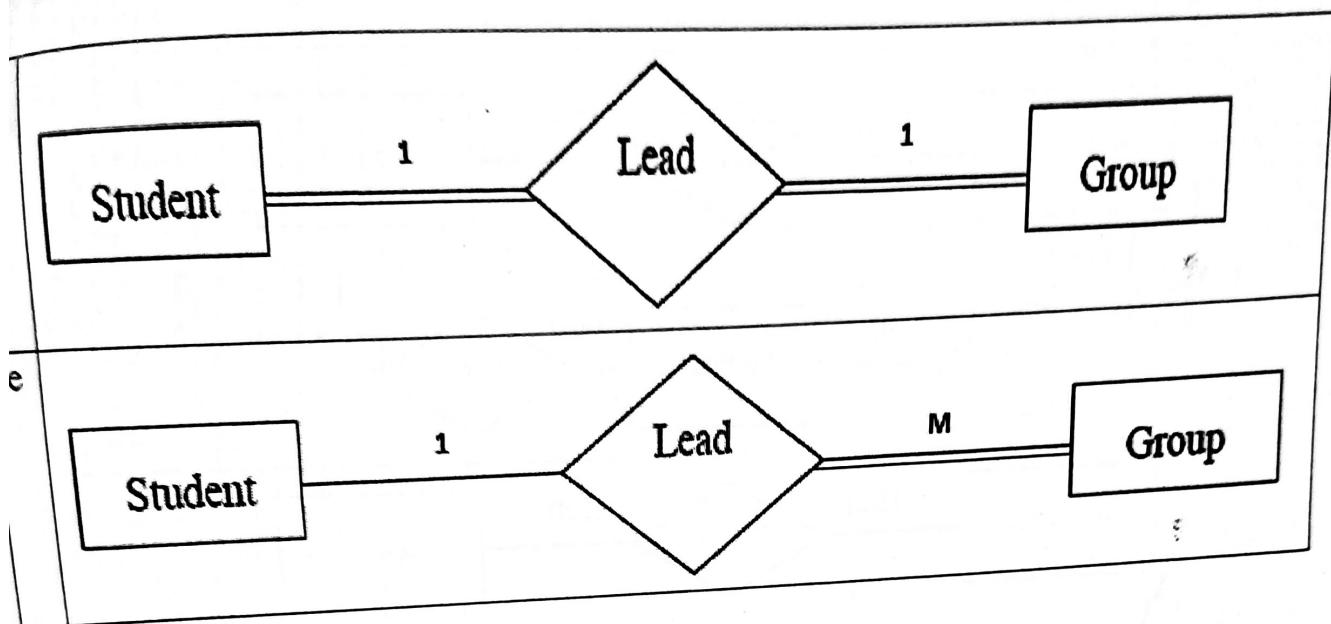


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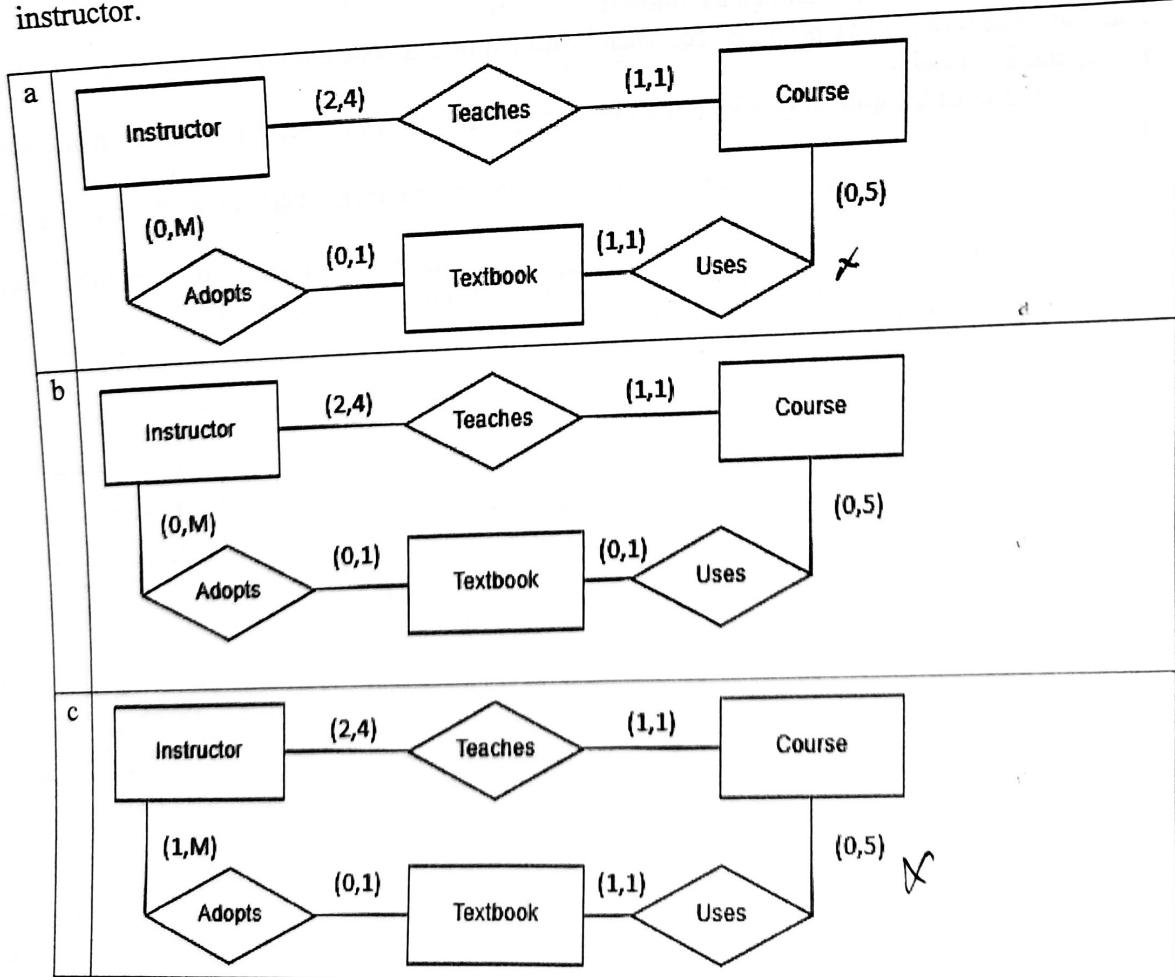


34. Each Student may lead 0 to 1 Group, and each Group should be led by only one Student. Not all students can lead groups. All groups must be led.

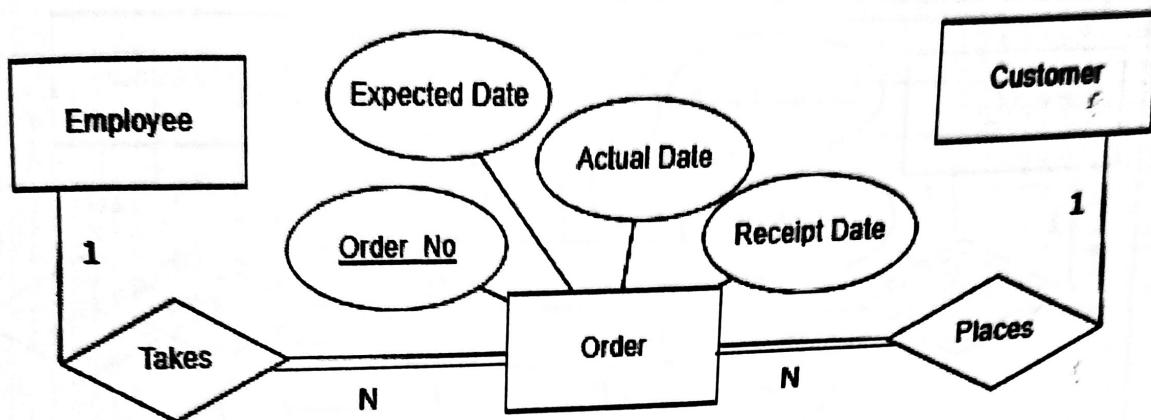




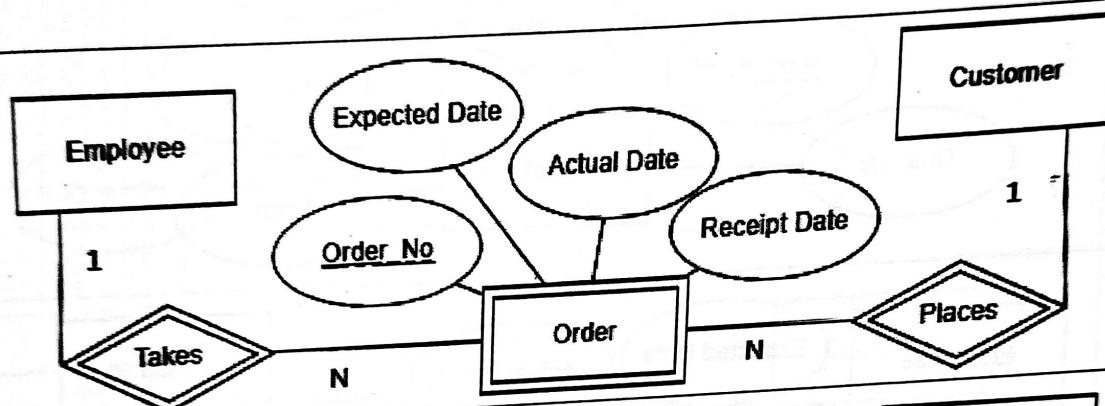
35. Assume that a course may or may not use a textbook, but that a text by definition is a book that is used in some course. A course may not use more than five books. Instructors teach from two to four courses. Each course is taught by exactly one instructor. Each textbook is used by one and only one course. An instructor does not have to adopt a textbook for all courses.
 - If a text exists, it is used in some course, hence it is adopted by some instructor who teaches that course. An instructor is considered to adopt a text if it is used in some course taught by that instructor.



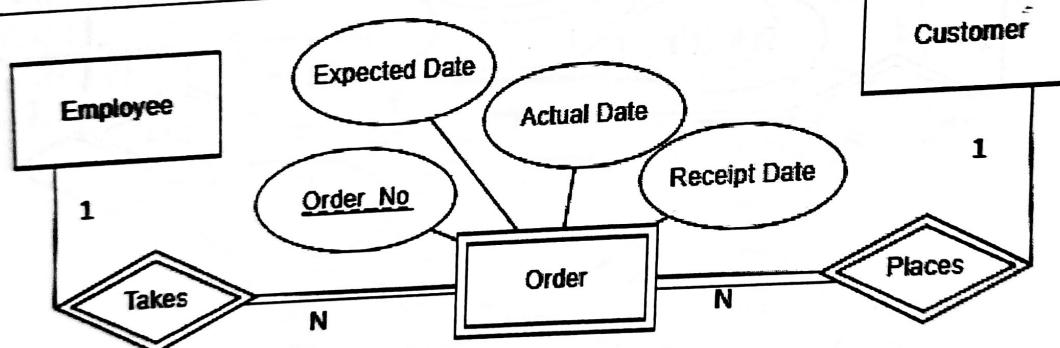
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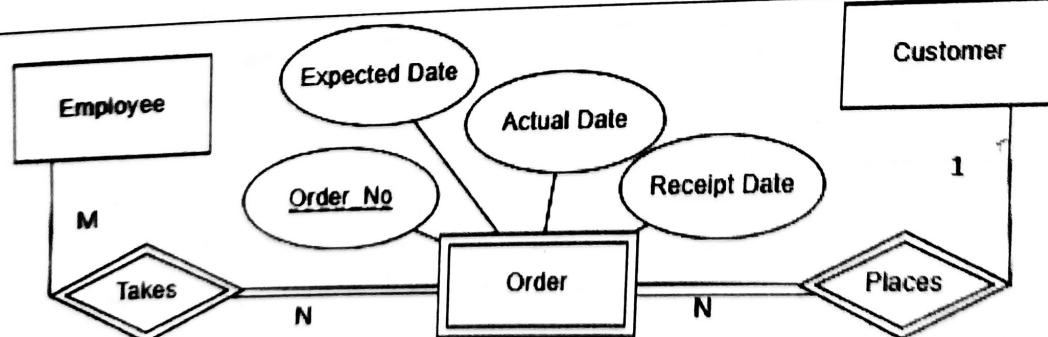
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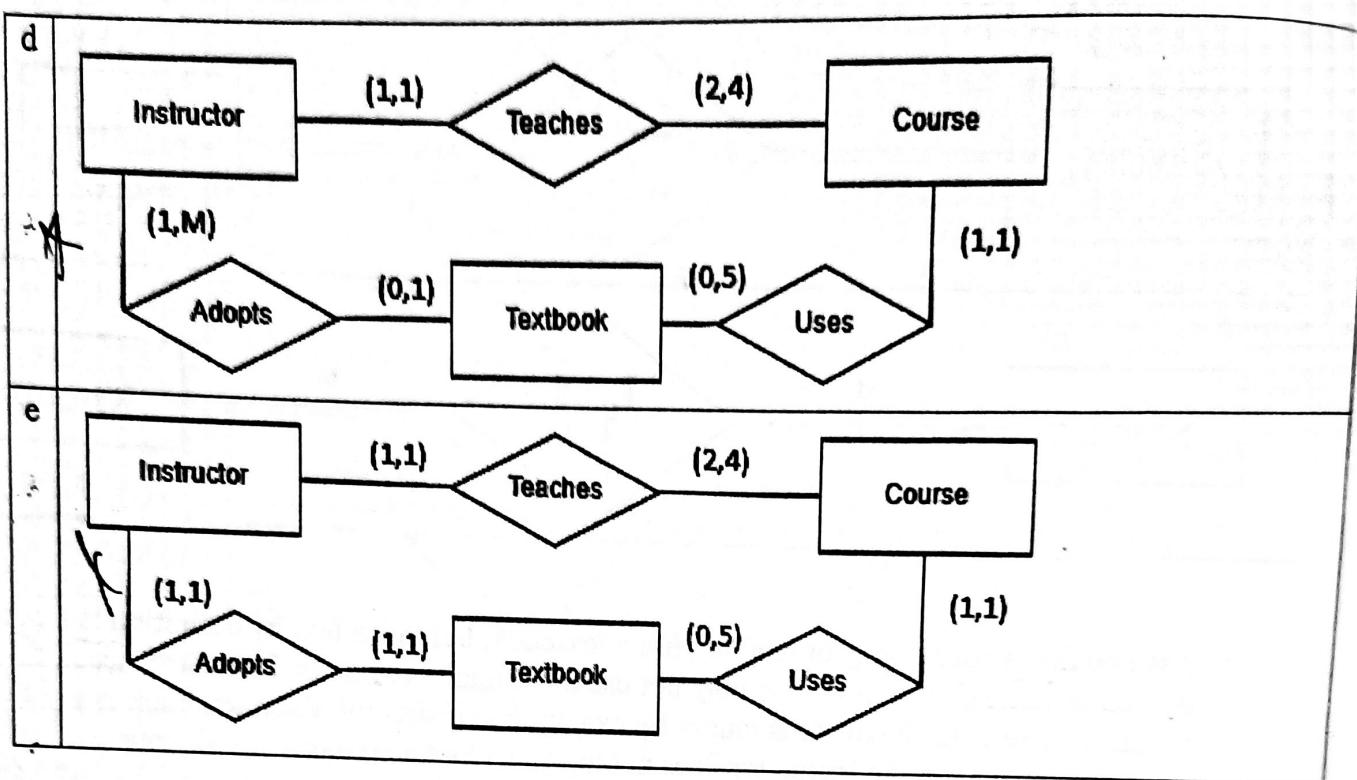
e



37. Select correct ERD covering complete requirements of MAIL_ORDER database

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Consider the following statement for answering Q36-37

Consider a MAIL_ORDER database in which employees take orders for parts from customers. The data requirements are summarized as follows:

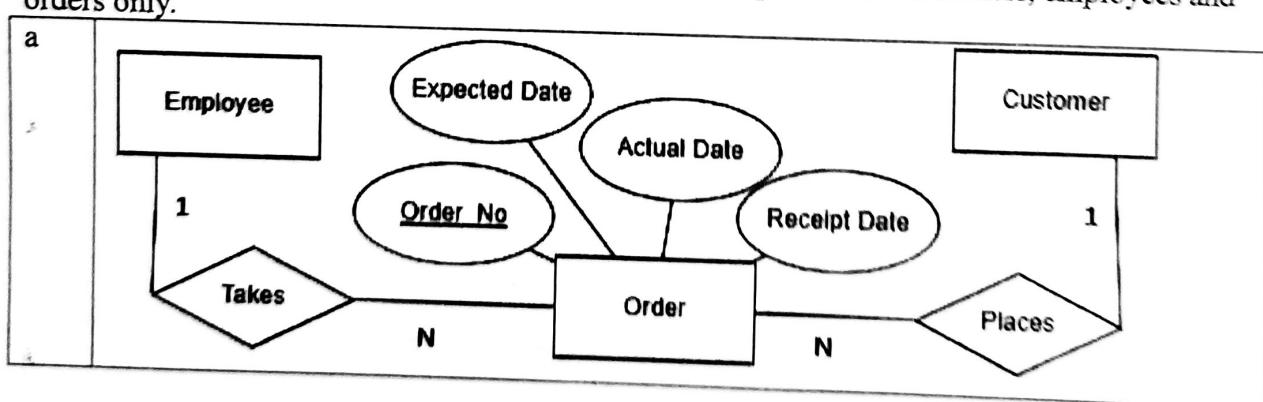
The mail order company has employees, each identified by a unique employee number, first and last name, and Zip Code.

Each customer of the company is identified by a unique customer number, first and last name, and Zip Code.

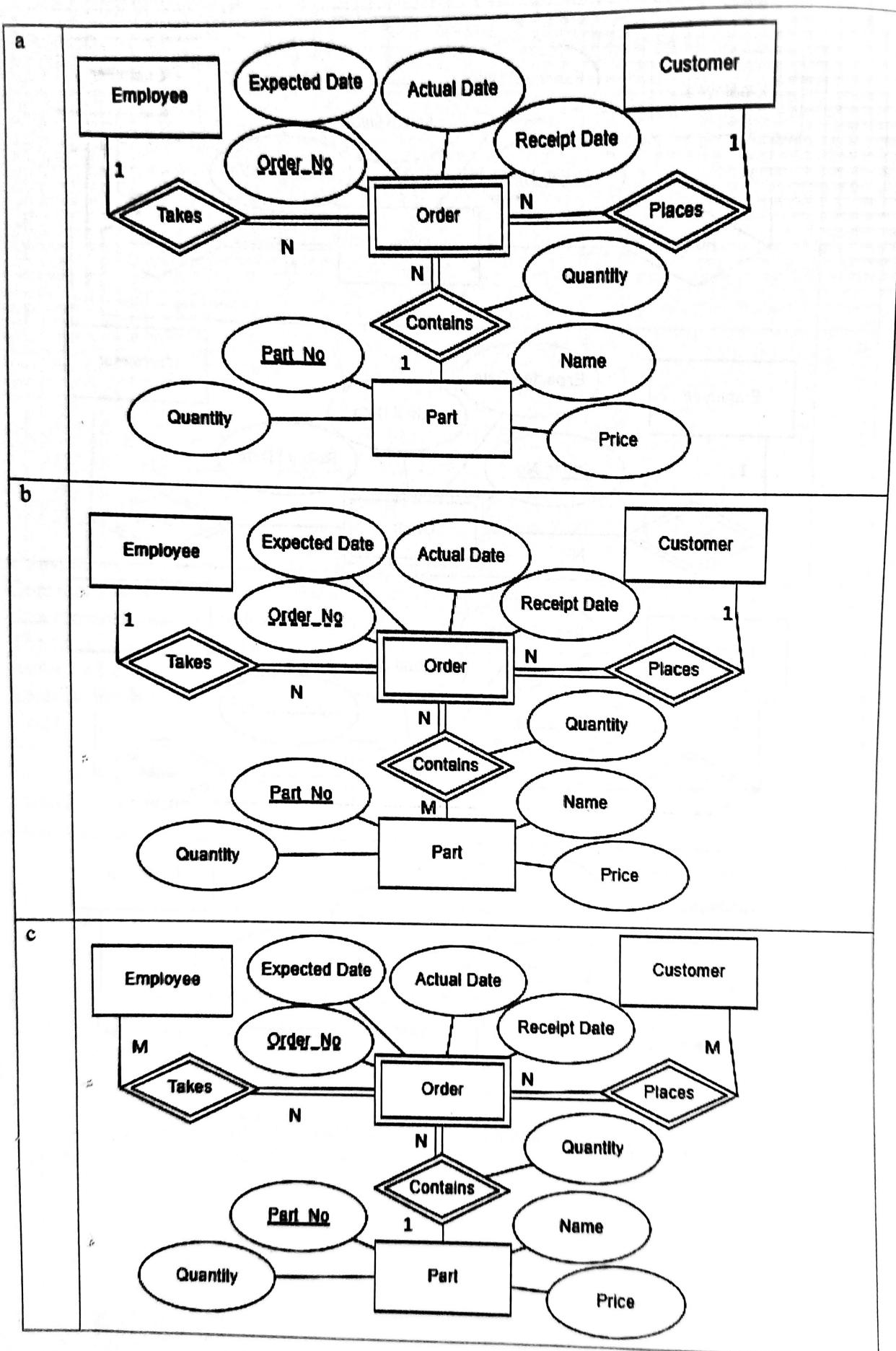
Each part sold by the company is identified by a unique part number, a part name, price, and quantity in stock.

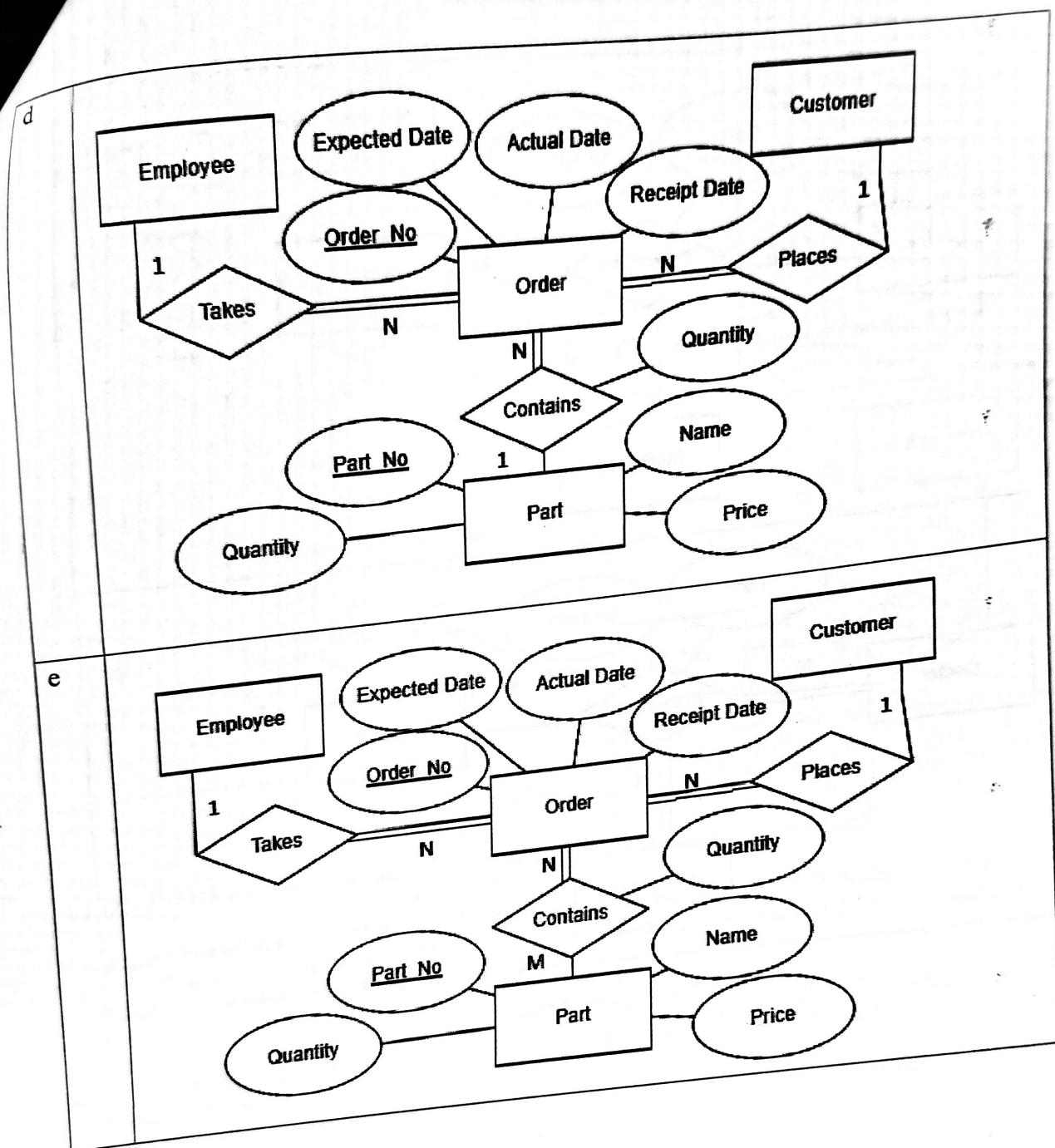
Each order placed by a customer is taken by an employee and is given a unique order number. Each order contains specified quantities of one or more parts. Each order has a date of receipt as well as an expected ship date. The actual ship date is also recorded.

36. Select correct conceptual schema considering relationship between customers, employees and orders only.



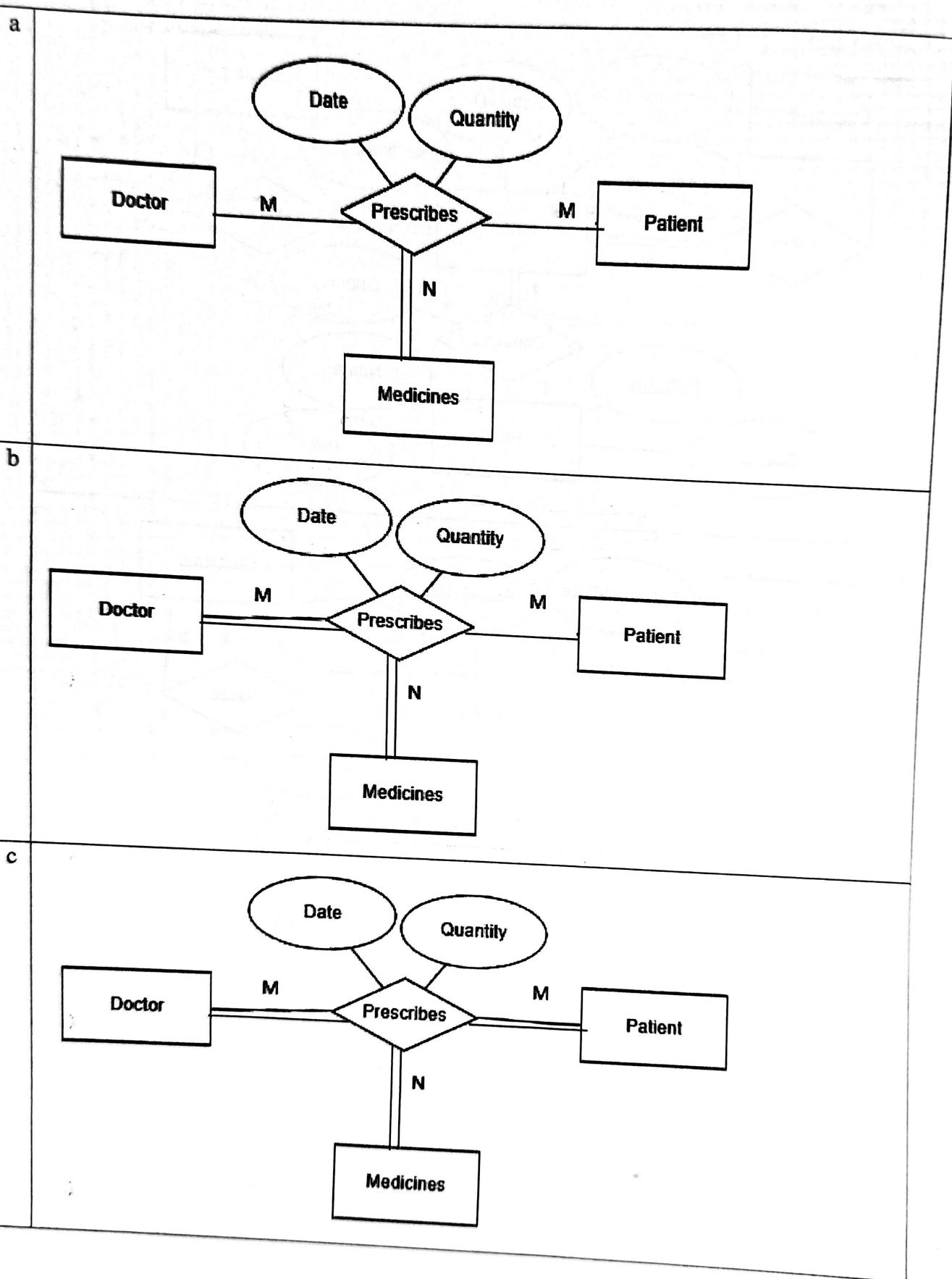
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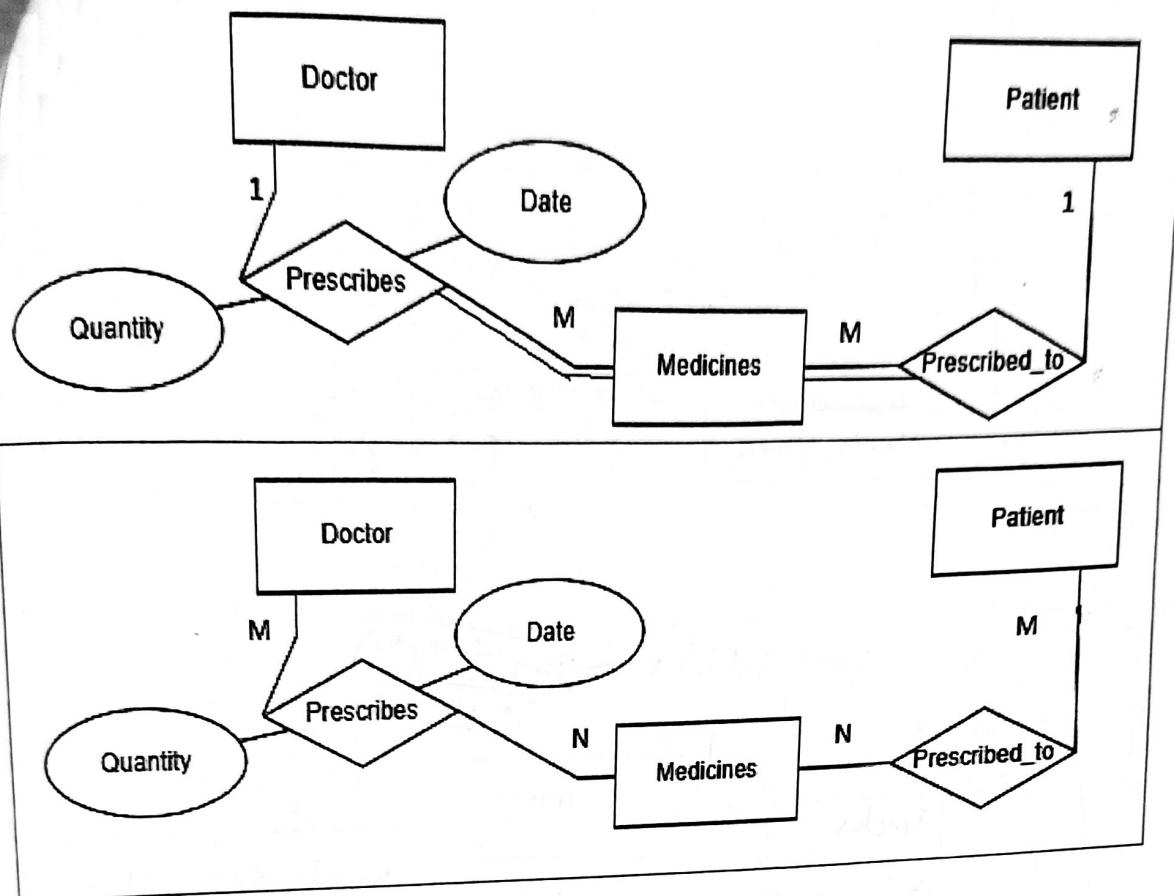




38. Doctor prescribes medicines to the patient.

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Question 2

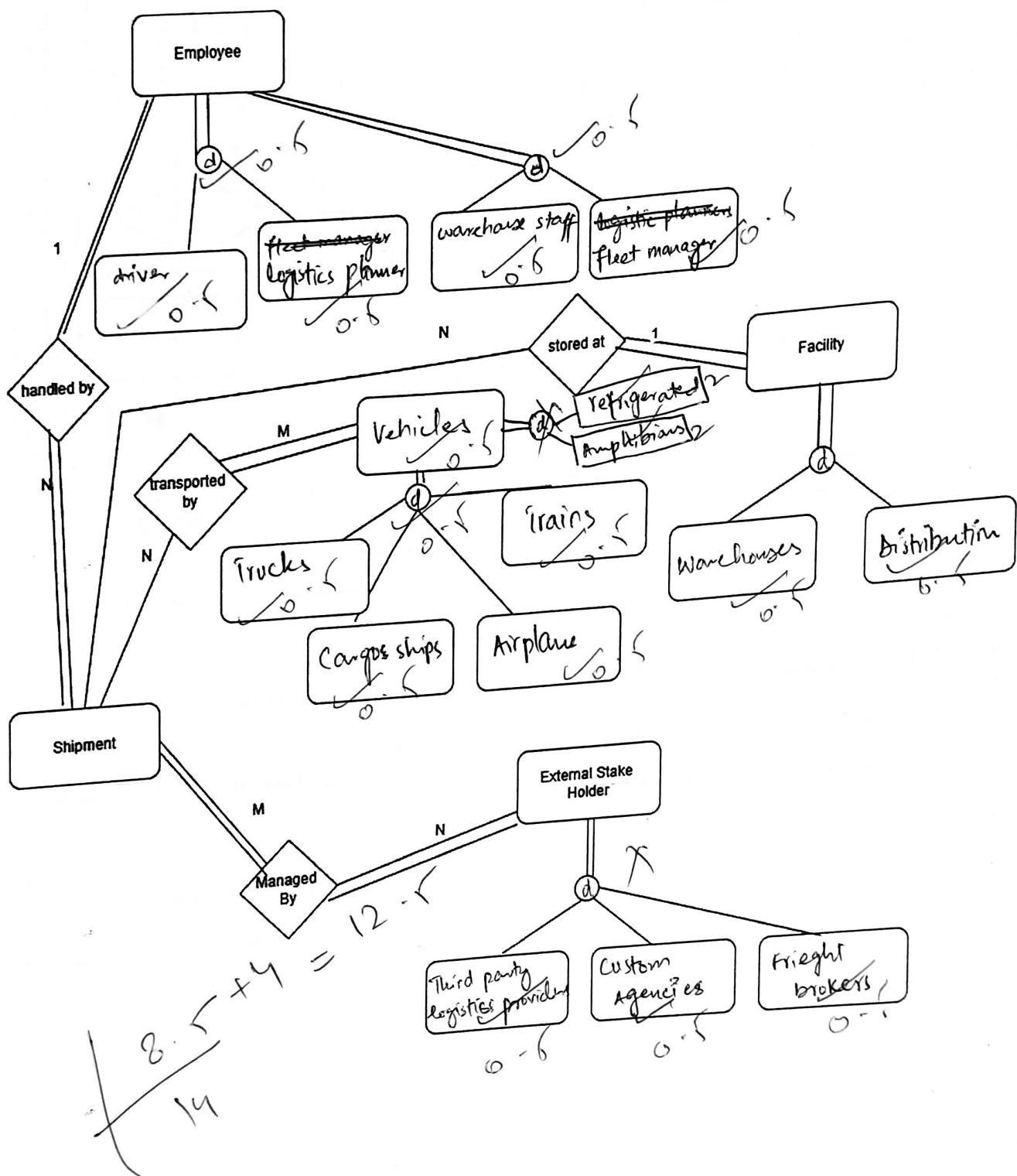
[CLO2- Design a conceptual model using (E)ER diagrams for an enterprise]

Read the case study. Complete and fill the diagram below. It should include Disjoint constraint, overlapping constraint, lattice, hierarchy, shared sub class (if any). Besides blank entities, there are some missing entities as well.

A multinational logistics and supply chain corporation operates warehouses, distribution centers, and transportation hubs across different regions. The company manages the movement of goods, raw materials, and finished products between manufacturers, suppliers, retailers, and customers. It provides services such as freight transportation, inventory management, customs clearance, and last-mile delivery.

The organization employs a diverse workforce, including drivers, warehouse staff, logistics planners, and fleet managers, some of whom may perform multiple roles across different operational units. A driver cannot be a logistics planner whereas the fleet manager cannot be working in the warehouse. An employ may handle multiple shipments but each shipment is taken care by one employee. The shipment is stored at a single facility whereas many shipments may be stored there. The transportation fleet consists of various types of vehicles, including trucks, cargo ships, airplanes, and trains. Vehicles can be categorized as refrigerated and amphibious. A shipment may be distributed among various vehicles.

The company's warehouses and distribution centers are the type of facilities. These facilities use automated inventory systems that track shipments, store product details, and optimize delivery schedules. The corporation partners with multiple external stakeholders who will manage multiple shipments, they might be third-party logistics providers, customs agencies, or freight brokers.



THE END