**Identifying the Relational Database Concepts and Schema**

**Learning Objectives**

*After completing this topic, you should be able to*

* *describe relational database concepts*
* *recognize the constructs in a relationship database schema*
* *normalize database tables*

**Exercise overview**

In this exercise, you're required to identify the characteristics of relational databases and types of relational databases. You're also required to describe how to normalize database relations and the key concepts of database modeling. Additionally, you will recognize the constructs in a relational database schema and referential integrity.

This involves the following tasks:

* describing relational database management system concepts
* recognizing database schemas and referential integrity, and
* normalizing database relations

**Describing RDBMS concepts**

**Question**

What are the key characteristics of a relational database?

**Options:**

1. Data is stored in relations
2. A relational attribute consists of a set of tuples
3. The data type describes the kind of values two relations can take
4. An attribute takes its value from an appropriate domain

**Answer**

***Option 1:*** *This option is correct. A relational database stores all its data inside relations, which are groups of tuples and attributes.*

***Option 2:*** *This option is incorrect. In a relational database, a tuple consists of a set of attributes, and each tuple is linked to an entity.*

***Option 3:*** *This option is incorrect. The data type describes the kind of values an attribute can contain in a relation.*

***Option 4:*** *This option is correct. The data type for a domain specifies the kind of value an attribute can contain.*

**Correct answer(s):**

1. Data is stored in relations  
4. An attribute takes its value from an appropriate domain

**Question**

You're planning to set up a relational database management system or RDBMS in your company. There are several RDBMSs available in the market. You want to assess the key characteristics of some of these databases.  
  
Match each type of RDBMS with its description.

**Options:**

1. Oracle
2. IBM DB2
3. PostgreSQL
4. OpenOffice.org Base
5. Microsoft Access
6. MySQL

**Targets:**

1. An ORDBMS that complies with the SQL:2008 Standard
2. An RDBMS that is written using SQL, Java, Microsoft .NET, and PL/SQL
3. An OODBMS that is written in the SQL query language
4. An RDBMS that runs on HSQLDB and stores data, forms, and queries in one file
5. A desktop file-based database system that is written in the Visual Basic language and uses the Jet Database engine
6. An open source RDBMS that is written in C and C++

**Answer**

*Oracle is an ORDBMS developed and marketed by Oracle Corporation. It complies with the SQL:2008 Standard.*

*IBM DB2 is an enterprise-level RDBMS that uses SQL, Java, Microsoft .NET, and PL/SQL as its programming languages.*

*PostgreSQL is an open source OODBMS and is written in the SQL query language.*

*OpenOffice.org Base is an open source RDBMS that is available under a BDS license, and uses HSQLDB as its default database engine.*

*Microsoft Office Access is written in the Microsoft Visual Basic programming language and stores data in the Microsoft Jet Database engine.*

*MySQL is an open source RDBMS that is written in C and C++ and allows users to query and retrieve data from multiple storage engines.*

**Correct answer(s):**

Target 1 = Option A

Target 2 = Option B

Target 3 = Option C

Target 4 = Option D

Target 5 = Option E

Target 6 = Option F

**Question**

You've been instructed to create a database model for storing and managing your company's employee data.  
  
Select the statements about database modeling that are correct.

**Options:**

1. Database modeling is performed only once in the database design process
2. Normalization is used to model the database
3. The database structure is represented by using Entity-Relationship Diagrams
4. Data flow diagrams are used to map the relationships between entities

**Answer**

***Option 1:*** *This option is incorrect. Database modeling is an iterative process, and you can make changes to the data when required.*

***Option 2:*** *This option is incorrect. Database normalization is the process of organizing data in a database by removing duplicate data and eliminating inconsistencies in relations.*

***Option 3:*** *This option is correct. Entity-Relationship Diagrams or ERDs are used to visually represent data in logical structures. This type of diagram helps to identify the database system requirements.*

***Option 4:*** *This option is correct. An ERD consists of data flow diagrams that represent the flow of data through a system. These diagrams help you to map the relationships between entities in a database.*

**Correct answer(s):**

3. The database structure is represented by using Entity-Relationship Diagrams  
4. Data flow diagrams are used to map the relationships between entities

**Recognizing database schemas**

You want to build an efficient relational database to manage your company's customer database. To ensure that you develop a good database architecture, you should be able to correctly use the schemas and their components. You should also be able to maintain referential integrity.

**Question**

Before you begin building the architecture of your database, you want to ensure that you're aware of key concepts related to the relational database schemas.  
  
Which statements about the relational schemas are correct?

**Options:**

1. The logical structure of a database is represented by the internal schema
2. To control the user's access rights and permissions, you need to customize the external schema for each user
3. To limit the values a user can add to an attribute, you need to define constraints for the associated tuple
4. A relation should have an attribute or set of attributes for which each tuple has a unique value
5. A relationship where a single tuple in a table is linked to multiple tuples in another table is called one-to-many relationship

**Answer**

***Option 1:*** *This option is incorrect. The internal schema represents the physical structure of a database. The logical structure is represented by the conceptual schema.*

***Option 2:*** *This option is correct. You customize the external schema for each user according to the user's access rights and permissions. This ensures that only authorized users can view and modify the data.*

***Option 3:*** *This option is incorrect. If you want to limit the values entered into an attribute, you need to define constraints for the attribute's domain. Domain constraints help you to specify lower or upper bounds of the values an attribute can take.*

***Option 4:*** *This option is correct. Every relation should have an attribute or set of attributes for which each tuple has a unique value or set of values. This type of attribute is called a primary key and is used to retrieve a specific tuple.*

***Option 5:*** *This option is correct. A one-to-many relationship signifies a link between one tuple in a table and multiple tuples in another.*

**Correct answer(s):**

2. To control the user's access rights and permissions, you need to customize the external schema for each user  
4. A relation should have an attribute or set of attributes for which each tuple has a unique value  
5. A relationship where a single tuple in a table is linked to multiple tuples in another table is called one-to-many relationship

**Question**

You now want to implement referential integrity in your database.  
  
Select the statements that are correct about referential integrity.

**Options:**

1. A primary key helps you to implement referential integrity
2. To ensure referential integrity, each parent row should be created or deleted before any child row
3. Referential integrity supports data duplication to create backups
4. Referential integrity allows users to insert data into child tables first

**Answer**

***Option 1:*** *This option is correct. A primary key requires that each of its associated table values be valid and unique.*

***Option 2:*** *This option is correct. To strengthen referential integrity, you use foreign keys that ensure that each parent row is created or deleted before any child rows.*

***Option 3:*** *This option is incorrect. Data duplication takes up unnecessary table space and slows down the performance of the database. Referential integrity prevents data duplication by implementing primary and foreign keys.*

***Option 4:*** *This option is incorrect. Referential integrity ensures that data is first inserted into parent tables, before being entered in child tables.*

**Correct answer(s):**

1. A primary key helps you to implement referential integrity  
2. To ensure referential integrity, each parent row should be created or deleted before any child row

**Normalizing database tables**

**Question**

You want to normalize a table in your company's database by using normal forms. The table should satisfy the requirements of the third normal form or 3NF.  
  
Which requirements should the table fulfill to be in 3NF?

**Options:**

1. The table should conform to 2NF requirements
2. Two attributes should store similar information in the same table
3. Attributes that depend on nonkey attributes need to be moved to a new table
4. Any attribute that depends on the primary key should be removed

**Answer**

***Option 1:*** *This option is correct. Database normalization is a progressive activity. So one of the conditions for a table to be 3NF is that it should meet the 2NF requirements.*

***Option 2:*** *This option is incorrect. There are no repeating groups of attributes or repeating attributes in a normalized table. So no two columns of a table should store similar information.*

***Option 3:*** *This option is correct. In 3NF, to reduce redunancy of data in the tables, any nonkey attributes that fully depend on other nonkey attributes instead of the primay key should be moved to new tables. The resulting tables must be related to each other by a foreign key which is based on the nonkey attribute the other nonkey columns depend on.*

***Option 4:*** *This option is incorrect. To meet the 3NF requirements, attributes that do not depend on the primary key should be removed from the relation.*

**Correct answer(s):**

1. The table should conform to 2NF requirements  
3. Attributes that depend on nonkey attributes need to be moved to a new table

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