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Question

1. What is a DBMS? What do we use it for?

DBMS is the abbreviation for Database Management System. It is a computerized system that enables users to create and maintain a database. In other words, DBMS is a system to facilitate defining, constructing, manipulating, and sharing databases among users.

We use DBMS in different majors which contain much information and data. For example, the Department of Motor Vehicles (DMV) can apply DBMS to manage information about driver's licenses and vehicle registrations. This can help the administrative processes (license renewal, annual registrations for vehicles, etc.) be faster as it takes less time to search and make changes on the big database of the system.

2. What is a Relational DBMS? How is it different from DBMS? Give examples for both.

A relational DBMS (RDBMS) is an application/system that stores data in a tabular form, while a DBMS only stores data as files. In RDBMS, the data values are stored in data tables, and each table has a primary key acting as an identifier. In DBMS, the data is only stored in a navigational or hierarchical structure.

Examples of DBMS: file systems, XML, Window Registry

Examples of RDBMS: MySQL, SQL server, or Oracle

3. Which user groups interact with a running DBMS?

The user groups interact with a running DBMS called the "*Actor on the Scene*". It consists of:

- Database administrators (DBA): those who take care of the security breaches and poor system response time
- Database designers: identify the data to be stored in the database and choose which structures to display and manage the data
- End users: they need access to the database in order to query, update, and generate reports
- System Analysts and Application Programmers (Software Engineers): those who need DBMS to develop and apply the specifications to determine the requirements of end users

The other groups maintain the database environment without using or interacting with the data in the system called "*Workers behind the Scene*". It consists of:

- DBMS system designers and implementers: design and implement the DBMS modules and interfaces as a software package
- Tool developers: design the software/system that facilitates the database modeling and design, and improve the performance of the software
- Operators and maintenance personnel: responsible for the running of both software and hardware relating to the database system environment

4. Describe the following terms:

   a. Data model. What are its three parts?

A data model is a type of data abstraction that is used to provide the conceptual representation of the data with certain specific constraints that define the structure of the database. Its three parts are logical concepts, properties, and interrelationships

b. Logical schema

From the conceptual design, the logical schema is created. And a data model implemented in a commercial DBMS will express the logical design. In other words, it defines how the system of the database should be implemented. The purpose of a logical schema is to develop a technical map of rules and data structures.

c. Conceptual schema

The conceptual schema will define what the system contains. It is transformed from the requirements specification and analysis phase with some computerized tools in order to create a database implementation.

d. Physical schema

Physical schema is the stage where more specifications are provided for storing and accessing the database. This is the actual implementation of the database. The physical schema will use a specific DBMS system.

5. How is SQL used in RDBMS?

SQL (Structured Query Language) is used by most of the RDBMS in order to manage the data in tabular format. It contains the primary key and the foreign key. The primary key will contain the

unique identifier for each row of the data in the data table. The foreign key will contain the related key to another table in the system. In other words, the foreign key will have the primary key of another table. The SQL will link the tables together to create an RDBMS.

6. What is redundancy? Give one advantage and disadvantage of redundancy.

Redundancy in file processing happens when every user group maintains its own files for handling its own data-processing application.

Advantages of redundancy:

- A backup place for the database where every user group has its own files and can backup in case one user group loses the data
- Data security improves since the database is stored in different places
- Faster data access for every user group since it has its files
- More data reliability thanks to the existence of multi copies of the data

Disadvantages of redundancy:

- Duplication of effort when processing or performing a single local update
- Storage space is wasted when the data is stored repeatedly
- Inconsistence may happen between the database

Elmasri 7e book (page 28-29)

1. ***Problem 1.8***

Informal queries:

- Check if a student has taken the prerequisite courses for the registering course
- The list of students that a teacher is teaching for a course or all of his/her courses

- Check the grades of a student
- Search for the list of courses for a department

Update operations:

- Update on student information (ID, name, department)
- Change the teacher for a course
- Change the course number or prerequisites
- A teacher changes the grade of a student in his/her class

2. ***Problem 1.10***

All the relationships among the records of the database:

- The primary key of the student table can link to the grade report table ⇔ The grade report table has the foreign key which is the primary key of the student table (Student_number)
- The section table has the foreign key which is the primary key of the course table (Course_number)
- The grade report table also has the foreign key which is the primary key of the section table (Section_number)
- The prerequisite table has the foreign key which is the primary key of the course table (Course_number)

In conclusion:

- Student_number links the student table and the grade report table
- Course_number links the course table with the prerequisite table and the section table
- Section_number links the section table with the grade report table

3. ***Problem 1.12***

Integrity constraints:

- The primary key of each table cannot be null (Student_number, Course_number, Section_number) ⇔ Entity integrity constraints
- The primary key of each table must be unique ⇔ Key constraints
- The grade value in the grade report table must be a one-letter grade ⇔ Domain constraints
- The year value in the section table must be an integer ⇔ Domain constraints
- If a foreign key refers to the primary key of another table, the data of the foreign key must exist in the primary key list of the other table ⇔ Referential integrity constraints

4. ***Problem 1.14***

a.

If the name of the 'CS' (Computer Science) Department changes to 'CSSE'

(Computer Science and Software Engineering) Department, the Department column (in the Course table) is the first column that has to change. And since the corresponding prefix for the course number also changes, the Course_number (in Course, Section, and Prerequisite tables) column must change. Thus, 3 tables will be affected by the change.

b.

In order to restructure the columns in the COURSE, SECTION, and

PREREQUISITE tables so that only one column will need to be updated, we can change the Course_number column in the SECTION and PREREQUISITE table to Course_name, since the

change in question (a) only affects the prefix for the course number but not the name of the course,