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CS457

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HW#1B

Questions

1. Provide an example for each of the following types of data models:

a. Conceptual data models

Conceptual data models describes the database at a very high level and is useful to understand the needs or requirements of the database.

Example: Hotel reservations system, library system, online ordering system

b. Physical data models

Physical data models provide concepts that describe the details of how data is stored on the computer storage media. It defines all the relational data models and objects of the database.

Concepts made by physical data models are usually for computer specialists, not for end users.

Example: primary key, foreign key, integer, varchar, etc.

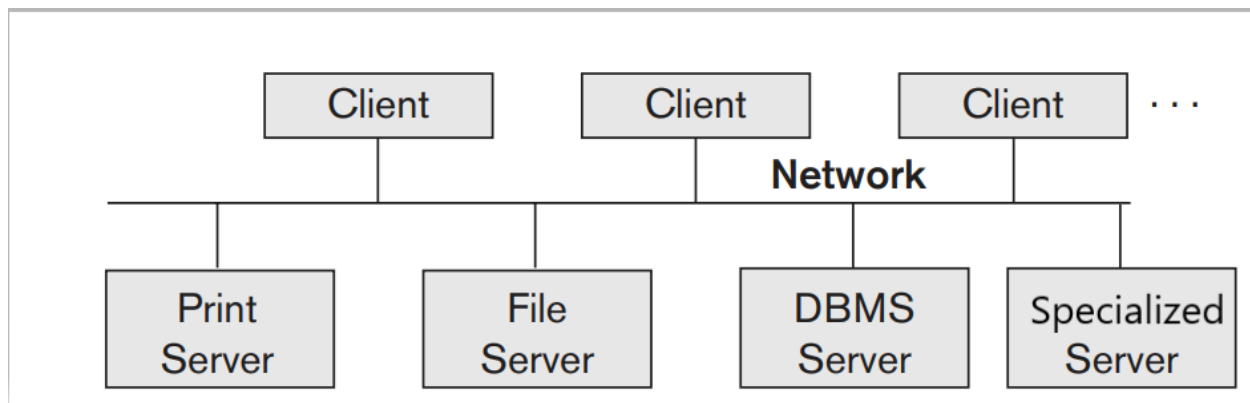
c. Representational data models

Representational data models provide concepts that may be easily understood by end users but that are not too far removed from the way data is organized in computer storage.

Example: entities, attributes, relationships, etc.

2. Draw the diagram of a client-server DBMS architecture and mention its main attributes.

Logical architecture of a client-server DBMS:



Main attributes in a client-server DBMS architecture:

- Client: a user machine that provides user interface capabilities and local processing
- Server: a system containing both hardware and software that can provide services to the client machines, such as file access, printing, archiving, or database access:
 - Print server: connected to various printers
 - File server: maintain the files of the client machines
 - DBMS server: responsible for database access
 - Specialized server: with specific functionalities (e.g.: web servers, e-mail servers)

3. Differentiate between the Relational and Object data models with an example.

Relational data models: used in many current commercial DBMSs. Relational data models store data in collection of tables, where each table can be separated as a file

Example: SQL systems, data tables with primary key and foreign key linking together

Object data models: implemented in some commercial systems but not widespread used. It stores data as objects, their properties, and their operations. Objects with the same structure and behavior belong to a class, and classes are organized to hierarchies.

Example: key-value storage system (NOSQL system), document-based, graph-based, column-based, and key-value data models

4. Draw and explain the schema diagram for the database in a bank account holder system.

CUSTOMER

ID	Name
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CONTACT_INFO

Email	Phone_num	Address	ID
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CARD

ID	Type	Card_num	Expiration	CVV	PIN
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TRANSACTION

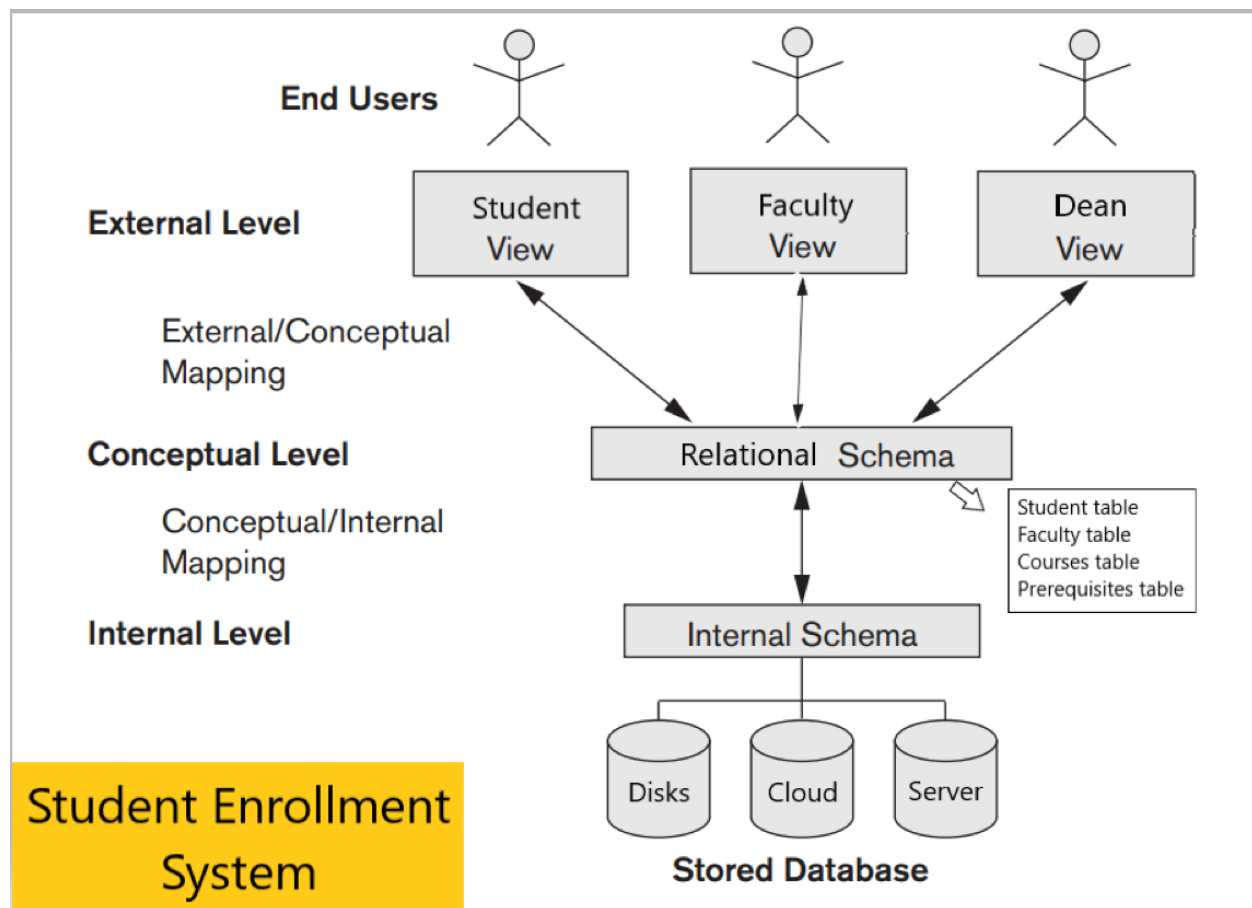
Transaction_ID	Card_num	Date	Trans_amount
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PRIVATE_INFO

ID	Password	Log_history	Face_ID
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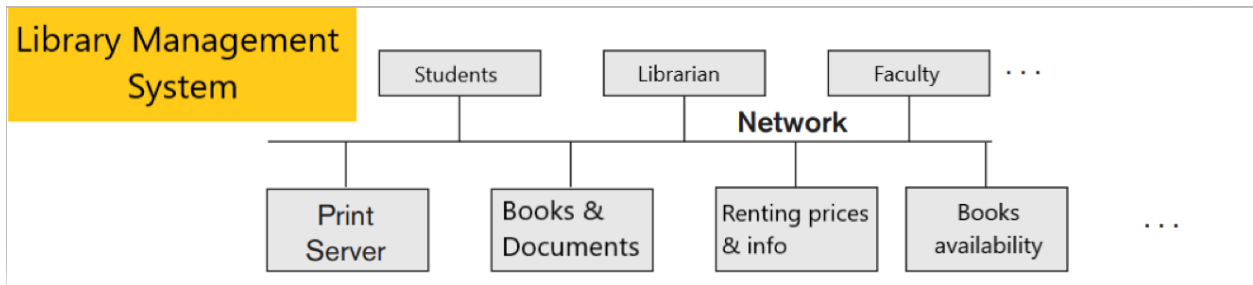
The bank account holder system has 5 sections: CUSTOMER, CONTACT_INFO, CARD, TRANSACTION, and PRIVATE_INFO. Each of these sections will have detail information on the end user of the banking system. And through the schema diagram, we can see that the 5 sections link together since every section has one of more common key to other sections.

5. Draw and explain the Three Schema architecture for a Student Enrollment system in a University



The Three Schema architecture for a Student Enrollment System will have 3 levels: external level, conceptual level, and internal level. At the external level, end users will have different point of view and different access to the database, corresponding to the user's authority. At the conceptual level, the data is saved under relational schema, which is separated in different tables consisting of different information (e.g. student, faculty, courses, prerequisites, etc). Finally, at the internal level, the data is saved in different databases such as disks, cloud, or server.

6. Draw and explain the Two-Tier client-server architecture for a Library management system.



The Two-Tier client-server architecture for a Library management system will consist of end users such as students, librarian, and faculty and the servers such as print server for printers, books & documents server for the information of books, renting server for the prices and information on renting, and books availability server for checking the status of a book. All servers and clients are connected via a common network used by both clients and servers.

Elmasri 7e book (pages 55-56)

7. Problem 2.12

For the database shown in Figure 1.2, there are different type of users such as students, teachers & faculty, dean. The end users may need a web browser or an application that can show the information needed in tables or in a easy-to-understand form.

They can be separated into 3 categories: transcript-related user, registration office user, and admission office user.

The interface for the transcript-related user should have an application which can provide the complete grade report/transcript based on the student ID. It will be served to print out the report of students.

For the registration office user, the interface should provide users access to the data used for the registration process. Furthermore, users should be able to manipulate and change the data in

order to modify the students' grade. It can also help users to check students' prerequisites, add/remove students from a course.

The interface should provide the admission office users the ability to add a new student to the grand database in order to continue with the registration process. These users may use the same interface as the registration officer users, however it should have less authority to some of the data in the whole database.

8. Problem 2.14

The three-tier client-server architecture will be the best choice for the airline reservation system. Because the interface will be placed in the client system, which means each end user will have a different interface based on their authority and characteristics. Furthermore, the server will contain the DBMS and the application/web browser will contain the logic of the system (business rules such as constraints, procedures, etc.)

Other architectures will not be a good choice. In a centralized DBMS architecture, DBMS functionality user interface both performed on the same system. Thus, it is not appropriate for web based system as the end users should have different interface. The two-tier client-server architecture has the logical application stored at a data server, which is inappropriate for airline reservation system.

9. Problem 2.15

STUDENT

Name	Student_number	Class	Major
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COURSE

Course_name	Course_number	Credit_hours	Department
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PREREQUISITE

Course_number	Prerequisite_number
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SECTION

Section_identifier	Course_number	Semester	Year	Instructor
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GRADE_REPORT

Student_number	Section_identifier	Grade
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For STUDENT section, the Student_number should be unique.

For COURSE section, the Course_number and Course_name should be unique.

For PREREQUISITE section, no column has to be unique.

For SECTION section, the Course_number should be unique.

For GRADE_REPORT section, the Student_number should be unique