Nepal College Of Information Technology
DBMS
Assignment-1 Solution

1. List some significant differences between a file-processing system and a DBMS.

Answer: Some main differences between a database management system and a file-processing system are:

· Both systems contain a collection of data and a set of programs which access that data. A database management system coordinates both the physical and the logical access to the data, whereas a file-processing system coordinates only the physical access.

· A database management system reduces the amount of data duplication by ensuring that a physical piece of data is available to all programs authorized to have access to it, whereas data written by one program in a file-processing system may not be readable by another program.

· A database management system is designed to allow flexible access to data (i.e., queries), whereas a file-processing system is designed to allow predetermined access to data (i.e., compiled programs).

· A database management system is designed to coordinate multiple users accessing the same data at the same time. A file-processing system is usually designed to allow one or more programs to access different data files at the same time. In a file-processing system, a file can be accessed by two programs concurrently only if both programs have read-only access to the file.

2. List five responsibilities of a database management system. For each responsibility, explain the problems that would arise if the responsibility were not discharged.

Answer: A general purpose database manager (DBM) has five responsibilities:

a. interaction with the file manager.
b. integrity enforcement.
c. security enforcement.
d. backup and recovery.
e. concurrency control.

If these responsibilities were not met by a given DBM (and the text points out that sometimes a responsibility is omitted by design, such as concurrency control on a single-user DBM for a micro-computer) the following problems can occur, respectively:

a. No DBM can do without this, if there is no file manager interaction then nothing stored in the files can be retrieved.

b. Consistency constraints may not be satisfied, account balances could go below the minimum allowed, employees could earn too much overtime (e.g., hours > 80) or, airline pilots may fly more hours than allowed by law.

c. Unauthorized users may access the database, or users authorized to access part of the database may be able to access parts of the database for which they lack authority. For example, a high school student could get access to national defense secret codes, or employees could find out what their supervisors earn.

d. Data could be lost permanently, rather than at least being available in a consistent state that existed prior to a failure.

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e. Consistency constraints may be violated despite proper integrity enforcement in each transaction. For example, incorrect bank balances might be reflected due to simultaneous withdrawals and deposits, and so on

3. What are main functions of a database administrator? List six major steps that you would take in setting up a database for a particular enterprise.

Answer: Five main functions of a database administrator are:

· To create the scheme definition

· To define the storage structure and access methods

· To modify the scheme and/or physical organization when necessary

· To grant authorization for data access

· To specify integrity constraints

Answer: Six major steps in setting up a database for a particular enterprise are:

· Define the high level requirements of the enterprise (this step generates a document known as the system requirements specification.)

· Define a model containing all appropriate types of data and data relationships.

· Define the integrity constraints on the data.

· Define the physical level.

· For each known problem to be solved on a regular basis (e.g., tasks to be carried out by clerks or Web users) define a user interface to carry out the task, and write the necessary application programs to implement the user interface.

· Create/initialize the database.

4. Explain the distinctions among the terms primary key, candidate key, and super key.

Answer: A *super key* is a set of one or more attributes that, taken collectively, allows us to identify uniquely an entity in the entity set. A super key may contain extraneous attributes. If *K* is a super key, then so is any superset of *K*. A super key for which no proper subset is also a super key is called a *candidate key*. It is possible that several distinct sets of attributes could serve as candidate keys. The *primary key* is one of the candidate keys that is chosen by the database designer as the principal means of identifying entities within an entity set.

5. A university registrar's office maintains data about the following entities: (a) courses, including number, title, credits, syllabus, and prerequisites; (b) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom; (c) students, including student-id, name, and program; and (d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints.

Answer: See Figure 2.3.

In the answer given here, the main entity sets are *student, course, course-offering*, and *instructor*. The entity set *course-offering* is a weak entity set dependent on *course*. The assumptions made are :

a. a class meets only at one particular place and time. This E-R diagram cannot model a class meeting at different places at different times.

b. There is no guarantee that the database does not have two classes meeting at the same place and time.

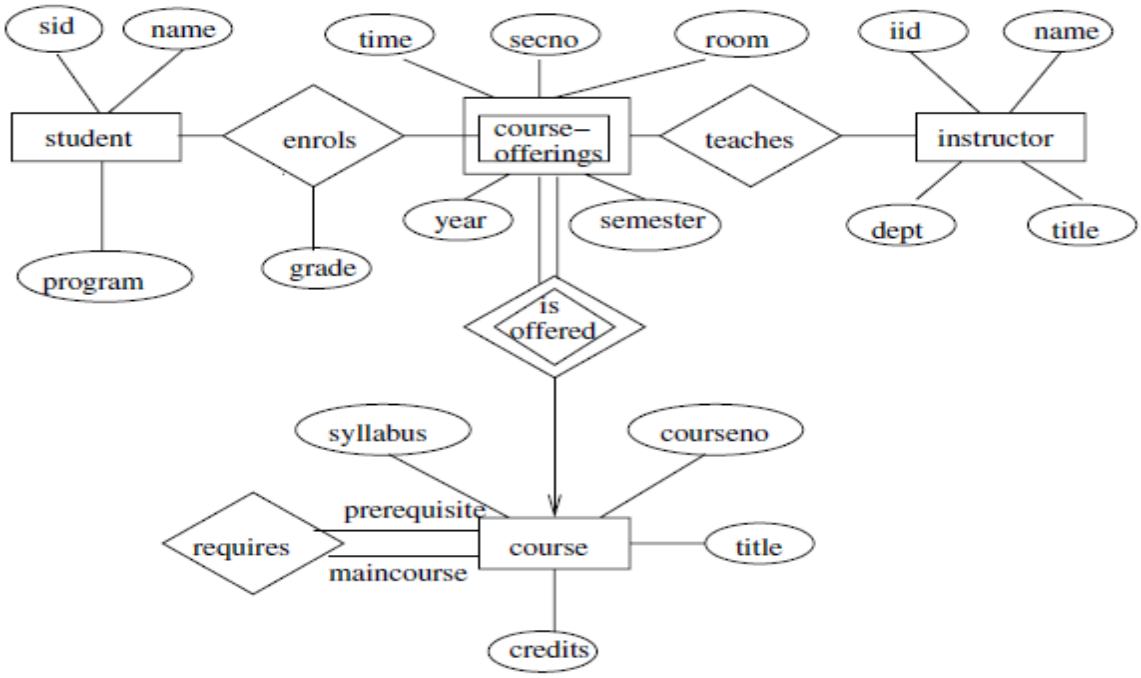


Figure 2.3 E-R diagram for a university.

6. Explain the difference between a weak and a strong entity set.

Answer: A strong entity set has a primary key. All tuples in the set are distinguishable by that key. A weak entity set has no primary key unless attributes of the strong entity set on which it depends are included. Tuples in a weak entity set are partitioned according to their relationship with tuples in a strong entity set. Tuples within each partition are distinguishable by a discriminator, which is a set of attributes.

7. Design an E-R diagramfor keeping track of the exploits of your favourite sports team. You should store thematches played, the scores in eachmatch, the players in each match and individual player statistics for each match. Summary statistics should be modeled as derived attributes.

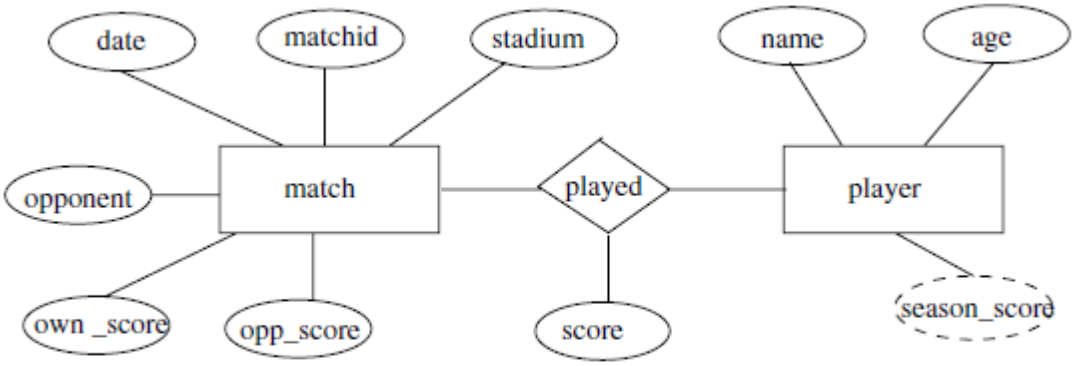
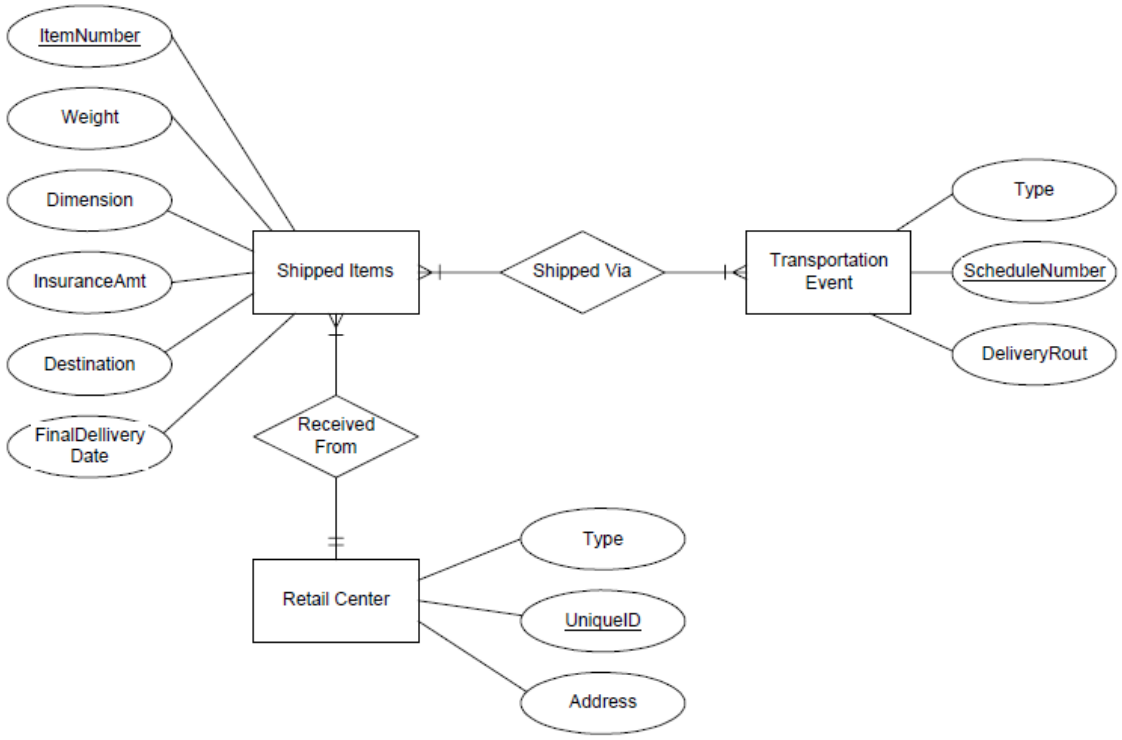


Figure 2.6 E-R diagram for favourite team statistics.

8. UPS prides itself on having up-to-date information on the processing and current location of each shipped item. To do this, UPS relies on a company-wide information system. Shipped items are the heart of the UPS product tracking information system. Shipped items can be characterized by item number (unique), weight, dimensions, insurance amount, destination, and final delivery date. Shipped items are received into the UPS system at a single retail center. Retail centers are characterized by their type, uniqueID, and address. Shipped items make their way to their destination via one or more standard UPS transportation events (i.e., flights, truck deliveries). These transportation events are characterized by a unique scheduleNumber, a type (e.g, flight, truck), and a deliveryRoute. Please create an Entity Relationship diagram that captures this information about the UPS system. Be certain to indicate identifiers and cardinality constraints.

Solutions:



9. Compare between Conceptual, Logical and Physical Data models.

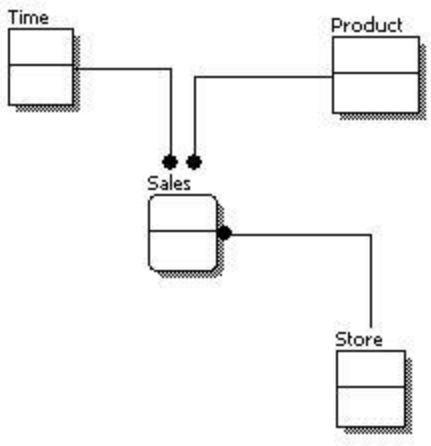
Answer: **Conceptual Data Model:**

A conceptual data model identifies the highest-level relationships between the different entities. Features of conceptual data model include:

- Includes the important entities and the relationships among them.
- No attribute is specified.
- No primary key is specified.

The figure below is an example of a conceptual data model.

Conceptual Data Model



From the figure above, we can see that the only information shown via the conceptual data model is the entities that describe the data and the relationships between those entities. No other information is shown through the conceptual data model.

Logical Data Model:

A logical data model describes the data in as much detail as possible, without regard to how they will be physical implemented in the database. Features of a logical data model include:

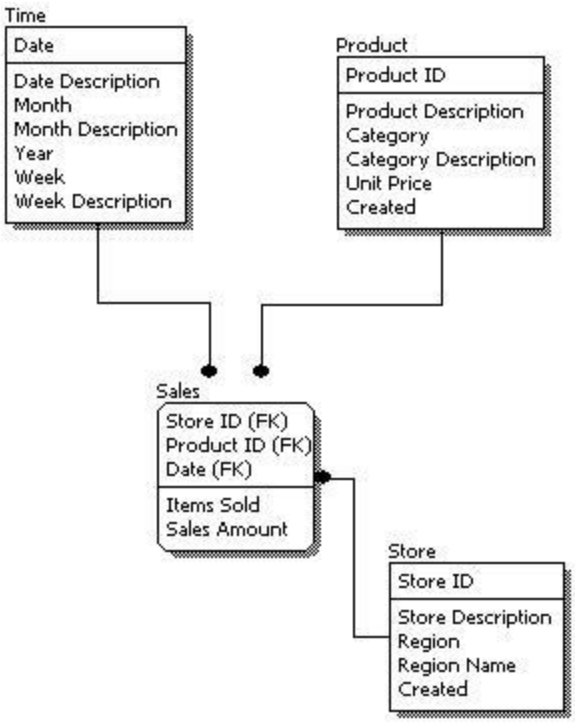
- Includes all entities and relationships among them.
- All attributes for each entity are specified.
- The primary key for each entity is specified.
- Foreign keys (keys identifying the relationship between different entities) are specified.
- Normalization occurs at this level.

The steps for designing the logical data model are as follows:

1. Specify primary keys for all entities.
2. Find the relationships between different entities.
3. Find all attributes for each entity.
4. Resolve many-to-many relationships.
5. Normalization.

The figure below is an example of a logical data model.

Logical Data Model



Physical Data Model:

Physical data model represents how the model will be built in the database. A physical database model shows all table structures, including column name, column data type, column constraints, primary key, foreign key, and relationships between tables. Features of a physical data model include:

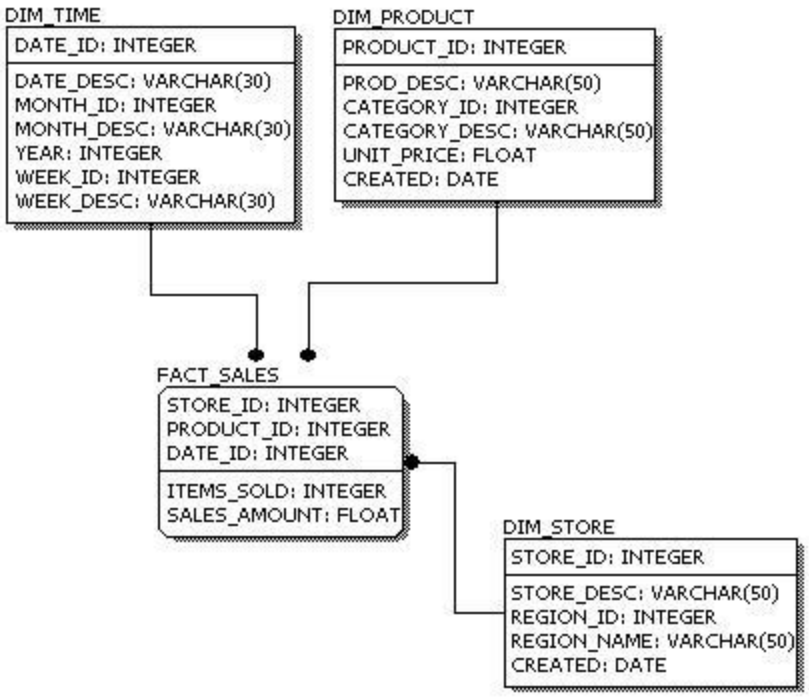
- Specification all tables and columns.
- Foreign keys are used to identify relationships between tables.
- Denormalization may occur based on user requirements.
- Physical considerations may cause the physical data model to be quite different from the logical data model.
- Physical data model will be different for different RDBMS. For example, data type for a column may be different between MySQL and SQL Server.

The steps for physical data model design are as follows:

1. Convert entities into tables.
2. Convert relationships into foreign keys.
3. Convert attributes into columns.
4. Modify the physical data model based on physical constraints / requirements.

The figure below is an example of a physical data model.

Physical Data Model



The table below compares the different features:

Feature	Conceptual	Logical	Physical
Entity Names	✓	✓	
Entity Relationships	✓	✓	
Attributes		✓	
Primary Keys		✓	✓
Foreign Keys		✓	✓
Table Names			✓
Column Names			✓
Column Data Types			✓

10. What are different types of database user? Explain.

Answer: There are four different types of database-system users, differentiated by the way they expect to interact with the system. Different types of user interfaces have been designed for the different types of users.

• **Naive users** are unsophisticated users who interact with the system by invoking one of the application programs that have been written previously. For example, a bank teller who needs to transfer $50 from account A to account B invokes a program called transfer. This program asks the teller for the amount of money to be transferred, the account from which the money is to be transferred, and the account to which the money is to be transferred. Naive users may also simply read *reports* generated from the database.

• **Application programmers** are computer professionals who write application programs. Application programmers can choose from many tools to develop user interfaces. **Rapid application development**

(RAD) tools are tools that enable an application programmer to construct forms and reports without writing a program.

• **Sophisticated users** interact with the system without writing programs. Instead, they form their requests in a database query language. They submit each such query to a **query processor**, whose function is to break down DML statements into instructions that the storage manager understands. Analysts who submit queries to explore data in the database fall in this category. **Online analytical processing (OLAP)** tools simplify analysts' tasks by letting them view summaries of data in different ways.

• **Specialized users** are sophisticated users who write specialized database applications that do not fit into the traditional data-processing framework. Among these applications are computer-aided design systems, knowledge-base and expert systems, systems that store data with complex data types (for example, graphics data and audio data), and environment-modeling systems.

11. What is DBA? What are roles and responsibility of DBA?

Answer: A person having the central control over the system is called a **database administrator** (**DBA**) or **database manager**. The functions of a DBA include:

- **Schema definition**. The DBA creates the original database schema by executing a set of data definition statements in the DDL.
- **Storage structure and access-method definition**.
- **Schema and physical-organization modification**. The DBA carries out changes to the schema and physical organization to reflect the changing needs of the organization, or to alter the physical organization to improve performance.
- **Granting of authorization for data access**. By granting different types of authorization, the database administrator can regulate which parts of the database various users can access. The authorization information is kept in a special system structure that the database system consults whenever someone attempts to access the data in the system.
- **Routine maintenance**. Examples of the database administrator's routine maintenance activities are:
  - Periodically backing up the database, either onto tapes or onto remote servers, to prevent loss of data in case of disasters such as flooding.
  - Ensuring that enough free disk space is available for normal operations, and upgrading disk Space as required.
  - Monitoring jobs running on the database and ensuring that performance is not degraded by very expensive tasks submitted by some users.

12. Discuss about evolution of DBMS.

Answer:

- Over the course of the last four decades of the twentieth century, use of databases grew in all enterprises. In the early days, very few people interacted directly with database systems, although without realizing it they interacted with databases indirectly— through printed reports such as credit card statements, or through agents such as bank tellers and airline reservation agents.
- Then automated teller machines came along and let users interact directly with databases. Phone interfaces to computers (interactive voice response systems) also allowed users to deal directly with databases—a caller could dial a number, and press phone keys to enter

information or to select alternative options, to find flight arrival/departure times, for example, or to register for courses in a university.

- The internet revolution of the late 1990s sharply increased direct user access to databases. Organizations converted many of their phone interfaces to databases into Web interfaces, and made a variety of services and information available online. For instance, when you access an online bookstore and browse a book or music collection, you are accessing data stored in a database.
- Moreover, now there Multimedia databases which can store pictures, video chips and sound messages. Geographic Information Systems (GIS) to store and analyze maps, weather data and satellite image. Data Ware house and Online Analytic Processing (OLAP) systems are used in many companies to extract and analyze useful information for decision making.