Relational Database Management Systems – April 2011

I. Section-A: 5 X 4 =20 Marks

1. What is Database System?

The term Database System refers to an organization of components that define and regulate the collection, storage, management and use of data within a database environment.

2. Write about ER Model Notation.

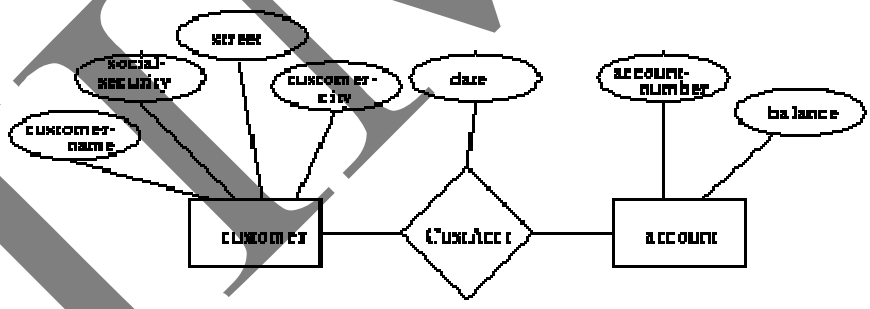
E-R Diagram: An entity-relationship diagram (ERD) is a data modeling technique that creates a graphical representation of the entities, and the relationships between entities, within an information system. Any ER diagram has an equivalent relational table, and any relational table has an equivalent ER diagram.

Entity: The entity is a person, object, place or event for which data is collected. It is equivalent to a database table. An entity can be defined by means of its properties, called attributes. For example, the CUSTOMER entity may have attributes for such things as name, address and telephone number.

Relationship: The relationship is the interaction between the entities.

E-R diagram components are:

- Rectangles representing entity sets.
- Ellipses representing attributes.
- Diamonds representing relationship sets.
- Lines' linking attributes to entity sets and entity sets to relationship sets.



3. Differentiate between Table and View.

Table: Table are defined in three steps.

1. The name of the table is given.
2. Each column is defined, possibly including column constraints.
3. Table constraints are defined.

Create table Tablename(column-name1, data type(number of characters))
(column-name2, data type(number of characters))
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(column-name, data type(number of characters))

View: A definition of a restricted portion of the database. Views are useful for maintaining confidentiality and restricts access to selected parts of the database and for simplifying frequently used

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query types.

The formats of create view command is

Create view V As select statement
As = query specification
V= view name

Create view stud-view as
(Select stud-no, stud-name
From student
Where percentage<=35)

A view is a database object that represents one or more database tables. It doesn't occupy any table Space.

4. What is database Integrity?

A) A condition or integrity that is applied to a particular set of data is commonly termed Integrity Control or Constraint.

In relational model terminology, integrity controls may apply to

(1) Individual attributes

(2) the relationship between two different attributes (perhaps in different relations)

(3) the relationship between tuples of one or more tables. Ideally, the enforcement of integrity constraints would be carried out by the DBMS currently as each new data item is entered.

5. DBMS Selection.

6. Explain the storage media.

7. Database Administration.

DBA functions may generally fall into the areas of communicating with database users; planning, designing, and implementing database systems; and establishing standards and procedures.

Communicating with Users: - Database systems often have three components: a central, widely used database containing much of the firm's data; several functional database (e.g., for accounting) used by a more limited set of programs; and perhaps a few dedicated database, used for a single application (e.g., a bill-of-materials database). The important organizational issue here is that the general impact of implementing a database system is the centralization of a significant portion of the firm's data.

Centralizing data through a database system tends to eliminate local ownership of data and to reduce redundancy. Ownership and control are transferred to the central data dictionary, which maintains a record of the ownership and use of each data element. Such a shifting of control over data may generate resistance from some users. This resistance can be mitigated by actively educating users as to the advantages of learning database technology: how it can make them more

effective and efficient at their jobs. The DBA, in cooperation with top management, should provide this education

Establishing standards and procedures: - organizations having few standards and procedures may encounter difficulty in converting to the database environment, since the record shows that the integrated data management facilitated by database systems requires good, comprehensive standards and procedures. An organization that is beginning to implement a database system may find it useful to examine the standards in use at other organizations that are already using database systems.

Analysis and routing of trouble reports:- A formal trouble-reporting system was established in order to report all errors to the DBA. Trouble reports are analyzed to determine the likely cause of each reported problem. The reports are then routed to the appropriate manager or user group for disposition. Each trouble report contains a complete log and descriptive information. Each report requires a formal response to the report's initiator specifying how the problem has been resolved.

1. Monitoring of hardware and software: The status of all hardware and software is regularly monitored, and reports of failures and consequent action are made to appropriate mangers and user groups. Periodic analysis of hardware and software requirements is made, forming the basis for decisions on replacement and upgrading, including needs for additional database storage media.

2. Testing: Performance acceptance testing is conducted to evaluate all new procedures, software, and hardware. Structural and consistency checks of the database are conducted on a regular basis.

3. Security: security classifications are implemented that identify which user groups are authorized to access specific data elements sin the database and what actions may be performed thereon. Computer operations area frequently monitored to assure that these access controls are functioning in the intended way.

4. Backup and recovery: Backup and recovery procedures are tested regularly to assure their effectiveness in restoring the database after any disruption of service/ a disaster plan has been drawn up and is tested periodically to make sure it works.

5. Performance evaluation: Priorities have assigned to activities that compete for database resources, such as processing transactions, generating reports, and processing queries, system performance is monitored by collecting statistics on transaction volume, response time, error rates, and hardware utilization. Input is elicited from system users to monitor their satisfaction with the system's performance. Database size and growth is also tracked. File expansion programs are run and database reorganizations are performed as necessary. Activity logs and abnormal termination logs are reviewed and summaries prepared for management evaluation.

6. Integrity checking: Schedules have been developed for testing the integrity of the date stored in the database.

8. Write a short note on Oracle/MS-SQL Server.

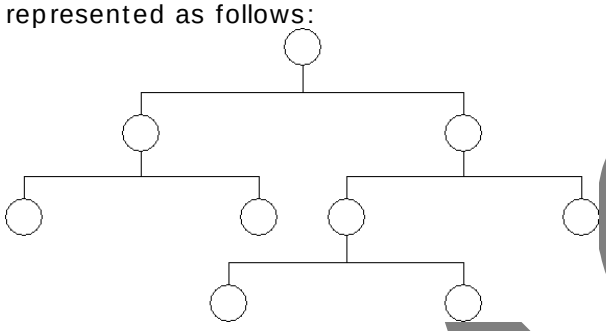
II. Section-B: 5 X 10 =50 Marks

9 (a). Define Database. Explain the various types of database models.

Database: Database is a collection of inter-related data items that can be processed by one or more application systems

A. There are three types of models

1. The Hierarchical Data Model: The Hierarchical Data Model can be represented as follows:

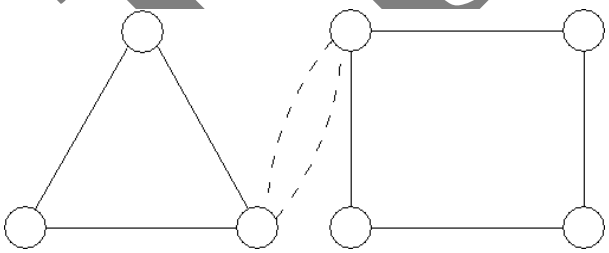


A hierarchical database consists of the following:

- It contains nodes connected by branches.
- The top node is called the root.
- If multiple nodes appear at the top level, the nodes are called root segments.
- Each node (with the exception of the root) has exactly one parent.
- One parent may have many children.

2. The Network Data Model:

The Network Data Model can be represented as follows:



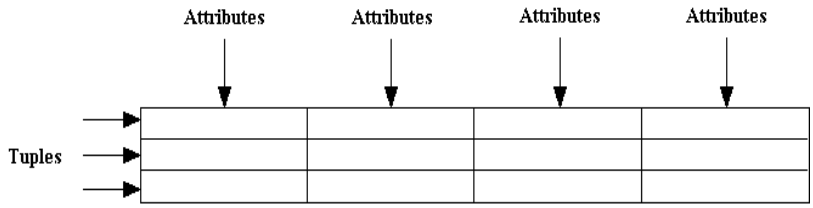
Like the Hierarchical Data Model the Network Data Model also consists of nodes and branches, but a child may have multiple parents within the network structure.

3. The Relational Data Model:

The Relational Data Model has the relation at its heart, but then a whole series of rules governing keys, relationships, joins, functional dependencies, transitive dependencies, multi-valued dependencies, and modification anomalies.

The Relation

The *Relation* is the basic element in a relational data model.



A relation is subject to the following rules:

- Relation (file, table) is a two-dimensional table.
- Attribute (i.e. field or data item) is a column in the table.
- Each column in the table has a unique name within that table.
- Each column is homogeneous. Thus the entries in any column are all of the same type (e.g. age, name, employee-number, etc).
- A Tuple (i.e. record) is a row in the table.

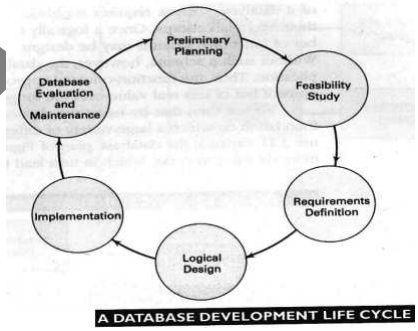
9(b). Explain the database development.

DDLC (Database Development Life Cycle):

It is a process for designing, implementing and maintaining a database system.

It consists of six stages:

1. Preliminary design
2. Feasibility design
3. Requirements definition
4. Conceptual design
5. Implementation
6. Database evaluation and maintenance.



A DATABASE DEVELOPMENT LIFE CYCLE

Preliminary Planning: It is a specific database system takes place during the strategic database planning project. After the database implementation project begins, the general information model produced during database planning is reviewed and enhanced if needed. During this process, the firm collects information to answer the following questions:

1. How many application programs are in use, and what functions do they perform?
2. What files are associated with each of these applications?

3. What new applications and files are under development?

This information can be used to establish relationships between current applications and to identify uses of application information. It also helps to identify future system requirements and to assess the economic benefits of a database system.

Feasibility Study: A feasibility study involves preparing report on the following issues:

1. Technological feasibility: Is suitable technology available to support database development?
2. Operational feasibility: Does the company have personnel, budget and internal expertise to make a database system successful?
3. Economic feasibility: Can benefits be identified? Will the desired system be cost-beneficial? Can costs and benefits be measured?

Requirements Definition: It involves defining the scope of the database identifying management and functional area information requirements and establishing hardware/software requirements. Information requirements are determined from questionnaire responses, interviews with managers and clerical users and reports and forms currently being used.

Conceptual Design: The conceptual design stage creates the conceptual schema for the database. Specifications are developed to the point where implementation can begin. During this stage, detailed models of user view are created and integrated into a conceptual data model recording all corporate data elements to be maintained in the database.

Implementation: During database implementation, a DBMS is selected and acquired. Then the detailed conceptual model is converted to the implementation model of the DBMS, the data dictionary built, the database populate, application programs developed and users trained.

Database Evaluation & Maintenance: Evaluation involves interviewing users to determine if any data needs are unmet. Changes are made as needed. Over time the system is maintained via the introduction of enhancements and addition of new programs and data elements as business needs change and expand.

10(a). Explain the modeling conceptual objects vs. physical objects.

10 (b). What is Relational Algebra? Explain the different operators of Relational Algebra.

A. The relational algebra is a collection of operators that are used to manipulate entire relations. These operations are used to select tuples or to combine tuples from individual relations for specifying a query on the database.

The eight relational algebra operators are

1. SELECT To retrieve specific tuples/rows from a relation.

2. PROJECT To retrieve specific attributes/columns from a relation.

3. PRODUCT To obtain all possible combination of tuples from two relations.

4. UNION To retrieve tuples appearing in either or both the relations participating in the UNION.

5. INTERSECT- To retrieve tuples appearing in both the relations participating in the INTERSECT.

6. DIFFERENCE To retrieve tuples appearing in the first relation participating in the DIFFERENCE but not the second.

7. JOIN To retrieve combinations of tuples in two relations based on a common field in both the relations.

11(a). Define Schema and View. How to create Schema, Table and View in SQL?

Schema: The logical design of the database is called Schema. The concept of relation schema corresponds to the programming language notion of type definition.

Create Schema Sch_name

Authorization Auth_name

Domain definition

Table definition

View definition

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11(b). Explain the process of developing client application

12(a). Explain the database security and database recovery.

Database security problems can be challenging, but they are generally easier to cope with than malicious access to the database, which includes the following:

1. Theft of information
2. Unauthorized modification of data
3. Unauthorized destruction of data

Thus, database security methods focus on preventing unauthorized users from accessing the database. Because DBMS features that make the database easy to access and manipulate also open doors to intruders, most DBMS include security features that allow only authorized persons or processing that can be accompanied once access is made.

Authentication: - Database access usually requires user authentication and authorization. For user authentication, the first level of security establishes that the person seeking system the user knows, such as log-on number and password, (2) something the user possesses, such as plastic ID card, or (3) a physical representation of the user, such as fingerprint or voiceprint.

Authorization and views: - A view is a means of providing a user with a personalized model of the database. It is also a useful way of limiting a user's access to various positions of the database: Data a user does not need to se are simply hidden from view. This simplifies system usage while promoting security. Executing selects, projections, and joins on existing relations can represent views. The user might also be restricted from seeing any part of the existing relation or from executing joins on certain relations.

Types of Views: - Different types of access authorization may be allowed for a particular view, such as the following:

1. Read authorization: allows reading, but not modification of data.
2. Insert authorization: allows insertion of new data, but no modification of existing data.
3. Update authorization: allows modification of data, but not deletion.
4. Delete authorization: allows deletion of data.

Views and security in SQL: -
CREATE VIEW viewname As (select statement)

Encryption: - The various authentication and authorization measures that are standard for protection access to database may not be adequate for highly sensitive data. In such instances, it may be desirable to encrypt the data. Encrypted data cannot be read by an intruder unless that party knows the method of encryption. Considerable research has been devoted to developing encryption methods.

Database Recovery:

Information stored on computer media is subject to loss or corruption caused by a wide range of events, it is important to provide means for resorting correct data to the database. Resorting the database to precisely the same state that existed at the time of system failure is not always possible, but database recovery procedures can restore the database to the state that existed shortly before the failure and identify the status of transaction processing at the time of

the failure. With this capability, unprocessed transactions can be processed against the restored database to bring it back to a fully current status.

Sources of Failure:

A useful classification of failure types includes the following:

System errors: the system has entered an undesirable state, such as deadlock, which prevents the program from continuing with normal processing. This type of failure may or may not result in corruption of data files.

Hardware failures: Two of the most common types of hardware failure and loss of transmission capability over a transmission link. In the former case, the cause usually results from the disk read/write head coming in physical contact with the disk surface.

Logical errors: Bad data or missing data are common conditions that may preclude a program's continuing with normal execution.

Recovery Procedures: -

To maintain data integrity, a transaction must be in one of the two following states:

Aborted: A transaction may not always complete its process successfully. To be sure the incomplete transaction will not affect the consistent state of the database, such transactions must be aborted, and resorting the database to the state it was in before the transaction in question began execution. Such restoration is achieved by rollback.

Committed: A transaction that successfully completes its processing is said to be committed. A committed transaction always leaves the database in a new consistent state.

12(b). Explain the process of mapping logical data structure to physical data structure.

A record is a collection of data items and is the unit for data storage at the logical or file level. The application program usually reads a complete record from the database. A record may consist of different fields and each field corresponds to an attribute of the record.

The records may of fixed size or may be variable in length; one block may contain multiple records. When the records are called unspanned , Whereas for spanned records, portions of a single record may lie in different blocks.

Different methods of arranging records in blocks are called blocking of records.

1. Fixed blocking for fixed-length records.
2. Variable length blocking for unspanned variable length records
3. Variable length blocking for spanned records.

Magnetic tape files allow only sequential file organization where the records are stored in a sequential order only. Whereas with magnetic disc, we can have 3 types of file organization. In indexed file organization ,the records are stored on index basis. In relative file organization, the records are stored on relative key which is evaluated by hashing method.

In logical organization of data refers to different formats of data structure, whereas in physical organization is in the form of storage structure. Storage is represented through files and collection of files is known as Directory.

13(a). Explain the DBMS Selection and Implementation.

13(b). Explain the functions and capabilities of DBMS

A) The Data Dictionary/Directory: - An effective database system will allow growth and modification in the database without comprising the integrity of its data. The data dictionary/directory (DD/D) aids the accomplishment of this objective by allowing the definitions of data to be maintained separately from the data itself. This allows changes to be made to the data definitions with no effect on the stored data. For example, the subschema used by a particular program could be modified without in any way affecting the stored data. Other benefits provided by the DD/D include these:

- Physical storage structures can be changed without affecting the programs that use the data.
- Passwords and other security measures can be stored in the DD/D to facilitate control over data access.
- Centralized data definition enables easy reporting on the status of the database: Why is responsible for the various data items.

To yield these benefits, the DD/D usually includes the following features:

- A language for defining entries in the DD/D.
- A manipulation language for adding, deleting, and modifying entries in the DD/D
- Methods for validating entries in the DD/D
- Means for producing reports concerning the data contained in the DD/D.

Data Security and Integrity: -

1) Access Controls: - Access control is an important factor because they are a means of preventing unauthorized access to data. In the data-sharing database environment, good access controls are essential.

2) Concurrency controls: - Concurrency controls are a means of manipulating data integrity in the multi-user environment. Suppose user A and user B both access a given record at (essentially) the same time in order to process a transaction against the record. The DBMS must somehow limit access by one of the users until the others transaction has been completed. Without this type of facility, the accuracy and consistency of the database can rapidly erode.

3) View Controls: - It provides an automated means of limiting what a user is allowed to access from a given relation. This is a powerful feature that is commonly provided by relational DBMS. The ease of creating views and the

capability of the view facility can be a useful distinguishing factor among DBMSs. The DBMS purchaser may also be interested in whether views can be updated and what limitations may apply.

4) Encryption: - It facilitates may be important to institutions whose databases contain very sensitive data. Encryption can also be important for the maintenance of a secure password directory.

5) Backup and Recovery controls: -Effective Backup and recovery controls are absolutely essential to efficient operation of the database system. The ease of use of backup and recovery controls, and their completeness, and their reliability should be major factors in the DBMS selection decision.

Query, Data Manipulation, and Reporting Capabilities: -

The DBMS's ability to support reporting requirements, along with users' query and data manipulation needs, is the cornerstone of today's management information systems. A sound DBMS is going to provide the capability to generate structured reports in a variety of formats. In addition, the DBMS will provide a query language that is powerful, yet easy to learn and use. The language should be able to support both planned and unplanned query requirements with short response times.

Support of Specialized Programming Reguirements: -

Developing specialized programs to interface with the DBMS requires facilities for supporting program development and program testing. A worthy DBMS will provide a host language for expressing standard procedural program structures or will provide an interface capability for quick prototyping of applications.

Physical Data Organization Options: -

The firm acquiring a DBMS may not wish to involve itself in the details of physical data organization. Instead, it may gauge the efficiency of a DBMS's physical organization by running sample applications.

For those who are interested, however, exploring the physical organization features may be of value. For example, it is known that the inverted list is most efficient in supporting multikey retrieval, whereas the chain list is superior for file updating since there is no need for updating a separate file. Information on other architectural features may be elicited in the process of considering the DBMS's capability to support the types of applications common to the firm.