

(DATABASE DESIGN PROCESS)

LECTURE NO.1

TIME: 30 MIN.

PREVIEW OF TODAY'S TOPICS

- A. Database design for an organization
- B. Data Modeling, Ingredient of data Modeling

Name: _____

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Date: _____

DATABASE DESIGN FOR AN ORGANIZATION

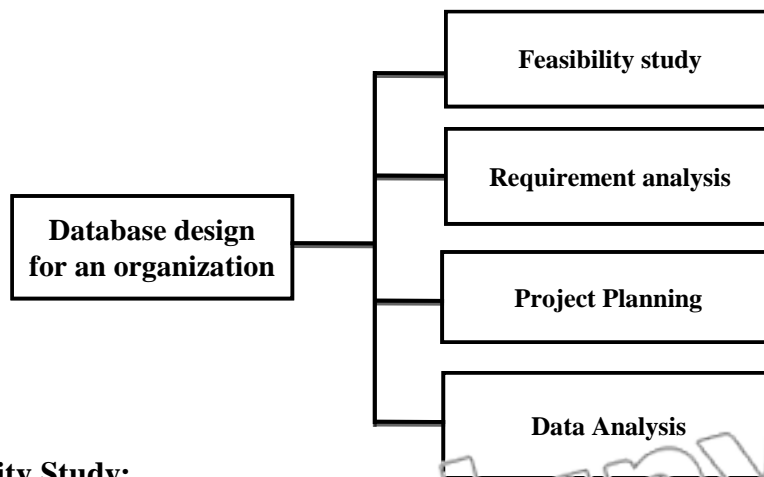
EXTENSIVE QUESTION

Q.1 Describe the different steps involved in analysis stage while designing database.

SHORT QUESTIONS

- (i) What is a purpose feasibility study? (LHR 2021) (MTN 2022) (DGK 2018, 2022) (SGD 20217) (U.B)
- (ii) How data is analysis performed? (GRW 2022) (SWL 2019) (A.B)
- (iii) Which activities are involved in data analysis? (RWP 2022) (U.B)
- (iv) What is project planning? (MTN 2021) (FSD 2021) (K.B)

DATABASE DESIGN FOR AN ORGANIZATIONS



Feasibility Study:

- (i) Feasibility study also known as preliminary investigation of the required database.
- (ii) It involves the area identification and selection.
- (iii) For example, which area or aspect is to be selected to start.
- (iv) After the selecting project, it is allocated a specific fund and a proper planning, is chalked out for its practical implementation.
- (v) Side by side, a proper market analysis is also worked out.

Requirements Analysis:

- (i) The requirements are gathered like the possible inputs for the database and the required functionality out of it.
- (ii) The users precisely narrate their needs of the database and the possible

domain and restrictions are also chalked out.

- **Project Planning:**
 - (i) A proper Schedule is laid down to accomplish this activity.
 - (ii) All the cost factors are taken into consideration.
 - (iii) For example, the salaries of team members, their logistics involve other trivial expenses and hardware costs.
- **Data Analysis:**

This is an important analysis aspect while designing a database:

 - (i) Data Flow Diagrams (DFD)
 - (ii) Decision Tables
 - (iii) Decision Trees

MULTIPLE CHOICE QUESTIONS

- (i) **All the hardware costs are considered during:** (SWL 2019)
 - (a) Project planning
 - (b) Requirements analysis
 - (c) Feasibility study
 - (d) Data analysis
- (ii) **In which of the following requirement of user is gathered?**
 - (a) Project planning
 - (b) Requirements analysis
 - (c) Feasibility study
 - (d) Data analysis
- (iii) **Preliminary investigation of the Database is also called:**
 - (a) Project planning
 - (b) Requirements analysis
 - (c) Feasibility study
 - (d) Data analysis

SHORT QUESTIONS

- (i) **What is a purpose feasibility study?** (LHR 2021) (MTN 2022) (DGK 20218, 2022) (SGD 20217) (U.B)

A feasibility study is an analysis of how successfully a project can be completed, accounting for factors that affect it such as economic, technological, legal and scheduling factors. Project managers use feasibility studies to determine potential positive and negative outcomes of a project before investing a considerable amount of time and money into it.
- (ii) **How data analysis is performed?** (GRW 2022) (SWL 2019) (A.B)

A process of studying the existing system is known as analysis. The basic purpose of analysis is to know which activities are performed in the current system. The analysis also determines what should take place in the new system.

Data analysis involves the activities of:

 - Data flow diagram,
 - Decision tables
 - Decision tree
- (iii) **Why is requirement analysis conducted?**

The requirement analysis is conducted to gather the requirements for the project. These requirements include the possible inputs for database and the required functionality of project. It is also used to define the possible domain and restrictions related to the system.
- (iv) **Which activities are involved in data analysis?** (RWP 2022) (U.B)

Data analysis involves the activities of:

 - Data flow diagram,
 - Decision tables
 - Decision tree
- (v) **What is project planning?** (MTN 2021) (FSD 2021) (K.B)

After requirement analysis, a proper planning and time schedule must be developed for different activities that are required to design a database system. In addition to a time schedule for different activities, the cost factors are also taken into consideration.

DATA MODELING, INGREDIENT OF DATA MODELING

EXTENSIVE QUESTION

- Q.1 Identify the components of ER diagram.** (BWP 2022)
Q.2 What is data modeling explain different ingredients of data modeling. (RWP 2017)

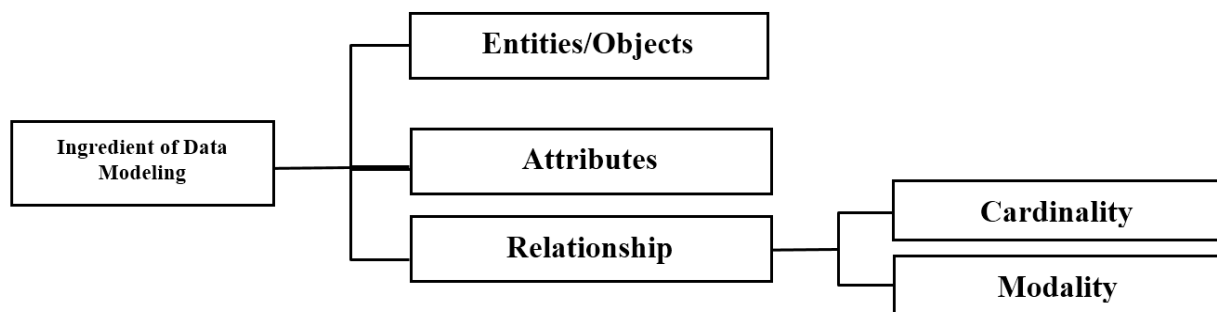
SHORT QUESTIONS

- (i) Define Entity. (LHR 2022) (BWP 2022) (DGK 2022,21) (K.B)
(ii) What is attribute? (FSD 2022) (RWP 2022) (LHR 2015) (K.B)
(iii) Define the term cardinality of a relation. (DGK 2021, 2022) (MTN 2018) (K.B)
(iv) Define Modality. (MTN 2021) (K.B)
(v) How can you define relation ER diagram? (SWL 2022)(U.B)
(vi) Differentiate between Cardinality and Modality. (BWP 2019) (U.B)
(vii) List down different types of relationship. (SWL 2021) (U.B)

DATA MODELING

“Data Modeling is the process of identifying the data objects and the relationships between them”.

INGREDIENTS OF DATA MODELING



Entities/ Objects:

- (i) A data entity/ object is anything that is participating in system.
(ii) It is always properly identifiable i.e., a TEACHER, a STUDENT, and AEROPLANE.

TEACHER

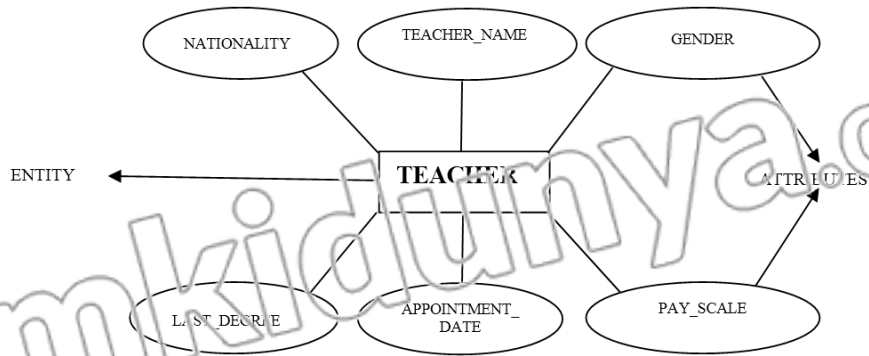
STUDENT

Attributes:

- (i) Attributes define the objects, describe their characteristics and in some cases make references to other objects(s).

- Example Attributes for A TEACHER:**

Teacher Name, Gender, Last Degree, Appointment Date, Pay Scale, Nationality Telephone No. etc.



Relationships:

- (i) The relationships indicate how the Entities/Objects are Connected or Related to each other.
- (ii) The Data objects are related/ connected to one another in different ways.

- **Examples of Relationships:**

- **A BOOK STORE orders BOOK(s).**
- **A BOOK STORE displays BOOK(s).**
- **A BOOK STORE stocks BOOK(s).**
- **A BOOK STORE sells BOOK(s).**
- **A BOOK STORE returns BOOK(s).**

- **Important things to note in Relationships:**

- (i) All the relationships define the relevant connections between both objects.
- (ii) All the relationships are bi-directional.
- (iii) We have to consider only the relevant relationships (in the context of the requirement)

CARDINALITY

Whether some occurrence (s) of object-1 are related to some occurrence(s) of object-2.

It is expressed as one or many e.g.

- A husband can have only one wife.
- A father can have many children.

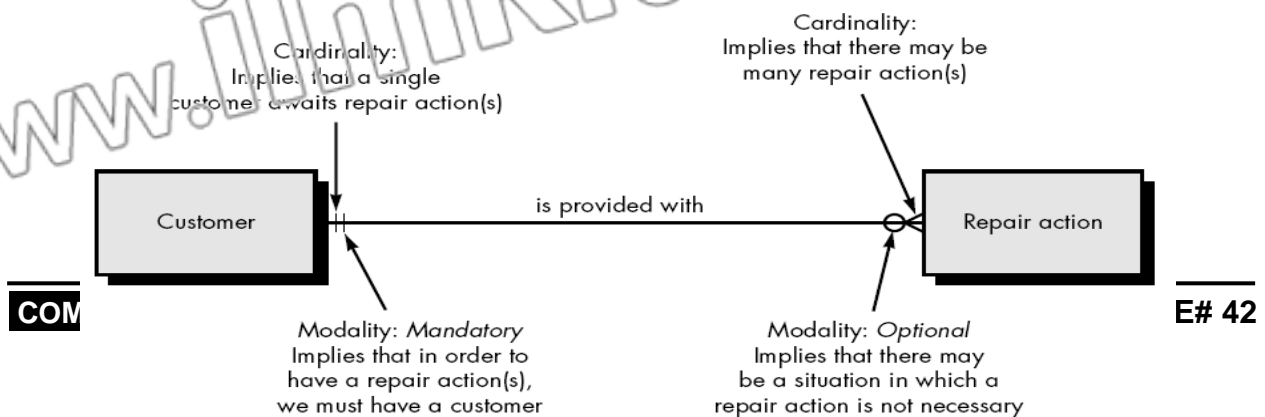
- **Different types of relation between objects:**

- (i) One to one
- (ii) One to many
- (iii) Many to many
- (iv) Recursive

MODALITY:

It defines the nature of the relationship between the entities like: -

- (i) Optional Represented by 0
- (ii) Mandatory..... Represented by 1



MULTIPLE CHOICE QUESTIONS

- (i) A relation between patient to bed is (or a relationship between a teacher to chair): (FSD 2022)
(a) One to one (b) One to many
(c) Many to many (d) Many to one
- (ii) Which is used to associate entities with one another? (BWP 2018) (LHR 2015)
(a) Entity (b) Attribute
(c) Identifier (d) Relationship
- (iii) Which of the following is used to describe the characteristics of an object? (SGD 2019)
(a) Attribute (b) Cardinality
(c) Modality (d) Entity
- (iv) A person's name, birthday and social security number are examples of: (MTN 2018)
(a) Attributes (b) Entities
(c) Relationship (d) Descriptions
- (v) Which of the following is an example of one-to-many relationship? (DGK 2018)
(a) Student – Regno (b) Person – DOB
(c) Mother – daughter (d) Country – Capital

SHORT QUESTIONS

- (i) Define Entity? (LHR 2022) (BWP 2022) (DGK 2022,21) (K.B)

Ans: A real world object is called an entity. An entity can be a person, place, thing or event for which data is collected and managed in a system. For example:

- **Place** Country, City
- **Person** Student, Teacher, Doctor
- **Thing** Car, Bike
- **Event** Examination

- (ii) Define Attribute? (FSD 2022) (RWP 2022) (LHR 2015) (K.B)

Ans: The characteristics or properties of an entity is called attribute. An entity may have many attributes. It is not possible to store all attributes. However useful attributes are stored in database system. For example, Name, Address, Phone and class are some attributes of the student entity.

- (iii) Define the term Cardinality of a Relation? (DGK 2021, 2022) (MTN 2018) (K.B)

Ans: The number of instances of one entity that can be associated with each instance of another related entity is known as cardinality of relationship. The cardinality is expressed as one or many such a country can have only one capital and a mother can have many children.

- (iv) Define Modality? (MTN 2021) (K.B)

Ans: Modality describes relationship as either mandatory or optional. It specifies absolute minimum number of relationships. The relationship is called optional if minimum number is zero. The relationship is called mandatory if minimum number is one.

- (viii) How can you define relation ER diagram? (SWL 2022) (MTN 2021) (DGK 2021)(U.B)
OR

What do know about relationship?

Ans: A logical connection between different entities is called relationship. For example, a relationship exists between a STUDENT and TEACHER because teacher teaches student. The entities that participate in a relationship are called participants. In ER diagram relationship is presented by a diamond symbol.

The types of relationships are:

- **One-to-One**
- **One-to-Many**
- **Many-to-Many**
- **Recursive**

(ix) **Differentiate between Cardinality and Modality.**

(BWP 2019) (U.B)

Ans: Following are the difference between Cardinality and Modality.

Cardinality	Modality
<ul style="list-style-type: none">• The number of instances of one entity that can be associated with each instance of another related entity is known as cardinality of relationship. The cardinality is expressed as one or many such as a country can have only one capital and a mother can have many children.	<ul style="list-style-type: none">• Modality describes relationship as either mandatory or optional. It specifies absolute minimum number of relationships. The relationship is called optional if minimum number is zero. The relationship is called mandatory if minimum number is one.

(x) **List down different types of relationship.**

(SWL 2021) (U.B)

Ans: The types of relationships are:

- **One-to-One**
- **One-to-Many**
- **Many-to-Many**
- **Recursive**

REVISION LECTURE NOTES

CHAPTER NO.3 (DATABASE DESIGN PROCESS)

LECTURE NO.2

TIME: 30 MIN.

PREVIEW OF TODAY'S TOPICS

C. ER-Diagram (An example), Database design Process

ER-DIAGRAM (AN EXAMPLE), DATABASE DESIGN PROCESS

EXTENSIVE QUESTION

Q.1 Write down the different phases of design process. (BWP 2018)

SHORT QUESTIONS

(i) What is ER Diagram? (BWP 2021) (FSD 2021) (DGK 2021) (U.B)

OR

Write the down primary objective of ER diagram.

(ii) Define implementation in database. (LHR 2022) (K.B)

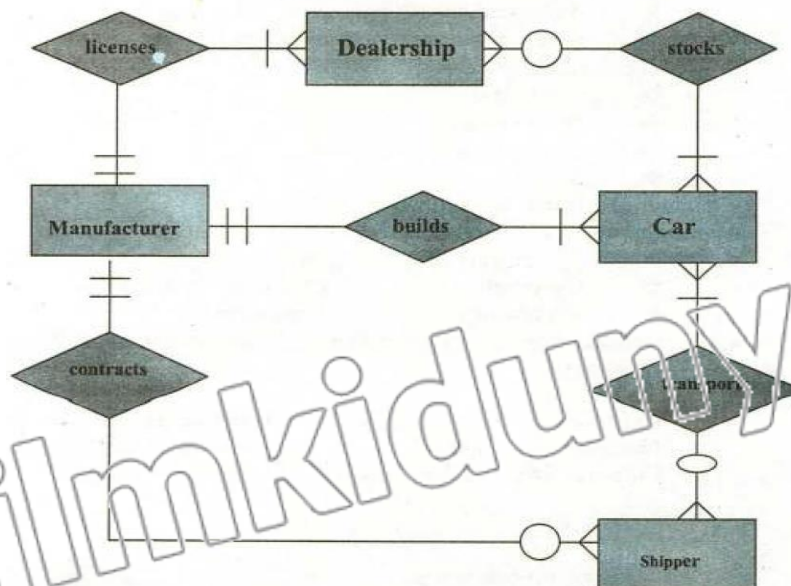
(iii) What is a purpose of Logical Database Design process? (RWP 2018) (U.B)

(iv) What is Physical Database Design? (SWL 2021)(K.B)

(v) Write a note on planning process in database development process.

ER-DIAGRAM (AN EXAMPLE)

Entity-Relation Diagram (An Example)



- The Entity/Object – relationship pair discussed above is the objective of the Data Model.
- These pairs can be represented graphically using the Entity-Relationship Diagram (ERD).
- It was basically proposed/used for design of a Relational Database system and now is being adopted for other Database types also.

- A set of primary components are identified for the ERD: Data objects, Attributes, Relationships, Cardinality and modality.
- The primary objective of the ERD is to represent Entities/Objects and their relationships/association.
- Data modeling and the Entity-Relationship diagram provide the Analyst or database administrator with a concise notation for examining data within the context of a Data Processing Application or constructing a physical Database

DATABASE DESIGN PROCESS

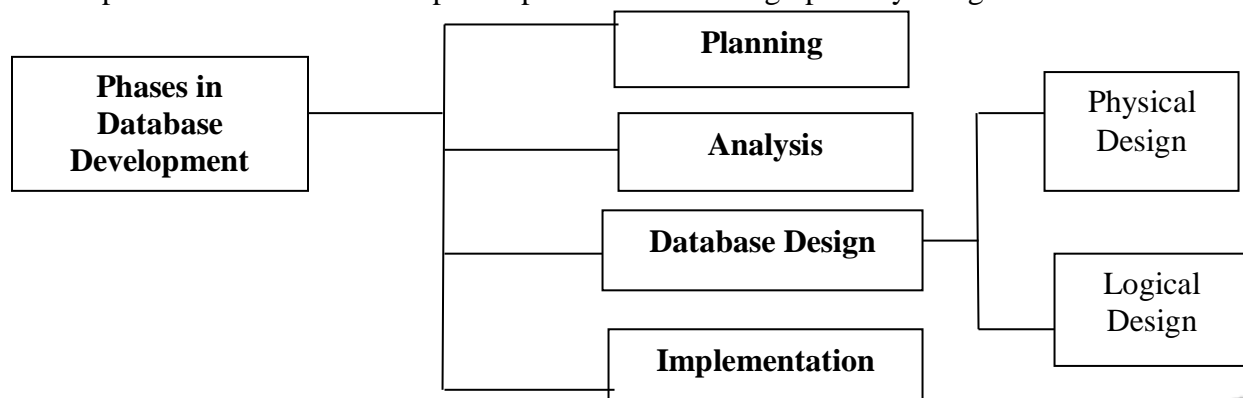
DATABASE DEVELOPMENT PROCESS/DESIGN:

The database development is very important and creative activity. The major objective of database design is to map the conceptual data model to an implementation model that a particular DBMS can process. The database and database system must be acceptable to the organization and all its users. The users can easily perform different operations on the database without any problem.

The database development process consists of two activities. The first activity involves the design of the data contents and the structure of database. The second activity is related to the design of database applications. The two activities are closely related to each other. For example, by analyzing the database application, we can identify the data items that will be stored in the database.

PHASES IN DATABASE DEVELOPMENT PROCESS

The database development process includes a series of phases. The major phases are: planning, analysis, design, and implementation. Each phase is divided into steps. The phases of database development process are shown graphically in figure below.



(1) Planning

The database planning phase begins when a customer requests to develop a database project. It is a set of tasks or activities which decides the resources required in the database development and time limits of different activities for the completion of the system.

(2) Analysis

Analysis is done in order to understand or study the current system (or problem, which is to be solved). It is very important activity for the development of database system. In this phase, the requirements and expectation of the users are collected and analyzed. The collected requirement help to understand the current system and for the improvement of that system (or for designing the new system).

(3) Database Design

The database design is very important step of database development process. In this phase, the database structure is designed: Database design is further divided into two steps.

(4) Logical Database Design

In logical database design, the conceptual data model (or logical data model) is converted into database structure for a specific DBMS. If there is a relational DBMS, then the conceptual data models are mapped to the normalized relations.

(5) Physical Database Design

In physical database design, the logical database is converted into physical storage structures such as files and tables. The indexes and access methods are also specified. Similarly, physical design is also concerned with security, backup and recovery etc.

(6) Implementation

The database system is implemented after it has been designed and developed. After implementation user start using database system.

MULTIPLE CHOICE QUESTIONS

- (i) **In ERD model, the relationship between two entities is represented by a:** (LHR 2022) (DGK 2021, 2022) (RWP 2019)
- (a) Diamond symbol (b) Rectangular box
(c) Oval symbol (d) Line
- (ii) **Organizing the database in Computer disk storage is done in:** (SWL 2019, 2021)
- (a) Logical design (b) Physical design
(c) Analysis (d) Implementation
- (iii) **In an ER Diagram, a rectangle represents:** (BWP 2021) (SGD 2018)
- (a) Entity (b) Attribute
(c) Relationship (d) Fields
- (iv) **Which of the following activities are involved in data analysis?**
- (a) Data flow diagram (b) Decision Tables
(c) Decision Trees (d) All of these
- (v) **In which of the following phase requirement and expectations of users are collected and analyzed?**
- (a) Logical design (b) Physical design
(c) Analysis (d) Implementation

SHORT QUESTIONS

- (i) **What is ER Diagram?** (BWP 2021) (FSD 2021) (DGK 2021) (U.B)

Ans: An ER Diagram is a geographical representation of entities and their relationships in a database. ER diagram uses different symbols to represent different information of database system. Entities are represented by rectangles. Relationships are represented by diamond and attributes are represented by oval.

- (ii) **Define database implementation.** (LHR 2022) (K.B)

Ans: The database system is implemented after it has been designed and developed. After implementation, user start using database system.

(iii) What is Logical Database Design?

(KVP 2013) (U.B)

Ans: In logical database design, the conceptual data model (or logical data model) is converted into database structure for a specific DBMS. If there is a relational DBMS, then the conceptual data models are mapped to the normalized relations.

(iv) What is Physical Database Design?

(SWL 2021)(K.B)

Ans: In physical database design, the logical database is converted into physical storage structures such as files and tables. The indexes and access methods are also specified. Similarly, physical design is also concerned with security, backup and recovery etc.

(v) Write a note on planning process in database development process.

Ans: The database planning phase begins when a customer requests to develop a database project. It is a set of tasks or activities, which decides the resources required in the database development and time limits of different activities for the completion of the system.

PREVIEW OF TODAY'S TOPICS

- D. Conceptual database design
- E. Physical database design & its Components (Data volume and Usage analysis)

CONCEPTUAL DATABASE DESIGN

PHYSICAL DATABASE DESIGN & ITS COMPONENTS

(DATA VOLUME AND USAGE ANALYSIS)

EXTENSIVE QUESTION

Q.1 Write down the different components of a logical database design model?

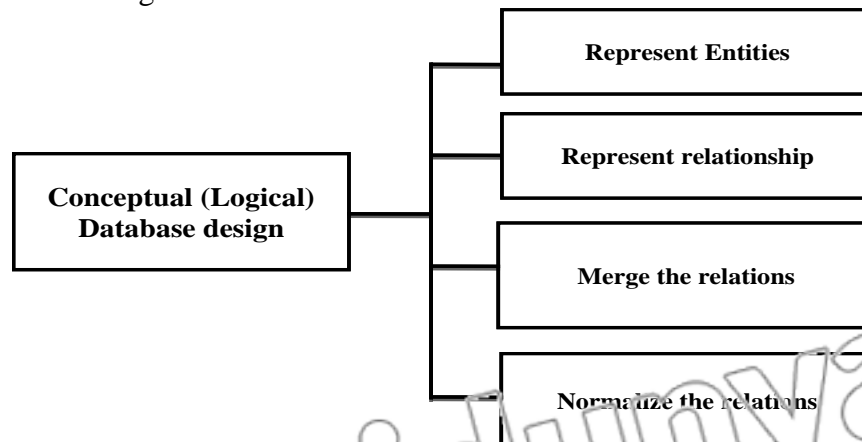
SHORT QUESTIONS

- (i) Define the Conceptual (logical) database design. (K.B)
- (ii) Write down the different phases of logical Database design process. (U.B)
- (iii) Why it necessary merge the relations in logical Database design process? (U.B)

CONCEPTUAL (LOGICAL) DATABASE DESIGN

Definition:

The process of mapping the conceptual data models (from analysis) to structures that are specific to the target DBMS.



• **Represent Entities:**

- (i) Each entity type in the E-R diagram is represented as a relation in the Relational view of Data Model
- (ii) The identifier of the entity type becomes the Primary key of the relation.
- (iii) Other attributes of the entity type become non-key attributes of the relation.

• **Represent Relationships:**

- (i) Each relationship in an E-R diagram must be represented in the relation model.
- (ii) It depends on its nature.

- (iii) For example, in some cases, we represent a relationship by making the primary key of one relation a foreign key of another relation.
- **Merge the Relations:**
 - (i) There may be redundant relations (that is, two or more relations that describe the same entity type).
 - (ii) They must be merged to remove the redundancy.
 - (iii) This process is also known as View Integration.
 - (iv) For example, we have one relation as: EMPLOYEE1 (EMPNO, NAME, ADDRESS, PHONE)
 - (v) And another relation as EMPLOYEE2 (EMPNO, ENAME, EMP-ADDR, EMP-JOB-CODE, EMP-DOB)
 - (vi) When the two relations have the same primary key (EMPNO) they describe the same entity and may be merged into one relation.
 - (vii) The result of merging the relations is the following relation. EMPLOYEE (EMPNO, NAME, ADDRESS, PHONE, EMP-JOB-DOCE, EMP-DOB)
- **Normalize the Relations:**
 - (i) The relations may have unnecessary redundancy and may be subject to anomalies (error) when they are updated.
 - (ii) Normalization is the process that refines the relations to avoid error in database.

MULTIPLE CHOICE QUESTIONS

- (i) **In an E-R diagram, an entity is represented as:** (BWP 2021) (SGD 2018)
 - (a) As a relation in RDBMS
 - (b) As a Rectangular in RDBMS
 - (c) As a Diamond in RDBMS
 - (d) Both (a) & (b)
- (ii) **Merging the relation is also known as:**
 - (a) View integration
 - (b) View entities
 - (c) View indexes
 - (d) Both (a) & (b)
- (iii) **Cause of merging the relation is:**
 - (a) To remove the redundancy
 - (b) To remove the consistency
 - (c) To remove the normalization
 - (d) Both (b) & (c)
- (iv) **Normalization is a process that:**
 - (a) That increase the redundancy
 - (b) That increase the duplication
 - (c) That redefine the relation to avoid errors in a database
 - (d) Both (a) & (b)

SHORT QUESTIONS

- (i) **Define the Conceptual database design.**
 Conceptual data model describes about the data to be stored in the database. The conceptual data model provides the permanent structure of the data resource of the organization. E-R model is a popular conceptual data model. It is most commonly used during the analysis phase of database development process, to create data model that can be used to implement the database. It is expressed in terms of entities, relationship between entities and the attributes of the entities. The conceptual data model is expressed as entity-relationship diagrams.

(ii) Write down the different phases of logical Database design process.

Ans: There are following phases of logical Database design process:

- Represent entities
- Represent Relationship
- Merge the relations
- Normalize the relations

(iii) Why it necessary merge the relations in logical Database design process?

Ans: There may be redundant relations (that is, two or more relations that describe the same entity type). They must be merged to remove the redundancy. This process is also known as View Integration.

Example

We have one relation as:

EMPLOYEE1 (EMPNO, NAME, ADDRESS, PHONE)

And another relation as

EMPLOYEE2 (EMPNO, ENAME, EMP-ADDR, EMP-JOB-CODE, EMP-DOB)

When the two relations have the same primary key (EMPNO) they describe the same entity and may be merged into one relation. The result of merging the relations is the following relation.

EMPLOYEE (EMPNO, NAME, ADDRESS, PHONE, EMP-JOB-DOCE, EMP-DOB)

PHYSICAL DATABASE DESIGN & ITS COMPONENTS

(DATA VOLUME AND USAGE ANALYSIS)

EXTENSIVE QUESTION

Q.1 What elements combined, produce the physical database designs? Explain

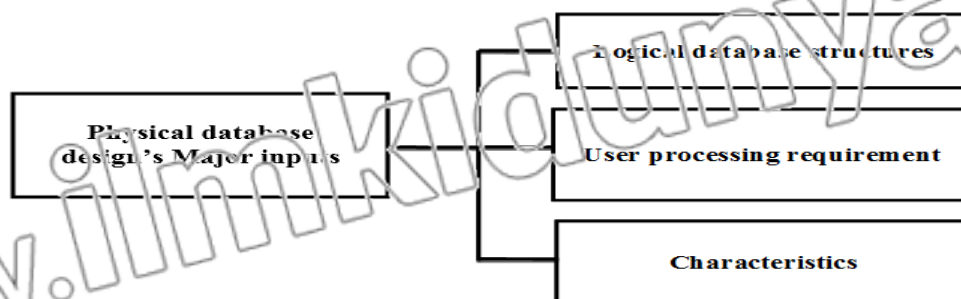
SHORT QUESTIONS

- (i) Define physical database design. (SWL 2021) (K.B)
- (ii) List any four Component of physical database design. (LHR 2022) (U.B)
- (iii) Write down the major inputs to Physical design (MTN 2022) (U.B)
- (iv) State the use of data volume and usage analysis?

PHYSICAL DATABASE DESIGN

Definition:

The major objective of physical database design is to implement the database as a set of stored records, files, indexes and other data structures that will provide adequate performance and ensure database integrity, security and recoverability



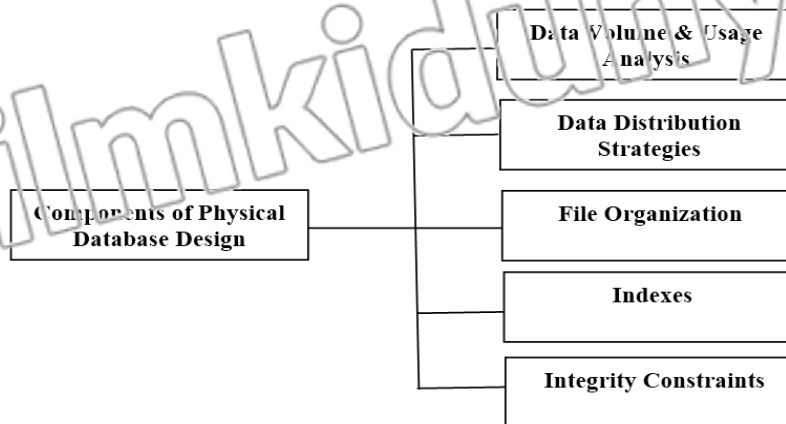
- Logical data base structures (Developed during logical database design) i.e., the Normalized Relations.
- User processing requirements

i.e. size and frequency of use of the data-Base, response time, security, backup, recovery etc.

- **Characteristics**

Of the DBMS and other components of the computer Operating environment

COMPONENTS OF PHYSICAL DATABASE DESIGN



- **Data Volume and Usage Analysis:**

Definition:

Data Volume and Usage Analysis is to estimate the size or volume and the usage patterns of the database.

- (i) Estimates of database size are used to select Physical storage devices.
- (ii) Estimates of usage paths or patterns are used to select the file organization and access methods.
- (iii) The use of indexes and to plan a strategy for data distribution.

MULTIPLE CHOICE QUESTIONS

- (i) **Organizing the database in computer disk storage is done in:** (BWP 2019)
 (a) Logical Design (b) Analysis (c) **Physical Design** (d) Implementation
- (ii) **All of the following are components of physical database design except?**
 (a) Data volume and usage analysis (b) Data distribution strategy
 (c) File organization (d) **Normalize the relations**
- (iii) **Which of the following belongs to users processing requirements?**
 (a) Response time (b) Security of data
 (c) Backup/recovery (d) **All of these**
- (iv) **Estimation of database size and estimation of usage patterns is determined in which of the following?**
 (a) Logical design (b) **Physical design**
 (c) Analysis (d) Implementation

SHORT QUESTIONS

- (i) **Define physical database design.** (SWL 2021)(K.B)
 In physical database design, the logical database is converted into physical storage structures such as files and tables. The indexes and access methods are also specified. Similarly, physical design is also concerned with security, backup and recovery etc.
- (ii) **List any four Component of physical database design.** (LHR 2022)(U.B)

Ans: Following are the major component of physical database design

- Data Volume and its usage

- Data Distribution strategy
- File Organization
- Indexes
- Integrity Constraints

(iii) Write down the major inputs to Physical design.

(MTN 2022 (U.B))

Ans: Following are the major inputs of physical database design.

- **Logical Database Structure:**

These are developed during logical database design such as normalized relations.

- **User Processing Requirements:**

It includes the size and frequency of use of database, response time, security, backup and recovery etc.

- **Characteristics:**

It includes the characteristics of DBMS and other components of computer operating environment.

(iv) How would you present the content of data volume & usage analysis in physical database design?

(SWL 2022)

Ans: It is used to estimate the size or volume and usage patterns of database. The estimate of database size is used to select the physical storage devices. The estimate of usage patterns are used to select file organization and access methods.

PREVIEW OF TODAY'S TOPICS

F. Database distribution strategies, File organization, Indexes, Integrity constant Implementation

DATABASE DISTRIBUTION STRATEGIES,

FILE ORGANIZATION, INDEXES,

INTEGRITY CONSTANT IMPLEMENTATION

EXTENSIVE QUESTION

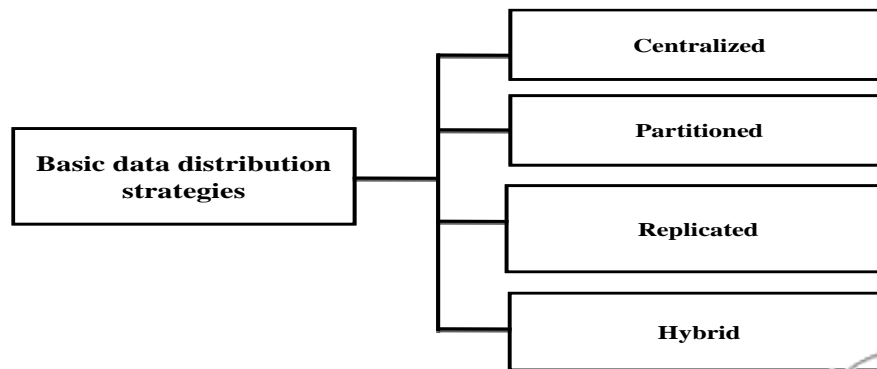
Q.1 Briefly describe basic data distribution strategies? (MTN 2018)(DGK 2018)(SGD 2018)

SHORT QUESTIONS

- (i) Write down the criteria for selecting file organization. (SGD 2018) (U.B)
- (ii) What do you mean by File Organization (BWP 2019) (U.B)
- (iii) Define integrity constraints. (K.B)
- (iv) List four data distribution strategy. (GRW2021)(U.B)

DATABASE DISTRIBUTION STRATEGIES

There are four data distribution:



- **Centralized:**
 - (i) All data are located at a single site.
 - (ii) Data communication costs may be high.
 - (iii) The database system fails totally when the central system fails
- **Partitioned:**
 - (i) The data base is divided into partitions (fragments).
 - (ii) Each portion is assigned to a particular site.
 - (iii) Major advantage of this database is moved closer to local users and so is more access-able.
- **Replicated:**
 - (i) Full copy of database is assigned to more than one site in the network.
 - (ii) This approach maximizes local access, but creates update

problems, since each database change must be reliably processed and synchronized at all of the sites.

- **Hybrid:**

- (i) The database is partitioned into critical and non-critical fragments.
- (ii) Non-critical fragments are stored at only one site, while critical fragments are stored at multiple sites.

FILE ORGANIZATION

Definition:

A technique for physically arranging the records of a file on secondary storage devices.

- **File organization criteria for selecting file organizations.**

- (i) High output for processing transactions.
- (ii) Efficient use of storage space.
- (iii) Protection from failure or data loss.
- (iv) Minimizing need for re-organization.
- (v) Accommodating growth.
- (vi) Security from un-authorized use.

- **Indexes:**

- (i) An index is a table that is used to determine the location of rows in a table (or tables) that satisfy some condition.
- (ii) They may be created on primary key, secondary key, foreign key etc.

- **Integrity Constraints:**

- (i) Database integrity refers to the correctness and consistency of data.
- (ii) It is another form of database protection.
- (iii) Security involves protecting the data from unauthorized operations, while integrity is concerned with the quality of data itself.
- (iv) Integrity is usually expressed in terms of certain constraints which are the consistency rules that the database is not permitted to violate.

IMPLEMENTATION

Definition:

The builder or the database administrator normally requires a server computer which will be linked with hundreds and thousands of computer users who would want to share and interact with the server (database).

- (i) The DBA might need the services of network administrators to connect the users with the server.
- (ii) The users are normally given the authorization permissions defined by their respective managers so that they can perform the authorized tasks while using the database facilities.
- (iii) In distributed computing environment, the database servers and users might be thousands of kilometers apart, and a lot of expensive telecommunication links are required to perform the designated tasks.
- (iv) NADRA and CRICK/NEC are some of the typical examples of this type of databases.

MULTIPLE CHOICE QUESTIONS

- (i) Which strategy is used to store data at single site? (RWP 2022)
 - (a) Centralized
 - (b) Hybrid
 - (c) Replicated
 - (d) Partitioned
- (ii) Database development process involves mapping of conceptual data model into: (GRW 2022)
 - (a) Object oriented data
 - (b) Network data model
 - (c) Implementation
 - (d) Hierarchical model

- (iii) **A technique for physically arranging the records of a file on secondary storage devices is called:** (FSD 2021)
- (a) Physical pointer (b) Retrieval program
(c) **File organization** (d) Update program
- (iv) **A factor to consider when choosing a file organization is:**
- (a) Fast Data Retrieval (b) Security
(c) Efficient Storage (d) All of these
- (v) **Which of the following refers to a method of database distribution in which one database contains data that are included in another database.**
- (a) Splitting (b) Partitioning
(c) Replication (d) Dividing

SHORT QUESTIONS

- (i) **List down four data distribution strategies.** (GRW2021)(U.B)
The basic data distribution strategies are:
- **Centralized**
 - **Partitioned**
 - **Replicated**
 - **Hybrid**
- (ii) **Write down the criteria for selecting file organization.** (SGD 2018) (U.B)
Following is the criteria for selecting file organization.
- Fast access for data retrieval.
 - Efficient use of storage space.
 - Protection from failure or data loss.
 - Minimizing need for re-organization.
 - Accommodating growth.
 - Security from un-authorized use.
- (iii) **What do you mean by File Organization** (BWP 2019) (U.B)
File organization is a technique for storing data on secondary storage devices so that it can be retrieved easily when needed. For selecting a file organization, the system designer must recognize several constraints including:
- **Physical characteristics of the secondary storage devices.**
 - **Available operating systems.**
 - **File management software.**
 - **User requirements for storing and accessing data.**
- (iv) **Define integrity constraints.**
Database integrity refers to the correctness and consistency of data. It is another form of database protection. Security involves protecting the data from unauthorized operations, while integrity is concerned with the quality of data itself. Integrity is usually expressed in terms of certain constraints which are the consistency rules that the database is not permitted to violate.
- (v) **Define hybrid distribution.**
The database is partitioned into critical and non-critical fragments. Non-critical fragments are stored at only one site, while critical fragments are stored at multiple sites.

- (vi) **List different constrains for selecting a file organization.**

Physical characteristics of secondary storage devices. Available operating system and file management software. User requirements for storing and accessing data.

STUDENTS LEARNING OBJECTIVES (SLOs)

MULTIPLE CHOICE QUESTIONS

Knowledge Based Questions

- (i) **An entity related to itself in an ERD model refers to:** (SWL 2022) (MTN 2021) (FSD 2019)
- (a) Recursive Relationship (b) One-to-many relationship
(c) Many-to-many relationship (d) One-to-one relationship
- (ii) **The major objective of Database design process is to map:**
- (a) Implementation model to conceptual model
(b) **Conceptual model to implementation model**
(c) Logical model to physical model
(d) Physical model to logical model
- (iii) **Which of the following are ingredients of data modeling?**
- (a) Entities / Objects (b) Attributes
(c) Relationship (d) **All of above**
- (iv) **A data model is:**
- (a) A logical representation of the structure of the database
(b) Shown as an entity relationship diagram
(c) Transformed into tables and relationships (d) **All of above**
- (v) **An advantages of partition is:**
- (a) **Efficiency** (b) Extra space and up data time
(c) Redundancy (d) Both (a) & (b)

Understanding Based Questions

- (i) **Which defines the nature of the relationship among entities?**
- (a) **Modality** (b) Cardinality
(c) Object (d) Both (a) & (b)
- (ii) **Customers, cars and parts are examples of.**
- (a) **Entities** (b) Attributes
(c) Cardinals (d) Relationship
- (iii) **Which of the following are ingredients of data modeling?**
- (a) Entities / Objects (b) Attributes
(c) Relationship (d) **All of these**
- (iv) **Which of the following activities are involved in data analysis?**
- (a) Data flow diagram (b) Decision Tables
(c) Decision Trees (d) **All of these**
- (v) **Which of the following are basic data distribution strategies?**

- (a) Centralized
(c) Replication
- (b) Partitioned
(d) All of these

Application Based Questions

- (i) **A factor to consider when choosing a file organization is:**
 (a) Fast Data Retrieval
 (c) Efficient Storage
- (b) Security
 (d) All of above
- (ii) **Merge relation is important because:**
 (a) Different views may need to be integrated
 (b) New data requirements may produce new relations to be merged.
 (c) Both (a) & (b)
 (d) None of these
- (iii) **Merging the relation is also known as:**
 (a) View integration
 (c) View index
- (b) View entities
 (d) Both (a) & (b)
- (iv) **In hybrid distribution which kind of fragments are stored at only one site:**
 (a) Critical fragments
 (c) Critical and non-critical fragments
- (b) Non-critical fragments
 (d) Only large fragments
- (v) **All the hardware costs are considered during:** (SWL 2019)
 (a) Project planning
 (c) Feasibility study
- (b) Requirements analysis
 (d) Data analysis

SHORT QUESTIONS

Knowledge Based Questions

Q.1 What is Data Modeling?

Ans: Data modeling is often the first step in database design and object-oriented programming as the designers first create a conceptual model of how data items relate to each other. Data modeling involves a progression from conceptual model to logical model to physical schema.

Q.2 Define Entity? (LHR 2022) (BWP 2022) (DGK 2022,21) (K.B)

Ans: A real world object is called an entity. An entity can be a person, place, thing or event for which data is collected and managed in a system.

Example:

- **Place** **Country, City**
- **Person** **Student, Teacher, Doctor**
- **Thing** **Car, Bike**
- **Event** **Examination**

Q.3 Define Attribute? (FSU 2022) (RWP 2022) (LHR 2015) (K.B)

Ans: The characteristics or properties of an entity is called attribute. An entity may have many attributes. It is not possible to store all attributes. However useful attributes are stored in database system.

Example: Name, Address, Phone and class are some attributes of the student entity.

Q.4 What is meant by File Organization? (BWP 2019)

Ans: File organization is a technique for physically arranging records of a file on secondary devices. The system designer must recognize several constraints to select a file organization.

Q.5 Explain relationship with an example. (SWL 2022) (MTN 2021) (DGK 2021)

Ans: A logical connection between different entities is called relationship.

Example:

A relationship exists between a student and teacher because teacher teaches student. The entities that participate in a relationship are called participants.

Understanding Based Questions

Q.1 Why we need to merge relation in a logical database design?

Ans: In order to remove redundant relations (Data redundancy), we merge the relations this process is called view integration.

Q.2 Why is requirement analysis conducted?

Ans: The requirement analysis is conducted to gather the requirements for the project. These requirements include the possible inputs for database and the required functionality of project. It is also used to define the possible domain and restrictions related to the system.

Q.3 How we identify the nature of relationship in database design process?

Ans: Modality is used to identify the relationship in database. Modality describes relationship as either mandatory or optional. It specifies absolute minimum number of relationships. The relationship is called optional if minimum number is zero. The relationship is called mandatory if minimum number is one.

Q.4 Why estimation paths / patter is used in physical database design?

Ans: Estimates of usage paths or patterns are used to select the file organization and access methods, to plan for the use of indexes and to plan a strategy for data distribution.

Q.5 Why ER-diagram is used in database design process?

Ans: An ER diagram is a graphical representation of entities and their relationships in a database. ER diagram uses different symbols to represent different information of database system. Entities are represented by rectangles. Relationships are represented by diamond. Attributes are represented by oval.

Application Based Questions

Q.1 Which data distribution strategy is best for an organization who is operating at international level?

Ans: Replication:

In this strategy, the full copy database is designed to more than one site in the network.

Q.2 List different constrains for selecting a file organization? (RWP 2018)

Ans: Following are the different constrains for selecting a file organization:

- Physical characteristics of secondary storage devices.
- Available operating system and file management software.
- User requirements for storing and accessing data.

Q.3 State the purpose of Hybrid data distribution strategy.

Ans: Following are the purpose of Hybrid data distribution strategy.

In this strategy, database is partitioned in critical and non-critical fragments. Non-critical fragments are stored at only one site whereas critical fragments are stored at multiple sites.

Q.4 How many relationships can be used in relational database management? (SWL 2019)

Ans: The relationships are:

- One-to-One
- One-to-Many
- Many-to-Many
- Recursive
- None

Q.5 State the use of data volume analysis:

Ans: To estimate the size or volume and the usage patterns of the database. Estimates of database size are used to select physical storage devices and estimate the costs of storage.

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