SPRING MID SEMESTER EXAMINATION-2023

School of Computer Engineering
Kalinga Institute of Industrial Technology, Deemed to be University
Database Management System
[CS-2004]

Time: 1 1/2 Hours **Full Mark: 20**

Answer any four Questions including Q.No.1 which is Compulsory.
The figures in the margin indicate full marks. Candidates are required to give theiranswers in their own words as far as practicable and all parts of a question should beanswered at one place only.

1. Answer all the questions. [1 x 5]

a) Discuss the importance of data model in database design.

Sol: Minimum 2 points [1 Mark]

- Data model is a collection of conceptual tools for describing data, data relationships, data semantics and consistency constraints.
- It provides a way to describe the design of a databse.
- Data model helps to create a simplified, logical database that eliminates redundancy, reduces storage requirements, and enables efficient retrieval.

b) Mention the SQL command for adding a check constraint (salary greater than 10000) to an existing Emp table.

Sol: ALTER TABLE Emp ADD CONSTRAINT CHK_Salary CHECK (salary > 10000); [1 Mark]

c) Differentiate between CHAR and VARCHAR datatypes.

Sol: Minimum 2 points [1 Mark]

CHAR	VARCHAR
Used to store strings of fixed size.	Used to store strings of variable length.
Uses a fixed amount of storage, based on the size of the column.	Use varying amounts of storage space based on the size of the string stored.
If the length of the string is less than set or fixed-length then it is padded with extra memory space.	If the length of the string is less than the set or fixed-length then it will store as it is without padded with extra memory spaces.
CHAR takes 1 byte for each character.	VARCHAR takes 1 byte for each character and some extra bytes for holding length information.

d) Given the basic ER and relational models, which of the following is INCORRECT?
i. An attribute of an entity can have more than one value.
ii. An attribute of an entity can be composite.
iii. In a row of a relational table, an attribute can have more than one value.

iv. In a row of a relational table, an attribute can have exactly one value or a NULL value.

Sol: iii. In a row of a relational table, an attribute can have more than one value. [1 mark]

e) In a shop, an employee may manage many customers. However, a customer can be managed by only one employee. Further, every customer must be assigned to an employee however the same is not mandatory for every employee.
Which one of the following correctly represents the cardinality and participation for the relationship between employee and customer?
i. 1:1, total, partial **ii. 1:1, partial, partial**
iii. 1:M, partial, total **iv. 1:M, total, partial**
Sol: iii. 1:M, partial, total [1 Mark]

2.

a. Consider te following schema:
Supplier (<u>sid</u>, sname, address)
Parts (<u>pid</u>, pname, color)
Catalog (<u>sid, pid</u>, cost)
Solve the following queries by using *relational algebra as well as SQL* expressions.

i. Find the names of suppliers who supply some red part. [2 Marks]

Π_{sname} (Supplier $\bowtie$ Catalog $\bowtie$ $\sigma_{color='red'}$ (Parts))

```
select distinct sname from Supplier as S, Catalog
    as C, Parts as P
where S.sid = C.sid and C.pid = P.pid and
                color = 'red'
```

ii. Find the pids of parts supplied by at least two different suppliers. [2 marks]

Π_{pid} ($_{pid}G_{count\ sid>2}$ (Supplier $\bowtie$ Catalog $\bowtie$ Parts))

```
select pid from Supplier as S, Catalog as C, Parts
    as P group by pid
            having count (sid) >= 2
where S.sid = C.sid and C.pid = P.pid
```

b. What are the differences between equi join and natural join operation? Explain with the help of an example. [1 Mark]
Sol:

- In Natural join, the tables should have the same column names to perform equality operations on them. In Equi join, the common column name can be the same or different.
- Also in the resultant table of Equi join the common column of both the tables are present. But in the natural join, the common column is present only once in the resultant table.

3.

a. Explain different level of abstraction and level of data independence with respect to Library database system. [3 Marks]

Sol:

Data Abstraction is a process of hiding unwanted or irrelevant details from the end user. It provides a different view and helps in achieving data independence that is used to enhance the security of data.

Mainly there are three levels of abstraction for DBMS, which are as follows −

1. Physical or Internal Level
2. Logical or Conceptual Level
3. View or External Level

Physical or Internal Level

It is the lowest level of abstraction for DBMS, which defines how the data is actually stored, it defines data-structures to store data and access methods used by the database. Actually, it is decided by developers or database application programmers how to store the data in the database.

So, overall, the entire database is described in this level that is physical or internal level. It is a very complex level to understand. For example, customer's information is stored in tables and data is stored in the form of blocks of storage such as bytes, gigabytes etc.

Logical or Conceptual Level

Logical level is the intermediate level or next higher level. It describes what data is stored in the database and what relationship exists among those data. It tries to describe the entire or whole data because it describes what tables to be created and what are the links among those tables that are created.

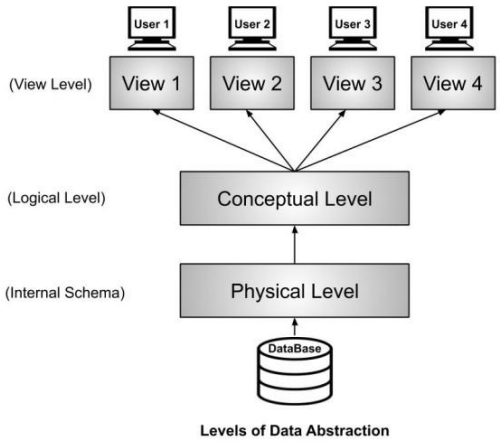
It is less complex than the physical level. Logical level is used by developers or database administrators (DBA). So, overall, the logical level contains tables (fields and attributes) and relationships among table attributes.

View or External Level

It is the highest level. In view level, there are different levels of views and every view only defines a part of the entire data. It also simplifies interaction with the user and it provides many views or multiple views of the same database.

View level can be used by all users (all levels' users). This level is the least complex and easy to understand.

For example, a user can interact with a system using GUI that is view level and can enter details at GUI or screen and the user does not know how data is stored and what data is stored, this detail is hidden from the user.



Levels of Data Abstraction

Data Independence

- Data independence can be explained using the three-schema architecture.
- Data independence refers characteristic of being able to modify the schema at one level of the database system without altering the schema at the next higher level.

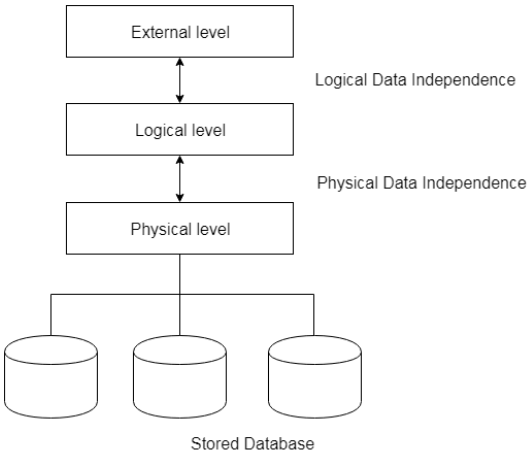
There are two types of data independence:

1. Logical Data Independence

- Logical data independence refers characteristic of being able to change the conceptual schema without having to change the external schema.
- Logical data independence is used to separate the external level from the conceptual view.
- If we do any changes in the conceptual view of the data, then the user view of the data would not be affected.
- Logical data independence occurs at the user interface level.

2. Physical Data Independence

- Physical data independence can be defined as the capacity to change the internal schema without having to change the conceptual schema.
- If we do any changes in the storage size of the database system server, then the Conceptual structure of the database will not be affected.
- Physical data independence is used to separate conceptual levels from the internal levels.
- Physical data independence occurs at the logical interface level.



b. Discuss the purpose and components of storage manager and query processor. [2 Marks]

Sol: Storage Manager – 1 Mark and Query Processor – 1 Mark

Storage Manager: Storage Manager is a program that provides an interface between the data stored in the database and the queries received. It is also known as Database Control System. It maintains the consistency and integrity of the database by applying the constraints and executing the DCL statements. It is responsible for updating, storing, deleting, and retrieving data in the database.
It contains the following components –

- **Authorization Manager:** It ensures role-based access control, i.e,. checks whether the particular person is privileged to perform the requested operation or not.
- **Integrity Manager:** It checks the integrity constraints when the database is modified.
- **Transaction Manager:** It controls concurrent access by performing the operations in a scheduled way that it receives the transaction. Thus, it ensures that the database remains in the consistent state before and after the execution of a transaction.
- **File Manager:** It manages the file space and the data structure used to represent information in the database.
- **Buffer Manager:** It is responsible for cache memory and the transfer of data between the secondary storage and main memory.

Query Processor: It interprets the requests (queries) received from end user via an application program into instructions. It also executes the user request which is received from the DML compiler.
Query Processor contains the following components –

- **DML Compiler:** It processes the DML statements into low level instruction (machine language), so that they can be executed.
- **DDL Interpreter:** It processes the DDL statements into a set of table containing meta data (data about data).
- **Embedded DML Pre-compiler:** It processes DML statements embedded in an application program into procedural calls.
- **Query Optimizer:** It executes the instruction generated by DML Compiler.

4.

a. Consider a database that consists of the following relations

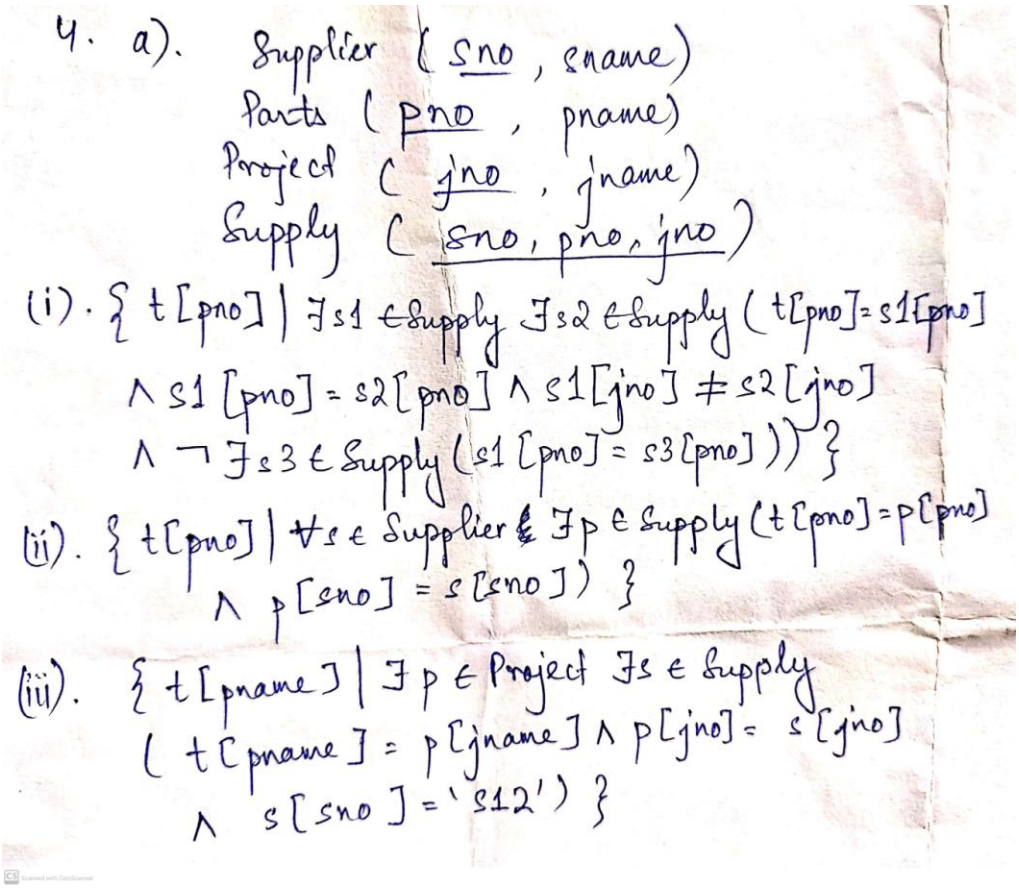
Supplier (sno, sname)
Parts (pno, pname)
Project (jno, jname)
Suuply (sno, pno, jno)
Solve the following queries by using *relational calculus* expressions. [3 Marks]

i. Retrieve the part numbers that are supplied to exactly two projects.

ii. Retrieve the part numbers that are supplied by every supplier.

iii. Retireve the project names that are supplied by supplier 'S12' only

Sol: 1 Mark for each query



b. What is a foreign key constraint? Why are such constraints important? What is referential integrity? [2 Marks]

Sol: A foreign key is a column (or combination of columns) in a table whose values must match values of a primary key column in some other table.

Importance –

The FOREIGN KEY constraint is used to prevent actions that would destroy links between tables. It ensures the values in the foreign key column are obtained from within the domain of the referred primary key column only.

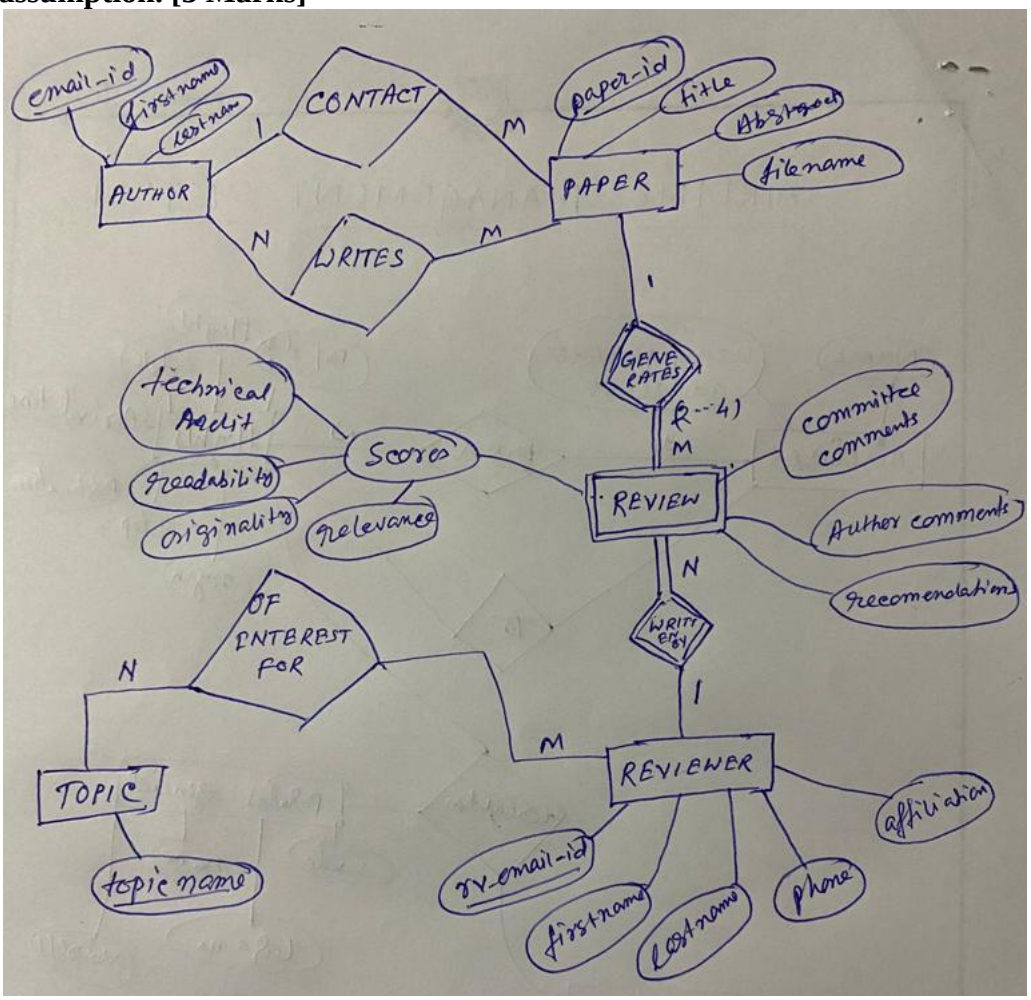
Referential integrity refers to the relationship between tables. It requires that if a value of one attribute of a relation references a value of another attribute, then the referenced value must exist.

5.

a. Consider a Conference database in which researchers submit their research papers for consideration. Reviews by reviewers are recorded for use in the paper selection process. The database system caters primarily to reviewers who record answers to evaluation questions for each paper they review and make recommendations regarding whether to accept or reject the paper. The data requirements are summarized as follows:

- **Authors of papers are uniquely identified by email id, First and last names are also recorded.**
- **Each paper is assigned a unique identifier by the system and is described by a title, abstract and the name of the electronic file containing the paper.**
- **A paper may have multiple authors, but one of the authors is designated as the contact author.**
- **Reviewers of papers are uniquely identified by email address. Each reviewer's first name, last name, phone number , affiliation and topics of interest are also recorded.**
- **Each paper is assigned between two and four reviewers. A reviewer rates each paper assigned to him or her on a scale of 1 to 10 in four categories: technical merit, readability, originality, and relevance to the conference. Finally, each reviewer provides an overall recommendation regarding each paper.**
- **Each review contains two types of written comments: one to be seen by the review committee only and the other as feedback to the author(s).**

Design an entity-relationship diagram for the conference database. Make necessary assumption. [3 Marks]



b. Convert the above ER diagram into relational schemas and specify primary and foreign keys. [2 Marks]