



Khaja Bandanawaz University

Subject :- Database Management System

2 MARKS

1. Discuss the responsibilities of DBA and database designers.

DBA:

Manages the database, controls user access, maintains security, monitors performance, and looks after database software and hardware.

Database Designer:

Identifies what data must be stored and organizes it in a suitable way for users and their needs.

2. Define entity type and entity sets.

Entity Type:

A category or blueprint of entities that share the same attributes, such as Student or Car.

Entity Set:

The collection of all entities of a particular type in the database at a specific time, such as all students enrolled in a school.

3. Define data models and list its types.

Data Model:

A set of concepts used to describe a database structure, including data, relationships, and constraints.

Types:

1. Conceptual (high-level) data models
2. Physical (low-level) data models
3. Implementation (representational) data models

4. Define the term relation schema.

Answer:

A relation schema describes a table by giving its name and the names of its attributes (columns). Example: STUDENT (Roll_No, Name, Age).

5. Define relational database state.

Answer:

A relational database state is the actual data stored in the tables at a particular moment. It changes when records are added, deleted, or updated.

6. Define select operation with syntax and example.**Select (σ):**

Selects rows from a table that satisfy a given condition.

Syntax: σ <condition> (Table_Name)

Example: σ DNO=4 (EMPLOYEE) — selects employees who work in department 4.

7. Define project operation with syntax and example.**Project (π):**

Selects specific columns from a table and removes the other columns.

Syntax: π <column_list> (Table_Name)

Example: π Fname, Lname, Salary (EMPLOYEE) — displays only employees' first name, last name, and salary.

8. Define JOIN operation with an example.**JOIN operation:**

Combines related rows from two tables into one table using a matching column.

Example: Join EMPLOYEE and DEPARTMENT using the department or manager ID to show employee/manager details alongside the department name.

5 marks

1. Explain with figure three schema architecture.

Ans: The goal of the three-schema architecture is to separate the user applications from the physical database. In this architecture, schemas can be defined at the following three levels.

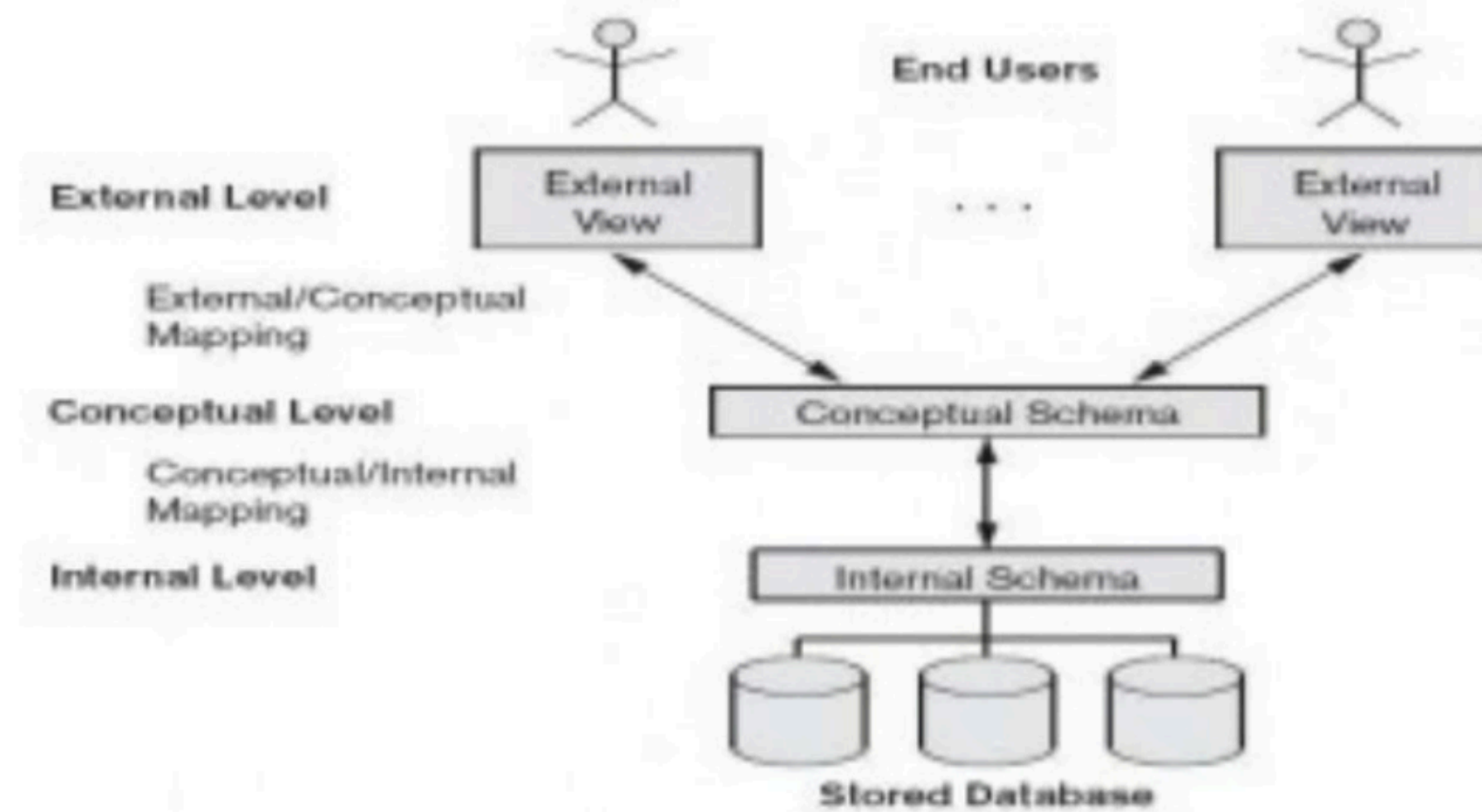


Fig: Three schema architecture

★ **Internal level (internal schema):**

- ❖ Describes the physical storage structure of the database.
- ❖ Uses a physical data model.
- ❖ Specifies complete details of how data is stored and how it is accessed (access paths).

★ **Conceptual level (conceptual schema):**

- ❖ Describes the overall structure of the database for all users.
- ❖ Hides physical storage details.
- ❖ Focuses on entities, data types, relationships, user operations, and constraints.

- ❖ Usually described using a representational data model when the DBMS is implemented.

★ **External (view) level:**

- ❖ Includes a number of external schemas (user views).
- ❖ Each external schema describes only the part of the database that a particular user group is interested in.
- ❖ Hides the rest of the database from that user group.

- ★ In a DBMS based on the three-schema architecture, each user group refers to its own external schema.
- ★ Hence, the DBMS must transform a request specified on an external schema into a request against the conceptual schema, and then into a request on the internal schema for processing over the stored database.
- ★ If the request is a database retrieval, the data extracted from the stored database must be reformatted to match the user's external view.
- ★ The processes of transforming requests and results between levels are called mappings.

2. Consider the following tables

EMPLOYEE(fname,minit,lname,ssn,bdate,address,sex,salary,super_ssn,dno)
DEPARTMENT(dname,dnumber,mgr_ssn,mgr_start_date)

DEPT_LOCATIONS(dnumber,dlocation)

PROJECT(pname,pnumber,plocation,dnum)

WORKS_ON(essn,pno,hours)

DEPENDENT(essn,dependent_name,sex,bdate,relationship)

Write the queries in relational algebra

- i) Retrieve the name and address of all employees who work for the research department

$$\begin{aligned}
 R1 &\leftarrow \sigma_{Dname = 'Research'}(DEPARTMENT) \\
 R2 &\leftarrow R1 \bowtie_{Dnumber = Dno} EMPLOYEE \\
 RESULT &\leftarrow \pi_{Fname, Lname, Address}(R2)
 \end{aligned}$$

- ii) Retrieve the social security number of all employees who work in the department 5 or directly supervise an employee who works in department 5.

$$R1 \leftarrow \sigma_{Dno = 5}(EMPLOYEE)$$

$$R2 \leftarrow \pi_{Ssn}(R1)$$

$$R3 \leftarrow \pi_{Super_ssn}(R1)$$

$$RESULT \leftarrow R2 \cup R3$$

iii) List the names of managers who have at least one dependent

$$R1 \leftarrow \pi_{Mgr_ssn}(DEPARTMENT)$$

$$R2 \leftarrow \pi_{Essn}(DEPENDENT)$$

$$R3 \leftarrow (R1 \cap R2)$$

$$RESULT \leftarrow \pi_{Lname, Fname}(R3 \bowtie_{Ssn=Ssn} EMPLOYEE)$$

iv) list the names of all employees with two or more dependants

$$T1 \leftarrow_{Essn} \mathcal{F}_{COUNT(Dependent_name)}(DEPENDENT)$$

$$T2 \leftarrow \sigma_{No_of_dependents \geq 2}(T1)$$

$$RESULT \leftarrow \pi_{Lname, Fname}(T2 \bowtie_{Ssn=Essn} EMPLOYEE)$$

10 marks

1. Consider the following COMPANY database

EMPLOYEE(fname, minit, lname, ssn, bdate, address, sex, salary, super_ssn, dno)

DEPARTMENT(dname, dnumber, mgr_ssn, mgr_start_date)

DEPT_LOCATIONS(dnumber, dlocation)

PROJECT(pname, pnumber, plocation, dnum)

WORKS_ON(essn, pno, hours)

DEPENDENT(essn, dependent-name, sex, bdate, relationship)

Write the queries in relational algebra

i) Find the names of employees who work on all projects controlled by department 5

$$R1 \leftarrow \pi_{pnumber}(\sigma_{Dnum=5}(PROJECT))$$

$$R2 \leftarrow \pi_{ESSN, Pno}(WORKS_ON)$$

$$R3 \leftarrow R2 \div R1$$

$$RESULT \leftarrow \pi_{Fname, Lnames}(R3 * EMPLOYEE)$$

ii) For every project located in Stafford, List the project number, the controlling department number and the department manager's last name, address, bdate

$$R1 \leftarrow \sigma_{Plocation = 'Stafford'}(PROJECT)$$

$$R2 \leftarrow (R1 \bowtie_{Dnum = Dnumber} DEPARTMENT)$$

$$R3 \leftarrow (R2 \bowtie_{Mgr_ssn = Ssn} EMPLOYEE)$$

$$RESULT \leftarrow \pi_{Pnumber, Dnum, Lname, Address, Bdate}(R3)$$

2. Draw the ER diagram for Airline database

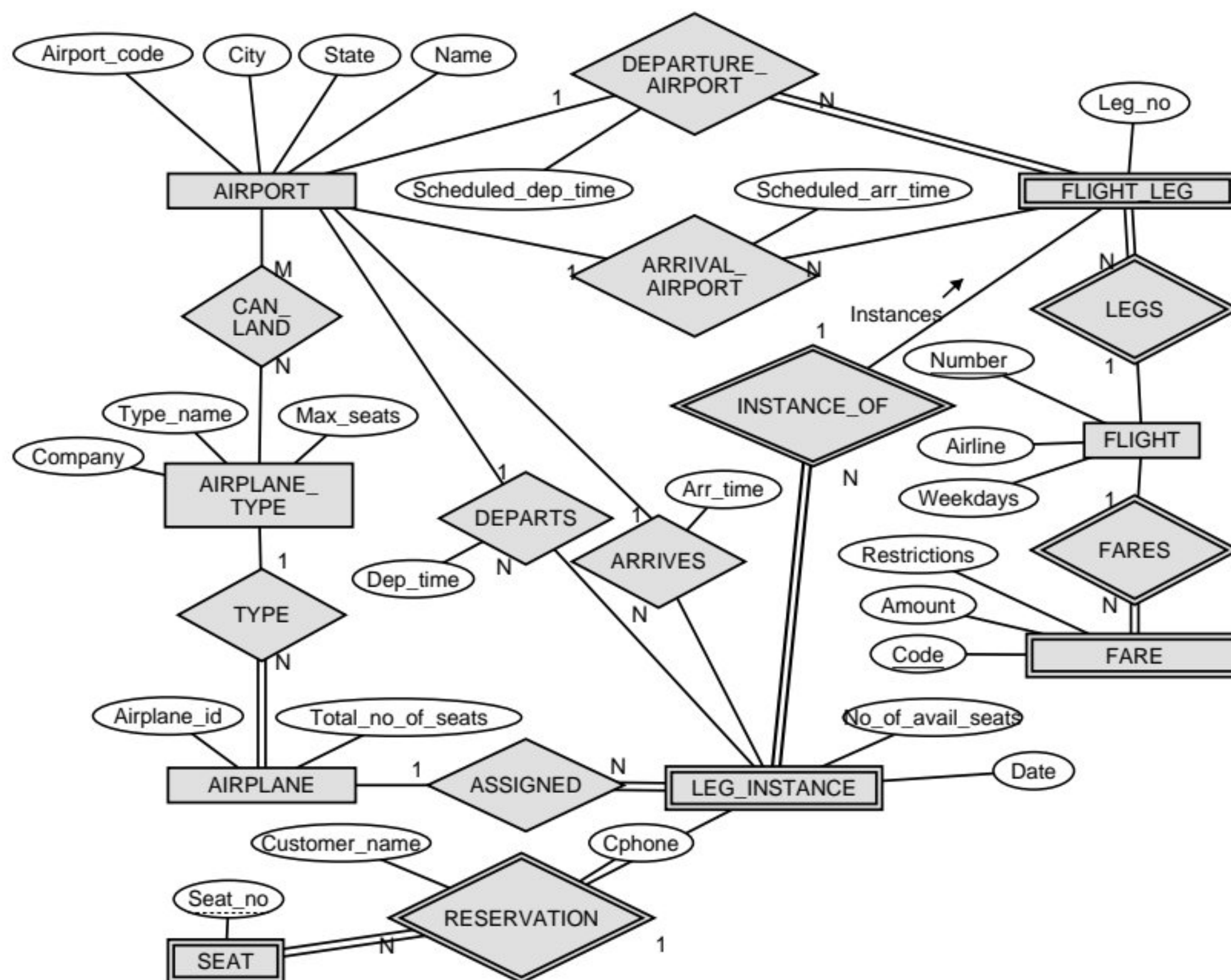


Fig: ER diagram for Airline database

Claude Opus 5.5



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