UNIT-5

Advanced Database Models, Systems, and Applications:

#Active Database Concepts and Triggers: [Imp]

Active Database is a database system that goes beyond the traditional role of data storage and retrival by incorporating active behaviour. It enables the database to react and respond to events and triggers in real-time. Active databases are suitable for applications that require dynamic, event-driven behaviour and complex data processing.

A trigger is a procedure that automatically invokes DBMS in response to changes to the database, and is specified by the database administrator (DBA). A database with set of associated triggers is generally called active database. Triggers provide a powerful mechanism for automating actions and maintaining data consistency and integrity within the database.

Active Database Example:

Consider a banking system that uses an active database to monitor customer transactions and detect potential fraud activities. The database would be designed to react to certain triggers, such as high-value transaction or a series of unusual transactions from same or different locations within a short period. Here's how it could work:

i) **Trigger:** A high-value transaction occurs, exceeding a predefined threshold.

ii) **Active Rule:** The active database has a rule defined to detect high-value transactions and potential fraud.

iii) **Action:** The rule triggers an action, such as sending an alert to the bank's fraud detection team.

iv) **Real-time Response:** Upon receiving the alert, the fraud detection team can take immediate action, such as blocking the account or contacting the customer to verify the transaction's legitimacy.

(active rules OR trigger उ आलो पनि आदि लेख्ला)

⊛ Differences between row-level and statement-level active rules/trigger:

Aspect	Row Level Active Rules	Statement Level Active Rules
Scope	Apply to individual rows within a table.	Apply to entire statements or transactions.
Event Trigger	Triggered by changes or events that affect specific rows.	Triggered by specific SQL statements or database operations
Rule Evaluation.	Evaluated for each affected row individually.	Evaluated once for the entire statement or transaction.
Actions	Actions can be performed on the affected row(s) individually	Actions can affect multiple rows or entire result set.
Performance	Rule evaluation for each row can impact performance.	Rule evaluation is typically faster since it's done once.

⊛ Applications/Uses of Active database:

→ Production control, e.g, power plants.
→ Maintenance tasks, e.g, inventory control
→ Financial applications, e.g, stock trading.
→ Telecommunication and network management
→ Air traffic control
→ Medical and Financial Decision Support Systems.

⊛ Weaknesses of active database:

→ Insufficient methodological support in design and analysis.
→ Lack of standardization.
→ Missing development and administration tools for triggers.
→ Weak performance
→ Lack of support for application development in many active database management system prototypes.

#Temporal Database Concepts: [Imp]

A Temporal Database is a database with built-in support for handling time sensitive data. Usually, databases store information only about current state, and not about past states. For example in an employee database if the salary of a particular person changes, the database gets updated, the old value is no longer there. However, in many cases it is important to maintain past data. In these cases temporal databases are useful. Temporal databases store information about states of the real world across time. It stores information relating to past, present and future time of all events.

Examples:

1) Finance: stock price histories need to be maintained.
2) Reservation Systems: Date and time of all reservations are important.
3) Personnel management: salary and position history need to be maintained.
4) Banking: credit, debit, loan etc. histories need to be maintained.

Types of time available in temporal database:

1) **Valid time:** Valid time is a time period during which a fact is true in the real world. For example, in a company the Salary of the employees have a valid start time and end time.

Eg: Valid Time Table.

Employee_no	Name	Salary	Valid Start Time	Valid End Time
E1	Rajesh	12000	2079-05-28	2080-06-28
E2	Dinesh	15000	2079-02-20	2080-03-20
E3	Dinesh	20000	2080-03-21	2080-06-21

2) **Transaction time:** The time period during which a fact stored in database was known. Unlike valid time here we can rollback database.

Eg: Transaction Time Table

Employee_no	Name	Salary	Transaction Start Time	Transaction End Time
E1	Rajesh	12000	2079-03-28, 10:02:33	2080-06-28, 10:02:33
E2	Dinesh	15000	2079-02-20, 11:13:30	2080-03-20, 11:13:33

OR Bi-temporal relation or data

3) **Bi-temporal time:** Bi-temporal time combines both valid and transaction time. It stores data w.r.t both of valid time and transaction time. In some applications both dimension are needed and this comes in use.

Eg: Bi-temporal Time Table

Employee_No	Name	Salary	Transaction Time	Valid Start Time	Valid End Time
E1	Rajesh	20,000	2078-10-20, 10:02:13	2075-10-10	2078-10-10
E2	Dinesh	25,000	2079-12-13, 11:00105	2078-12-15	Now
E3	Shyam	18,000	2060-11-11, 08:25:10	2076-01-01	2078-12-05

#Spatial Database Concepts:

A spatial database is a database that is enhanced to store and access spatial data or data that defines a geometric shape. These data are often associated with geographic locations and features, or constructed features like cities. Dat on spatial databases are stored as coordinates, points, lines, polygons and topology. Some spatial databases handle more complex data like three-dimensional objects.

Spatial databases address many of the limitations of static data files. Spatial databases can contain large amounts of data in multiple tables with linking mechanisms that maintain data integrity. They can enforce restrictions on data entry to limit collection of inconsistent data. They can grow, and can maintain copies of themselves for redundancy.

Examples of non-spatial data: Names, phone numbers, emails etc.

Examples of spatial data: Weather and climate data, Rivers, Farms, Medical imaging etc.

#Multimedia Database Concepts: [Imp]

Multimedia database is the collection of interrelated multimedia data that includes text, graphics, images, animations, video etc. Multimedia databases provide features that allow users to store and query different types of multimedia information. We can locate multimedia sources that contain certain objects of interest. For example, one may want to locate all video clips in a video database that include a certain person, say Roshan.

⊛ Contents of multimedia database:

i) Media data: It is actual data which represents an object.

ii) Media format data: The information such as resolution, sampling rate, encoding system, etc.

iii) Media keyword data: Media keyword data are the keyword description related to the generation of data. Examples are: place, time, date of recording etc.

iv) Media feature data: Media feature data contains data which is content dependent such as kind of texture, different shapes present in data etc.

⊛ Challenges to multimedia databases:

i) Design: physical, conceptual, and logical ~~data~~ design not addressed entirely.

ii) Storage: stored on standard disc, can lead to problems like representation, compression etc.

iii) Performance: Low performance since multimedia databases consume a lot of processing power and bandwidth.

iv) Queries and Retrival: Multimedia data lead to retrival and query issues such as efficient query formation, query execution etc. problems.

⊛ Multimedia Database Applications:

→ Documents and record management.
→ Knowledge dissemination
→ Education and training
→ Marketing
→ Advertisement
→ Entertainment.

Deductive Database Concepts:

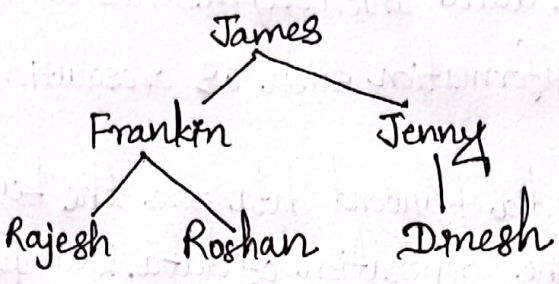
A database system that can make deductions based on rules and facts stored in the database. Datalog is the language typically used to specify facts, rules, and queries in deductive databases.

Database + Inference = Deductive Database

It uses two main types of specifications: "Facts" and "Rules". Facts are specified in a manner similar to the way relations are specified, except that it is not necessary to include attribute name.

Rules are somewhat similar to relational views. They specify virtual relations.

Example:



Facts

SuperVise (Frankin, Rajesh)
SuperVise (Frankin, Roshan)
SuperVise (James, Frankin).
SuperVise (James, Jenny).
SuperVise (Jenny, Dinesh).

Rules

Superior (X, Y) ← SuperVise (X, Y)
Superior (X, Y) ← SuperVise (X, Z), Superior (Z, Y).
Subordinary (X, Y) ← Superior (Y, X).

#Introduction to Information Retrival (IR) and Web Search: [Imp]

Information Retrival (IR)	Data Retrival
i) The software that deals with the organization, storage, retrival and evaluation of information from document repositories particularly textual information is called information retrival.	i) Data retrival deals with obtaining data from a database management system such as ODBMS. It is the process of identifying and retriving the data from the database, based on the query provided by user or application.
ii) Retrives information about a subject.	ii) Determines the keywords in the user query and retrives the data.
iii) Not always well structured and is semantically ambiguous.	iii) Has well defined structure and semantics
iv) The results obtained are approximate matches	iv) The results obtained are exact matches.
v) Results are ordered by relevance	v) Results are unordered by relevance.
vi) It is a probabilistic model.	vi) It is deterministic model.

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