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**IT 301: Advanced Database Systems**

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**MODULE I: Post-Test**

**1. What are the differences between row-level and statement-level active rules?**

* In the statement level semantics, the rule designer only refers to the transactions tables as a whole and the rule is triggered only one, so the rule must be different from the row- level semantics. ¬ In the row- level active rule- it signifies that the rule is triggered separately for each tuple. Where as in the level active rule- the rule would be triggered once for each triggering statement. ¬ in the row level- trigger the key word is FOR EACH ROW Whereas in the statement- level trigger, it doesn’t have FOR EACH key word.

**2. What are the differences among immediate, deferred, and detached consideration of active rule conditions?**

* If the result of the condition evaluation is true then the rule actions must be executed. Again, the execution can be done in immediate, deferred, or detached manner (explanation of these approaches is similar to question 24.2 and it is omitted).

**3. What are the differences among immediate, deferred, and detached execution of active rule actions?**

* In the case of immediate and deferred modes, the triggered transactions are essentially the sub transactions of the triggering transaction. But in the case of detached mode, the triggered transaction is started directly after event signalling and it is independent of the triggering transaction.

**4. Briefly discuss the consistency and termination problems when designing a set of active rules.**

* The consistency problem states that there might be a case when two or more rules contradict one another. The termination problem states that there might be a case when a set of two,or more triggers execute in a never ending (loop) cycle.

**5. Discuss some applications of active databases.**

Application which depend on data monitoring activities such as CIM, Telecommunications Network Management, Program trading, Medical and Financial Decision Support Systems can greatly benefit from integration with active database. ¬Production control, e.g., power plants. • The production control is the function of management which plans, directs and controls the material supply and processing activities of an enterprise so that specified products are produced by specified methods to meet an approved sales programme. It ensures that activities are carried out in such way that the available labour and capital used in the best possible way. ¬ Maintenance tasks, e.g., inventory control. • Maintenance tasks indicate which action –or set of actions-a maintenance technician is supposed to perform to complete a work order. Different maintenance tasks are assigned based on the type of equipment that needs to be maintained. Financial applications, e.g., stock & bond trading. • Financial application is a software program that facilitates the management of business processes that deal with money. Telecommunication and network management ¬ Air traffic control • Air traffic control is a service provided by ground-based air traffic controllers who direct aircraft on the ground and through controlled airspace, and can provide advisory services to aircraft in non-controlled airspace. ¬ Computer Integrated Manufacturing (CIM) • Computer Integrated Manufacturing (CIM) is the technique of using computers to control an entire production process. It’s commonly used by factories to automate functions such as analysis, cost accounting, design, distribution, inventory control, planning and purchasing. Statistics gathering and authorization tools.

**6. Discuss how time is represented in temporal databases and compare the different time dimensions.**

- In the temporal data bases, time represented as an ordered sequence of points in granularity. It is determined by the application. And for a particular application. Temporal database researchers are used the term chronon instead of point to describe the minimal granularity. For example: We consider that, some temporal application never requires time units that are less than one second at this time, each time point represents one second using this granularity. But in reality, each second is a time duration. Not a point. So, it may be divided into milliseconds, microseconds, etc.

**7. What are the differences among valid time, transaction time, and Bitemporal relations?**

* Valid time - true in the real-world Transaction time - value of the system clock when information is valid in the system. Bitemporal relations - application requires both valid time and transaction time

**8. Describe how the insert, delete, and update commands should be implemented on a valid time relation.**

**9. Describe how the insert, delete, and update commands should be implemented on a Bitemporal relation.**

* Some relations require both valid time and transaction that results in bi-temporal relations.

Insert

Insert operation is implemented by creating first version in the E\_BT table. The first tuple version is created using the insert command and makes it the current version.

Update

In the bitemporal databases, no attributes are physically changed in any tuple except for the transaction end time attribute Tret is with the value of uc (until changed).

For example consider E\_BT relation, the current version V of an em

Delete

When an employee is deleted, Tret is changed from uc to date the employee left the company.

**10. Describe how the insert, delete, and update commands should be implemented on a valid time relation.**

**11. What are the main differences between tuple versioning and attribute versioning?**

* Tuple versioning (also called point in time) is a mechanism used in relational database management system to store past states of a relation. ¬ Attribute versioning - simple complex object used to store all temporal changes of the object.

**12. How do spatial databases differ from regular databases?**

* Basically, a database consists of an organized collection of data for one or more uses, typically in digital form.

Spatial Database: has the ability to store and access both Location/Spatial Information and Attributes/Non-Spatial Information.

Non-Spatial/regular Database: has the ability to store and access only Attributes/Non-Spatial Information.

Basically, the differences are in the storage, function, and query capabilities between the two.

**13. What are the different types of spatial data?**

* Map data – Geographic or spatial features of objects in a map. Attribute data – Descriptive data associated with map features. Image data – Satellite images

**14. Name the main types of spatial operators and different classes of spatial queries**.

* SPATIAL OPERATORS ARE CLASSIFIED INTO THREE BROAD CATEGORIES: • Topological operators – Properties do not change when topological transformations applied. • Projective operators – Express concavity/convexity of objects. • Metric operators – Specifically describe object’s geometry. Three typical types of spatial queries: • Range queries Example: find all hospitals with the Metropolitan Atlanta city area. • Nearest neighbor queries Example: find police car nearest location of a crime • Spatial joins or overlays Example: find all homes within two miles of a lake

**15. What are the properties of R-trees that act as an index for spatial data?**

Properties of R-tree:  
  
Consists of a single root, internals nodes and leaf nodes.  
Root contains the pointer to the largest region in the spatial domain.  
Parent nodes contains pointers to their child nodes where region of child nodes completely overlaps the regions of parent nodes.  
Leaf nodes contains data about the MBR to the current objects.  
MBR-Minimum bounding region refers to the minimal bounding box parameter surrounding the region/object under consideration.

**16. Describe how a spatial join index between spatial objects can be constructed.**

* A spatial index is a data structure that allows for accessing a spatial object efficiently. It is a common technique used by spatial databases.  Without indexing, any search for a feature would require a "sequential scan" of every record in the database, resulting in much longer processing time. In a spatial index construction process, the minimum bounding rectangle serves as an object approximation. Various types of spatial indices across commercial and open-source databases yield measurable performance differences. Spatial indexing techniques are playing a central role in time-critical applications and the manipulation of spatial big data.

**17. What are the different types of spatial data mining?**

* At present, there are many spatial data mining algorithms, such as statistical analysis, neutral networks, clustering, decision trees, genetic algorithms, classification, etc.

**18. State the general form of a spatial association rule. Give an example of a spatial association rule.**

* A spatial association rule is a rule which describes the implication of one or a set of features by another set of features in spatial databases. For example, a rule like most big cities in Canada are close to the Canada-U.S. border" is a spatial association rule. A strong rule indicates that the patterns in the rule have relatively frequent occurrences in the database and strong implication relationships.

**19. What are the different types of multimedia sources?**

* Multimedia is simply multiple forms of media integrated together. An example of multimedia is a web page with an animation. Besides multiple types of media being integrated with one another, multimedia can also stand for interactive types of media such as video games, CD ROMs that teach a foreign language, or an information Kiosk at a subway terminal. Other terms that are sometimes used for multimedia include hypermedia and rich media.

There are number of data types that can be characterized as multimedia data types. These are typically the elements or the building blocks of or generalized multimedia environments, platforms, or integrating tools. The basic types can be described as follows: Text, Graphics, Audio, Animation, Video, Graphic Objects (see: Computer graphics and visualization).

**20. How are multimedia sources indexed for content-based retrieval?**

* An important research area • challenging problem since multimedia needs detailed interpretation from pixel values. • Different strategies in terms of syntactic and semantic indexing for retrieval

**21. What important features of images are used to compare them?**

* Multimedia database provide features that allow users to store and query different types of multimedia information, which includes images (such as photos or drawings). An image is typically stored either in raw form as a set of pixel or cell values, or in compressed form to save. The image shape descriptor describes the geometric shape of the raw image, which is typically a rectangle of cells. Each cell contains a pixel value that describes the cell content. In black-and-white images, pixels can be one bit. In gray scale or color images, a pixel is multiple bits. Because images may require large amounts of space, they are often stored in compressed form. Compression standards, such as GIF, JPEG, or MPEG, use various mathematical transformations to reduce the number of cells stored but still maintain the main image characteristics, Applicable mathematical transforms include Discrete Fourier Transform (DFT), Discrete Cosine Transform (DCT), and wavelet transforms.

**22. What are the different approaches to recognizing objects in images?**

* Object recognition is a computer vision technique for identifying objects in images or videos. Object recognition is a key output of deep learning and machine learning algorithms. When humans look at a photograph or watch a video, we can readily spot people, objects, scenes, and visual details. You can use a variety of approaches for object recognition. Recently, techniques in machine learning and deep learning have become popular approaches to object recognition problems. Both techniques learn to identify objects in images, but they differ in their execution.

**23. How is semantic tagging of images used?**

* Many multimedia images, which are generated in countless ways, must be semantically stored and managed to search for relevant images. Therefore, studies on image annotation have been conducted and the field is developing at a steady pace. In existing approaches, the user inputs the tag for the image directly to obtain the semantic tag. In this study, the tag is input to the image using a convolutional neural network, which can be used for deep learning. Thus, it the hassle of entering tags for images is eliminated. Through deep learning, the user can automatically input the tag for the image, and the entered tags can be expanded to the resource description framework model in Linked Tag. Finally, the user can perform semantic-based image search using the SPARQL query language.

**24. What are the difficulties in analysing audio sources?**

* Audio Source Separation, also known as the Cocktail Party Problem, is one of the biggest problems in audio because of its practical use in so many situations: identifying the vocals from a song, helping deaf people hear a speaker in a noisy area, isolating the voice in a phone call when riding a bike against the wind, and you get the idea.

**25. What are deductive databases?**

Deductive databases are an extension of relational databases which support more complex data modelling. Deductive database uses facts and rules.

**26. Define the clausal form of formulas and Horn clauses.**

A formula in clausal form consists of a conjunction of clauses. Each clause is a disjunction of literals. Each literal is either an atomic sentence or the negation of an atomic sentence, where an atomic sentence is a predicate applied to some terms. In mathematical logic and logic programming, a Horn clause is a logical formula of a particular rule-like form which gives it useful properties for use in logic programming, formal specification, and model theory. Horn clauses are named for the logician Alfred Horn, who first pointed out their significance in 1951.

**27. What is theorem proving, and what is proof-theoretic interpretation of rules?**

Theorem proving the formal method of providing a proof in symbolic logic. It uses deductive inference. Proof-theoretic semantic is an alternative to truth-condition semantics. It is based on the fundamental assumption that the central notion in terms of which meanings are assigned to certain expressions of our language, in particular to logical constants, is that of proof rather that truth.

**28. What is model-theoretic interpretation and how does it differ from proof theoretic interpretation?**

Model-theoretic semantics is an “account of meaning in which sentences are interpreted in terms of a model of, or abstract formal structure representing, an actual or possible state of the world.

**29. What are fact-defined predicates and rule-define predicates?**

A Prolog program consists of a number of clauses. Each clause is either a fact or a rule. A fact must start with a predicate (which is an atom) and end with a full stop. The predicate may be followed by one or more arguments which are enclosed by parentheses. The arguments can be atoms (in this case, these atoms are treated as constants), numbers, variables or lists. Arguments are separated by commas. A rule can be viewed as an extension of a fact with added conditions that also have to be satisfied for it to be true. It consists of two parts. The first part is similar to a fact (a predicate with arguments). The second part consists of other clauses (facts or rules which are separated by commas) which must all be true for the rule itself to be true. These two parts are separated by ":-". You may interpret this operator as "if" in English.

**30. What is a safe rule?**

Generates a finite set of facts.

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