K/L/TX

Reg. No:

Final Assessment Test – November 2024

VIT Vellore Institute of Technology

Course: **MDI3004 - Intelligent Database Systems**

Class NBR(s): **2707/2720**

Slot: **G1+TG1**

Time: **Three Hours**

Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

Answer ALL Questions

(10 X 10 = 100 Marks)

1. i. Construct a conceptual data model (ER diagram) for the global airline reservation system, incorporating the following entities and attributes: **[5]**
   - Airlines: AirlineID, AirlineName, Headquarters
   - Flights: FlightID, AirlineID, DepartureAirport, ArrivalAirport, DepartureTime, ArrivalTime, Duration
   - Aircraft: AircraftID, AircraftType, Capacity
   - Passengers: PassengerID, Name, ContactInformation
   - Reservations: ReservationID, PassengerID, FlightID, SeatNumber, BookingDate

   Relationships:

   - An airline can have many flights.
   - A flight can be operated by one airline and uses one aircraft.
   - A passenger can make many reservations.
   - A reservation is associated with one passenger and one flight.

   ii. Analyze the conceptual data model and identify potential data anomalies that could occur if the database is not properly normalized. **[5]**

2. Imagine a large e-commerce company's customer support department. The company has implemented an expert system to assist customer service agents in resolving customer inquiries efficiently. Design the architecture of Intelligent Database System (IDS) by applying the different levels of intelligence with its characteristics.

3. i. Write a JSON object book (as the root node) to explain the working of nested data models. Let the child nodes be author and chapters. Each chapter has further child nodes for its title and content. **[5]**

   ii. Convert the following Relational DB into Document DB. **[5]**

ID	first_name	last_name	Phone_ no	city	DOB	Location_ x	Location_y
1	Mary	Jones	555555 55555	Long Island	1998	-50.4	40.45

ID	User_id	profession
10	1	'Software developer'
20	2	'Software engineer'

ID	User_id	Name	version
20	1	'MyApp'	1.0.2
30	2	'Winsword'	1.4.1

ID	User_id	Make	year
30	1	'Rolls Royce'	1965
40	2	'Benz'	1945

4. i. Imagine that a company is developing a new software application for managing customer interactions. Create a Semantic Data Model (SDM) to represent the relationships between the following entities: Customer, Interaction, Agent, Product, and Company. Use the relationships that includes aggregation, generalization and classification. **[5]**

ii. Explain how the created SDM helps to increase the company's decision-making capabilities. **[5]**

5. Consider that a university is developing a database to manage its students, courses, and enrollments. The database schema includes the following entities and relationships:

Student (studentID, name, major)
Course (courseID, name, credits)
Enrollment (studentID, courseID, grade)

Relationships:

A student can enroll in multiple courses.
A course can have multiple students enrolled.
An enrollment has a grade associated with it.

i) Write ODL definitions for the entities student, course and enrollment with relationships. **[2]**
ii) Write OQL to list all students enrolled in the "Database Systems" course. **[2]**
iii) Write OQL to find the average grade for the "Artificial Intelligence" course. **[2]**
iv) Write OQL to list the students who have enrolled in at least 3 courses. **[2]**
v) Write OQL to list the students who have enrolled in both "Database Systems" and "Artificial Intelligence" courses. **[2]**

6. Illustrate the built-in and layered architectures of active database with suitable diagrams.

7. Assume that an e-commerce platform wants to improve its customer experience by providing personalized product recommendations with the data Model: Customer (customer_id, purchase_history), Product (product_id, category, price), Recommendation (customer_id, product_id, recommendation_score). Design a Starburst rule system for the following conditions.

i. Purchase History-Based Recommendations **[5]**
ii. Category-Based Recommendations **[5]**

8. Consider a medical expert system to diagnose common respiratory illnesses based on patient symptoms with facts and rules as follows.

Facts:

patient(ID, name, age, gender)
symptom(ID, name, description)
hasSymptom(patientID, symptomID)
illness(ID, name, description)
causes(illnessID, symptomID)

Rules:

Rule 1: Cough and Fever
IF hasSymptom(P, 'cough') AND hasSymptom(P, 'fever') THEN likelyIllness(P,'cold')
Rule 2: Shortness of Breath
IF hasSymptom(P, 'shortness_of_breath') THEN likelyIllness(P, 'asthma') OR likelyIllness(P, 'pneumonia')
Rule 3: Chest Pain
IF hasSymptom(P, 'chest_pain') AND hasSymptom(P, 'cough') THEN likelyIllness(P, 'pneumonia')

Show the Prolog implementation using queries for the following.

[2]

i. Find all patients with a cough. [2]
ii. Find the likely illness for a specific patient. [2]
iii. Find all symptoms associated with a given illness. [2]
iv. Find all patients who have a cough but not a fever. [2]
v. Find the most likely illness for a patient with symptoms of cough, fever, and shortness of breath.

9.a) How can a Knowledge-Based System (KBS) leverage the capabilities of a Relational Database Management System (RDBMS) to enhance data management and reasoning processes in a complex application? Analyze the potential benefits and challenges of this integration, and provide a real-world example to illustrate its effectiveness.

OR

9.b) In the context of a medical expert system, how can a Knowledge-Based System (KBS) be tightly integrated with a Relational Database Management System (RDBMS) to optimize data access, ensure data consistency, and streamline development? Explore strategies such as direct data access, Object-Relational Mapping (ORM), and stored procedures, considering their potential benefits and drawbacks.

10.a) Imagine a futuristic city where various interconnected devices and systems work together to enhance the quality of life for its residents. This smart city utilizes a MultiAgent System (MAS) to coordinate and manage these interconnected components. How would you address the following issues such as 'Coordination and Cooperation', 'Uncertainty and Dynamics', 'Scalability, Security', 'Privacy and Heterogeneity', 'Learning and Adaptation' to optimize resources and improve efficiency?

OR

10.b) Imagine you are building a news aggregation website that automatically collects articles from various online sources. To do this effectively, you need to extract relevant information from these articles, such as the headline, author, publication date, and main content. Recommend and explain the suitable Internet indexing methods for this scenario.

⇔⇔⇔ **K/L/TX** ⇔⇔⇔