Master of Computer Applications

MCAC 202: Database Systems
Unique Paper Code: 223401202
Semester II
May-2023
Year of admission: 2021

Time: Three Hours **Maximum marks: 70**

Note: Answer all the questions. Each question carries equal marks. Attempt all parts of a question together.

1. Consider the following requirements to create a database for the Indian Speed Post Service System. The system stores the details of customers, packages, post offices, and delivery staff. Each package has a unique tracking number, weight, and destination. Each customer has a name, address, and contact details. Each post office has a unique ID, address, and contact details. Each delivery staff has a unique ID, name, and contact details. A package is sent from a specific post office and delivered by a specific delivery staff member. A customer can send multiple packages, but a package can only be sent by one customer. Multiple packages can be sent from a single post office, and a delivery staff member can deliver multiple packages.

   (a) Draw an E-R diagram representing the above requirements, including the relationships between the entities. List your assumptions and clearly indicate the cardinality constraints and identifiers. [8]

   (b) Translate the E-R diagram you designed for Question 1(a) into Relational Schema. Your design should be compact and must not contain any unnecessary relations. [6]

2. (a) Explain the benefits of 'checkpoints' in database transactions. Also, highlight the role of checkpoints in partial rollbacks and improving transaction efficiency. [4]

   (b) Consider the following three transactions and schedule (time goes from top to bottom). Is this schedule conflict-serializable? Justify your answer. [5]

Transaction T_0	Transaction T_1	Transaction T_2
		read(Y)
		read(Z)
read(X)		
write(X)		
		write(Y)
		write(Z)
	read(Z)	
read(Y)		
write(Y)		
	read(Y)	
	write(Y)	
	read(X)	
	write(X)	

   (c) Differentiate between the "wait-die" and "wound-wait" approaches of deadlock avoidance. Also, give an example of each. [5]

3. (a) If you were developing a fresh web-based database application, what would have been the most effective method to safeguard against SQL injection? [4]

(b) Create a DTD for an XML file that stores information about Indian Premier League (IPL) teams, including their name, home city, captain, and a list of players. Each player should have a name, age, batting style, bowling style, and a unique player ID. Ensure that the DTD includes constraints: a unique team name, a team must have exactly 15 players, and specifying the valid values for batting and bowling styles [7]

(c) Write an XQuery to find all players who are 25 years old or younger from the XML file created by you in Question 3(b). [3]

4. (a) Derive the union rule, decomposition rule and the pseudo transitivity rule using the three Armstrong's axioms. [6]

(b) Let $\mathcal{F} = \{ABD \rightarrow AC, C \rightarrow BE, AD \rightarrow BF, B \rightarrow E\}$ be a set of functional dependencies on the relation schema $R = (A, B, C, D, E, F)$. Find a minimal cover of $\mathcal{F}$. [8]

5. Consider the following relations:

Authors(*au-id*, *au-name*, *city*, *state*)
Publishers(*pub-id*, *pub-name*, *city*, *state*)
Titles(*title-id*, *book-title*, *pub-id*, *price*, *book-category*)
Title_Author(*title-id*, *au-id*, *royalty_share*)

Write a SQL query to

(a) find publisher names that have published CS books. [3]

(b) find publishers for which there have been no titles [3]

(c) find the names of authors who have written only CS books. [3]

(d) find the names of authors who have participated in writing at least one CS book. [3]

(e) find the author names who live in the same city as some publisher. [2]