Roll Number: _____

Thapar Institute of Engineering and Technology Patiala
Computer Science and Engineering Department
Auxiliary Exam

Date - 25 Feb, 2024	UCS310: Database Management System
Time: 3 Hours, Max Marks:100	

Note: Attempt all questions. All parts of a question must be answered in order. Assume any missing data.

Q1	a) Why would you choose a database system instead of simply storing data in operating system files? When would it make sense not to use a database system? Explain at least four advantages of DBMS over file systems.	4

	b) Describe the following:
	   i. Database Administrator, Database Developer, and Application Programmers
	   ii. Data Integrity and Data Isolation (explain with suitable examples)
		7

	c) Discuss the different types of database architectures and compare their advantages and disadvantages.	7
	d) Specify the difference between physical and logical data independence. Which one is harder to achieve and why?	2
Q 2	a) Suppose you create a table as *EMP_PROJ (Emp#, Proj Ename, Pname, No_hours)* Explain how Insertion Anomaly, Deletion Anomaly, and Update Anomaly will occur in the above table with examples.	6
	b) Differentiate between weak and strong entities set with respect to the primary key with an example.	4

	c) Drik Gallery, a renowned photo and painting exhibitor, would like to hire you to prepare their database. The gallery keeps information about artists, such as their names, ids, addresses, ages, and sex.
	All the artists fall into two categories, painter and photographer (Yes, photography is an art!).
	
	For each piece of artwork, its unique id, the artist, the year it was produced, its name, description, and price are stored. Each artwork can be produced by only one artist.
	Artworks are subdivided into two categories, paintings and photos.
	Photos have information about the camera used to capture the photo, the camera's exposure time, focal length, and aperture. The paintings have information about its genre, which can be identified by an integer.
	Details of the genres:
	   1. History Painting: Religious, historical, or allegorical work with a moral message.
	   2. Portrait Art: Includes individual, group, or self-portraits.
	   3. Genre Painting: Scenes of everyday life.
	   4. Landscape Painting: Paintings whose principal content is a scenic view.
	   5. Still Life Painting: An arrangement of domestic objects or everyday items.
	Finally, the gallery keeps information about customers. For each customer, the gallery stores his/her customer id, name, address, and the artists and the artworks the customer is interested in. The customer's address has the following divisions- Street Address, City, State, and Zip.
	
	Draw an ER diagram for this database. Make sure cardinalities and primary keys are clear.
		10

Q 3	a) Given the set *F* of functional dependencies $\{AB \rightarrow D, B \rightarrow C, AE \rightarrow B, A \rightarrow D, D \rightarrow EF\}$ of a relation *R (A, B, C, D, E, F)*, find a minimal cover of F.	6
	b) Explain Multivalued Dependency using an example and also write the conditions to ensure a relation is in the 4th Normal Form (4NF).	4

	c) Consider the relation schema R(A, B, C, D, E, F) with the following set of functional dependencies: A→B, AE→F, CD→A, CE→F, BC→D
	   i. Find the primary key and all the candidate keys of the R.
	   ii. Is schema in 1NF? Why or why not? If not, decompose it to a collection of relations that are in 1NF.
	   iii. Is schema in 2NF? Why or why not? If not, decompose it to a collection of relations that are in 2NF.
	   iv. Is schema in 3NF? Why or why not? If not, decompose it to a collection of relations that are in 3NF.
	   v. Is schema R in BCNF form? Why or why not? If not, decompose it to a collection of relations that are in BCNF.
		10

Q4	a) Consider the given tables and write SQL commands for the following:
	Doctors(DID, DName, Year_of_Experience)
	Patients(PID, DocID, PName, Age, Gender, Symptoms)
	   i. Add a new column named 'Specialization' in the *Doctors* table.
	   ii. Display the name of doctors sorted according to their years of experience.
	   iii. Display the details of Doctors with more than 5 years of Experience.
	   iv. Show the details of Patients whose names start and end with A and N and have at least 5 characters.
	   v. Find the oldest patient age who has booked an appointment with a cardiologist.
	   vi. Find the DocID (in descending order) and the average age of all the patients who are treating the patient with an average age greater than 60.
	
	b) Write a PL-SQL program to check if a Year given by user input is a Leap year or Not.
	
	c) Discuss the differences between the following terms with example/SQL syntax
	   i. Inner, Natural, and Outer Join
	   ii. Function and Procedure of PL/SQL
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		4

Q5	a) Consider a database with objects X and Y and assume that there are two transactions T1 and T2. T1 first reads X and Y and then writes X and Y. T2 reads and writes X then reads and writes Y.
	   i. Give an example schedule that is not serializable. Explain why your schedule is not serializable.
	   ii. Show that strict 2PL disallows this schedule.
	
	b) Most implementations of database systems use strict two-phase locking (strict 2PL). Explain 2PL with an example and write three reasons for the popularity of this protocol.
	
	b) Given the following concurrent schedule S
	         S: $R_1(A)$, $R_2(A)$, $R_1(B)$, $R_2(B)$, $R_3(B)$, $W_1(A)$, $W_2(B)$
	
	   i. List all the conflict pairs and draw a precedence graph.
	
	   ii. Check whether the given schedule S is conflict serializable and view serializable or not. If the schedule is serializable, find the equivalent serial schedule
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		4
		
		5
		
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All The Best*