National University of Computer and Emerging Sciences, Karachi
Fall-2021, FAST School of Computing
Final Exam
3rd January 2022, 9:00 am – 12:00 pm

Course Code: CS2005	Course Name: Database Systems
Instructor Name: Dr. Zulfiqar Ali Memon, Ms. Anam Qureshi, Ms. Tania Iram, Mr. Danish, Ms. Abeer, Ms. Eman	
Student Roll No: 10 [redacted]	Section: H

Instructions:

- Return the question paper. Don't write anything on question paper, except your Roll # & Section #.
- Read each question completely before answering it. There are **7 questions and 3 pages.**
- In case of any ambiguity, you may make assumptions. But your assumptions should not contradict any statement in the question paper.
- All the answers must be solved according to the sequence given in the question paper.
- This paper is subjective. Write the answers only on answer sheet.

Time: 180 minutes. **Max Marks**: 50

Question 1: [7 marks]

In table 01, there are two transactions T1 and T2 running some read and write operations in an *interleaved* manner. After each operation, what will be the values of X, Y, and Z in the system log and in the database? Note that the recovery technique used is "deferred update". Moreover, before T1 and T2, the values of X, Y, and Z in the database are: X_0=20, Y_0=18, Z_0=3

Table 01: Transaction Processing Using Deferred Update Technique

T1	T2	System Log	Database
			X_0=20, Y_0=18, Z_0=3
Read_item(X)			
Write_item (X,20,25)			
	Read_Item(Y)		
	Write_Item(Y,18,19)		
Read_Item(Y)[Y=18]			
Write_Item(Y,18,21)			
Commit			
	Read_Item(Z)		
	Write_Item(Z,3,5)		
	Commit		

Question 2: [8 marks]

Consider the following two concurrent transactions in the scenario to update shared variable winner_name and the corresponding private variable prizemoney. Suppose these two transactions are executed concurrently, and T1 starts first. Each step of transaction is viewed as below:

T1	T2
Read winner_name	
	Read winner_name
Write winner_name='Azmat'	
	Write winner_name='Ali'
If name==winner_name then Update winner.prizemoney	
	If name==winner_name then Update winner.prizemoney
Commit	
	Commit

a) State the final result values of the shared variable winner_name and its effect on private variable winner.prizemoney in case of isolation level setting:
i) Level-0 Isolation (Read uncommitted)
ii) Level-1 Isolation (Read committed)

b) Which type of concurrency problem may be found here?

Question 3: [6 marks]

Consider a database in which researchers submit their research papers for consideration. Reviews by reviewers are recorded for use in the paper selection process. The database system caters primarily to reviewers who record answers to evaluation questions for each paper they review and make recommendations regarding whether to accept or reject the paper. The data requirements are summarized as follows:

- Authors of papers are uniquely identified by e-mail id. First and last names are also recorded.
- Each paper is assigned a unique identifier by the system and is described by a title, abstract, and the name of the electronic file containing the paper.
- A paper may have multiple authors, but one of the authors is designated as the contact author.
- Reviewers of papers are uniquely identified by e-mail address. Each reviewer's first name, last name, phone number, affiliation, and topics of interest are also recorded.
- Each paper is assigned between two and four reviewers. A reviewer rates each paper assigned to him or her on a scale of 1 to 10 in four categories: technical merit, readability, originality, and relevance to the conference. Finally, each reviewer provides an overall recommendation regarding each paper.
- Each review contains two types of written comments: one to be seen by the review committee only and the other as feedback to the author(s).

Draw an ER diagram based on the data requirements given above. Be certain to indicate min and max participation from each entity in relationship.

Question 4: [7.5 marks]

Consider the following MAILORDER relational schema describing the data for a mail-order company.

PARTS(Pno, Pname, Price)
CUSTOMERS(Cno, Cname, Street, Zip, Phone)
EMPLOYEES(Eno, Ename, Zip, Hdate)
ZIP_CODES(Zip, City)
ORDERS(Ono, Cno, Eno, Received, Shipped)
ODETAILS(Ono, Pno, Qty)

PARTS Table gives information about the parts supplied. Here Pno is a primary key.
CUSTOMERS Table gives information about the customers. Here Cno is a primary key.
EMPLOYEES Table gives information about the employees who takes the order. Eno is a primary key.
ZIP_CODES Table gives information about cities and their zip codes. Here Zip is a primary key.
ORDERS Table gives information about the orders booked by the customers. Here Ono is a primary key. Cno is Foreign key references Cno of Customers table. Eno is Foreign key references Eno of Employee table.
ODETAILS Table gives information on orders booked by the customer for a part. Ono and Pno are combined to make a primary key. Ono is Foreign key references Ono of ORDERS table and Pno is Foreign key references Pno of Parts table.

Write SQL queries for the following:

Part (a): Retrieve the names and cities of employees who have taken orders for parts costing more than $50.00.
Part (b): Retrieve the names of customers who have ordered parts from employees living in Wichita.
Part (c): Retrieve the names of customers who have ordered parts costing less than $20.00.
Part (d): Retrieve the names of customers who have not placed an order.
Part (e): Retrieve the names of customers who have placed exactly two orders.

Question 5: [6 marks]

Consider the following snapshot of a transaction:

a) Does this schedule follow 2PL (2 Phase Lock)? how?
b) If the above answer is yes, which type of 2PL (2 Phase Lock) is followed?

T1
Lock-s(X)
Read(X)
Lock-x(Y)
Read(Y)
Unlock(X)
Write(Y)
Unlock(Y)

Question 6:

Table 2 below gives the details of students registered in a particular course: [8 marks]

S → Student, C → Course, F → Faculty

Table 02 Students Registration Table

CID	SID	SName	CName	CVenue	FID	FName	SAge	FContact
CS101	k19-2345 k19-3476	Ali Ahmed, Abdullah Zahoor	Database	CR – 10	1005	Mr. Rehman	21, 20	03312546987
CS107	k20-2167 k20-2478 k20-2856	Ali Zafar, Zahoor Javed, Alia Ali	Data Structures	CR – 4	1854	Ms. Aisha	19, 20, 20	03314897524
CS110	k18-5487 k18-4476	Eman Riaz, Saad Aslam	IoT	CR – 10	2598	Mr.Saif	22, 23	03345987412
CS105	k21-2559 k21-4879	Taha Moin, Zain Ali	Programming with C	CR – 12	6598	Ms. Alina	19, 19	03336987456

a) The table shown above is susceptible to update anomalies. Provide examples of insertion, deletion, and update anomalies.

b) Describe and illustrate the process of normalization for Table 02. Convert the table up to 3NF by identifying the functional dependencies represented by the attributes. State any assumptions you make about the data shown in the table.

Question 7:

[7.5 marks]

Figure 01 represents a relational schema of Human Resource (HR) database of a large organization operating in different regions of the world. Referential integrity constraints are shown as directed arcs in the Figure 01. Write down a single relational (algebraic) expression for each of the following queries. Don't specify CARTESIAN PRODUCT.

a) What is the average salary of 'Sales Manager'?

b) Which employees were hired before their manager?

c) How many employees work in 'Asia'?

d) Provide job history of all the employees who are working in 'New York'. Don't use EQUI JOIN.

e) List the details of all the departments where minimum salary is more than 5000 Rs.

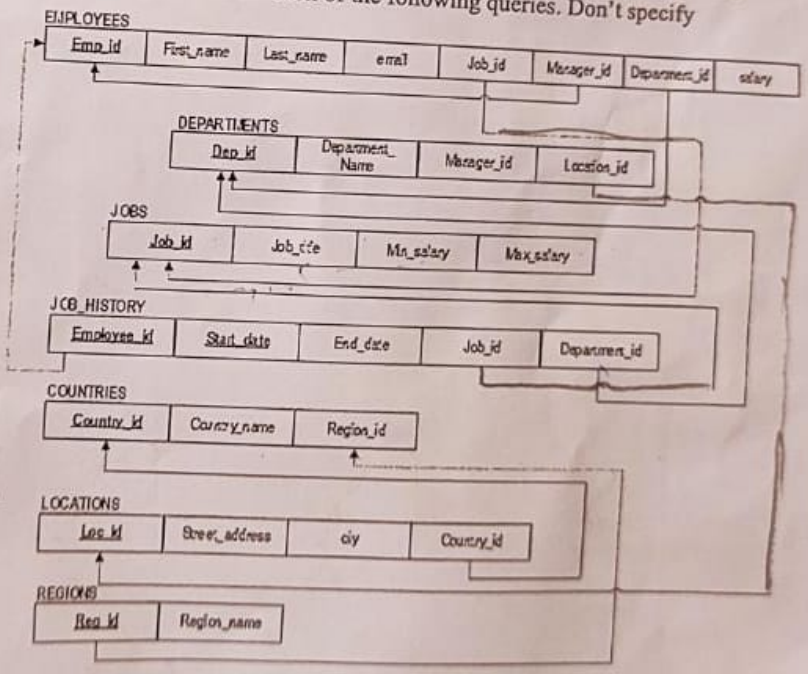

Figure 01

Good Luck