

Midterm 1

Section: _____ Name: _____

Roll No: _____

Question 1 (8 points)

a) You are hired by Great Lakes Insurance to implement a relational database for both its in-house and outside agents. The outside agents will use notebook computers to keep track of customers and policy information. Which DBMS architecture would you choose? Why would the other architectures not be a good choice?

We will develop a web interface to cater the outside agents. In this scenario, 3-tier architecture would be a good choice as it provides enhance security by adding a middle tier. Apart from this the middle tier can handle the business logic.

b) What is the difference between Procedural and Non Procedural DMLs? In which category does SQL Fall?

Procedural DMLs are the low level languages. User specify what data is required and how to get that data. They must be embedded in the programming languages.

Non-Procedural are high level languages. User only specify what data is required. SQL belong to this category. They can be used in a standalone way or embedded in programming languages.

c) Explain the differences between user views, a conceptual schema, and an internal schema as different perspectives of the same database.

External Schema: Describe the various user views

Conceptual schema: describe the structure and constraint for the database

Internal Schema: Describe the physical storage structure and access paths

d) The following table shows a relation called GRADE REPORT for a university. Identify the primary key of this relation. Indicate issues (if any) in the design of this table.

Grade Report

StudentID	StudentName	CampusAddress	Major	CourseID	CourseTitle	Instructor Name	Instructor Location	Grade
168300458	Williams	208 Brooks	IS	IS 350	Database Mgt	Codd	B 104	A
168300458	Williams	208 Brooks	IS	IS 465	Systems Analysis	Parsons	B 317	B
543291073	Baker	104 Phillips	Acctg	IS 350	Database Mgt	Codd	B 104	C
543291073	Baker	104 Phillips	Acctg	Acct 201	Fund Acctg	Miller	H 310	B
543291073	Baker	104 Phillips	Acctg	Mkgt 300	Intro Mktg	Bennett	B 212	A

PKey= (Student id , course ID)

Issues: Data redundancy, insertion, deletion and update anomalies

Consider the following relational database for next Question#2. It keeps track of the Student Representatives and Advisors.

- The attributes 'SDept', 'FDept' are Foreign Keys (from Department table) and attributes 'Advisor' and 'HOD' are Foreign Keys (from Faculty relation). The referential integrity constraint on these attributes is on Delete set NULL and on Update cascade.
- The attribute 'Dept' in Student_Rep relation is a Foreign Key (from Department table) and referential integrity constraint is on Delete and Update cascade.

Student

<u>RollNo</u>	SName	SDept	Advisor
1	Usman	CS	1
2	Ahmad	CS	NULL
3	Fatima	EE	2
4	Saba	CV	NULL
5	Hamza	EE	2
6	Ali	M	NULL
7	Kamal	CS	3
8	Zohaib	M	3

Student_Rep

<u>SRollNo</u>	<u>Year</u>	<u>Dept</u>
1	2010	CS
5	2010	EE
1	2011	CS
3	2011	EE
8	2011	M
7	2014	CS
5	2013	EE

Faculty

<u>Fid</u>	FName	FDept
1	Shoaib	CS
6	Ahmad	EE
3	Sobia	M
2	Azhar	EE
5	Sadia	CS
4	Romania	M

Department

<u>DName</u>	HOD
CS	1
CV	2
EE	1
M	NULL

Question 2(12 points)

Apply following operations on the above state of the schema. State if the operation would be carried out successfully or not.

Explain your answer briefly. In case of successful operation indicate the changes that will be made to the above database.

Please note that all operations are independent.

a) INSERT INTO Student_Rep VALUES (6, 2011, 'M')

Accept ☐

Explain: Rejectkey already exists

Reject ☐

b) INSERT INTO Faculty VALUES (6, 'Sadia', 'H')

Accept ☐

Explain: Reject key exists and no H in department table

Reject ☐

c) Modify the Fdept attribute of the Faculty tuple with Fdept='M' to 'HM'

Accept ☐

Explain:Reject .. Referential Intergrity violated ...no such dept exists in Department table

Reject ☐

d) DELETE Student_Rep tuples with year =2010

Accept

Explain: first two rows deleted

e) DELETE Department tuples with DName='M'

Accept

Explain: Delete row from Management table...

<u>delete row from student rep</u>	8	2011	M
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In faculty set sobia and Romania fdept to NULL

In student set Ali sdept to NULL

f) Modify the Fid attribute of the Faculty tuple with Fid=1 to 10.

Explain: Accept update the value in Faculty and also update Advisor in student and HOD in Department from 1 to 10

Question 3(12 points)

Consider the following relational schema for bank database.

BRANCH (branchName, branchCity), CUSTOMER (customerName, customerCity), ACCOUNT (account#, branchName),
DEPOSITOR (customerName, account#), LOAN (loan#, branchName), BORROWER (customerName, loan#).

Write **Relational Algebra statements** for the following queries:

- a) Find the names of all customers who have a loan at the Model Town branch but do not have an account at any branch of the bank.
- b) Find all customers who have an account from at least the "Super Market" branch and the "Melody" branch.
- c) Find all customers who have an account at all branches located in Islamabad city.

a) $R \leftarrow \pi_{\text{CustomerName}} (\sigma_{\text{BranchName} = \text{"Model Town"}} (\text{Loan}) * \text{Borrower}) - \pi_{\text{CustomerName}} (\text{Depositor})$

b) $R \leftarrow \pi_{\text{CustomerName}} (\sigma_{\text{BranchName} = \text{"Super Market"}} (\text{Account}) * \text{Depositor}) \cap \pi_{\text{CustomerName}} (\sigma_{\text{BranchName} = \text{"Melody"}} (\text{Account}) * \text{Depositor})$

c) $R \leftarrow \pi_{\text{CustomerName}, \text{BranchName}} (\text{Account} * \text{Depositor}) \div \pi_{\text{BranchName}} (\sigma_{\text{BranchCity} = \text{"Islamabad"}} (\text{Branch}))$

Question 4(2+3+3= 8 points)

Consider the relational state of the bank database.

Branch

<u>BranchName</u>	<u>BranchCity</u>
Faisal Town	Lahore
Model Town	Lahore
Mall Road	Lahore
Super Market	Islamabad
Melody	Islamabad

Customer

<u>CustomerName</u>	<u>CustomerCity</u>
c1	Lahore
c2	Islamabad
c3	Lahore
c4	Islamabad
c5	Lahore
c6	Lahore

Account

<u>Account#</u>	<u>BranchName</u>
ac1	Faisal Town
ac2	Super Market
ac3	Super Market
ac4	Melody
ac5	Model Town
ac6	Model Town
ac7	Super Market
ac8	Melody

Depositor

<u>CustomerName</u>	<u>Account#</u>
c1	ac1
c1	ac2
c2	ac3
c2	ac4
c2	ac5
c3	ac6
c4	ac7
c4	ac8

Loan

<u>Loan#</u>	<u>BranchName</u>
L1	Faisal Town
L2	Melody
L3	Super Market
L4	Faisal Town
L5	Melody
L6	Mall Road

Borrower

<u>CustomerName</u>	<u>Loan#</u>
c1	L1
c4	L2
c4	L3
c6	L4
c6	L5
c6	L6

Given the above relational state, write the result of the following queries. Also describe in a sentence what each query does.

- a) $\text{Result1}(\text{BranchCity}, \text{BranchName}, \text{NoOfAccounts}) \leftarrow \text{BranchCity}, \text{BranchName } \mathcal{F}_{\text{COUNT}(*)} (\text{Branch} * \text{Account})$
- b) $\text{Result2} \leftarrow \pi_{\text{CustomerName}, \text{CustomerCity}} (\text{Customer} * (\pi_{\text{CustomerName}} (\text{Borrower}) \cap \pi_{\text{CustomerName}} (\text{Depositor})))$
- c) $\text{Result3} \leftarrow \pi_{\text{CustomerName}, \text{CustomerCity}, \text{Account\#}} (\sigma_{\text{CustomerCity} = \text{"Lahore"}} (\text{Customer}) \bowtie \text{CustomerName} = \text{customerName } \text{Depositor})$

a)

BranchCity	BranchName	NoOfAccounts
Lahore	Faisal Town	1
Lahore	Model Town	2
Islamabad	Super Market	3
Islamabad	Melody	2

b)

CustomerName	CustomerCity
c1	Lahore
c4	Islamabad

c)

CustomerName	CustomerCity	Account#
c1	Lahore	ac1
c1	Lahore	ac2
c3	Lahore	ac6
c5	Lahore	NULL
c6	Lahore	NULL