National University of Computer and Emerging Sciences, Lahore
Spring Semester 2014

Course: CS204- DATABASE SYSTEMS Time Allowed: *90 min.*
Date: *March 1, 2014*
Max Points: 60

SECTION(CS-A, B, C)
Midterm 1

Section: _____ Name: _____ Roll No: _____

Question 1*(5 points)*

a) List five advantages of Database approach

b) Define Valid State of a Database

c) What are the three levels of Three-Schema Architecture?

d) Define logical and physical Data independence

e) Discuss the various reasons that lead to the occurrence of NULL values in relations.

Question 2 *(5 points)*

Given the following relation schemas, instances, primary and foreign key constraints, list all constraints violations for each row, if applicable.

R(A, D)
S(A, B, C)
S.A is a foreign key to R.A.
C and D have string domains. A and B have integer domains.

R

Row#	A	D
1	1	Aa
2	2	NULL
3	NULL	4
4	5	b3c
5	X	4

S

Row#	A	B	C
1	1	Aa	X
2	4	4	NULL
3	3	NULL	Y
4	NULL	3	Z
5	1	2	Z

Question 3 *(10 points)*

Consider the following relational schema
Reader (readerId, rstName, lastName, address, city, dateOfBirth)
Book (ISBN, title, author, numberOfPages, yearOfPublication, publisherName)
Publisher (publisherName, placeOfPublication)
Categories (categoryName, includedIn)
Copy (ISBN, copyNumber, shelf, position)
Loan (readerId, ISBN, copyNumber, returnDate)
BookCategory (ISBN, categoryName)

i) Identify the foreign keys in above schema.

ii) What is the implication of deleting a publisher? What is the consequence of updating a readerId? In both cases, take into account the keys and constraints.

iii) Maintain the state by inserting following data into schema.

a. **Insert <1,'Ahmed', 'Ali', 'abc', 'lahore', '10-10-1989'> into Reader**
b. **Insert <2,'Atif', 'Qureshi', 'abcd', 'lahore', '10-10-1990'> into Reader**
c. **Insert <1001,'Database', 'Ramez Elmasri', 1000, 2006, 'Addison'> into Book**
d. **Insert (1001,1,1,1) into Copy**
e. **Insert (1001,2,1,1) into Copy**
f. **Insert (1,1001,1,'02-02-2014') into Loan**

iv) Apply following operations on the above state of the schema. Discuss all integrity constraints violated by each operation, if any. *Please note that all operations are independent*.

a. **Insert <null, 'Ali', 'Ahmed', 'abc', 'lahore', '10-10-1989'> into Reader**
b. **Insert <1,1002,'02-02-2014'> into Loan**
c. **Delete the Loan tuple with *readerid* = 2**
d. **Modify the *CopyNumber* attribute of the Loan with *CopyNumber* = 2**

Consider the following relational database for next Questions.

The schema is of an electronic appliance shop. The store keeps track of the items in the store, customers and different orders placed by each customer.

Order

OrderNo	CustomerNo	Date
1	c1	2014-01-25
2	c2	2014-01-26
3	c3	2014-01-27

Customer

CustomerNo	Name	City	Phone
c1	Isbah	Isb	1234567
c2	Tahreem	Lhr	2345678
c3	Izaan	Lhr	3456789

Order_Item

OrderNo	ItemNo	Quantity
1	123	10
1	456	20
1	789	10
2	234	20
2	345	10

Item

ItemNo	Name	Price	Type	Manufacturer
123	A	1200	T1	LG
234	B	2200	T2	LG
345	C	2400	T2	LG
456	D	1400	T1	Sony
567	E	1600	T1	Sony
678	F	1800	T1	Samsung
789	G	2600	T2	Sony

Question 4 *(20 points)*

Write the output of the following queries:

a. $R \leftarrow \pi_{customerNo,\ itemNo}\ (Order * (Order\_Item * (\sigma_{manufacturer='LG'}\ (Item))))$

b. $S\ (customerNo,\ name,\ orderNo,\ date) \leftarrow (\sigma_{city='Lhr'}\ (Customer))$ ⨯ Order

c. SELECT manufacturer, type, COUNT(itemNo) NoOfItems FROM Item GROUP BY manufacturer, type

d. SELECT manufacturer FROM item
WHERE itemNo IN (SELECT itemNo FROM Item INTERSECT SELECT itemNo FROM Order_Item)

Question 5 *(20 points)*

Write the following queries in SQL:

a. List the name, type and price of all items manufactured by 'Samsung' or LG.

b. For each customer, list the name and quantity of the items bought before January 2014.

Write the following queries in Relational Algebra:

c. Retrieve the name and phone of the customers in Lahore who have not placed any order.
d. Find the orders that include all the items manufactured by ‘Sony’. List order number, order date and customer name for all such orders.