Roll No. _____Name _____ Section ___

National University of Computer and Emerging Sciences, Lahore Campus

Course:	Database Systems	Course Code:	CS203
Program:	BS(Computer Science)	Semester:	Spring 2018
Duration:	60 Minutes	Total Marks:	35
Paper Date:	26-Feb-18	Weight	15%
Section:	ALL	Page(s):	5
Exam:	Midterm-I [SOLUTION]		

Instruction/Notes: Scratch sheet can be used for rough work however, all the questions and steps are to be shown on question paper. ***No extra/rough sheets should be submitted with question paper***.
You will not get any credit if you do not show proper working, reasoning and steps as asked in question statements.

Consider the following State and Schema of a Retailer Store database. It keeps track of the orders placed by the customers.

CUSTOMER

cid	cname	city
100	Ismail	Karachi
200	Isbah	Lahore
300	Tahreem	Islamabad
600	Izaan	Lahore
700	Khadija	Karachi
800	Alia	Lahore

ORDER

oid	odate	cid
1	2018-01-20	200
3	2018-01-20	600
5	2018-02-15	300
7	2018-02-20	800

PRODUCT

pid	pname	price	company
10	Nutella	250	Ferrero
20	Kinder Joy	60	Ferrero
40	Milo	30	Nestle
50	Maggi Noodle	25	Nestle
70	Donuts	50	Dunkin Brands
80	Horlicks	400	GSK

ORDER_DETAIL

oid	pid	quantity	discountPercent
1	10	2	15
1	70	6	25
3	10	1	15
5	10	3	15
5	40	4	15
5	50	5	25
7	10	2	15

```
CREATE TABLE
customer (
        cid INT NOT NULL,
        cname VARCHAR(30),
        city VARCHAR(30),
        PRIMARY KEY (cid)

);
```

```
CREATE TABLE product (
        pid INT NOT NULL,
        pname VARCHAR(30)
        UNIQUE,
        price DECIMAL(9,2),
        company VARCHAR(30),
        PRIMARY KEY (pid)

);
```

```
CREATE TABLE order (

        oid INT NOT NULL,

        odate DATE,
        cid INT,
```

```
CREATE TABLE order_detail (
        oid INT NOT NULL,
        pid INT NOT NULL,
        quantity INT,
        discountPercent INT,
```

PRIMARY KEY (oid), FOREIGN KEY (cid) REFERENCES customer(cid) ON DELETE SET NULL ON UPDATE CASCADE);	PRIMARY KEY (oid, pid), CHECK (quantity>0), FOREIGN KEY (oid) REFERENCES order(oid) ON DEL CASCADE ON UPDATE CASCADE, FOREIGN KEY (pid) REFERENCES product(pid) ON D CASCADE ON UPDATE CASCADE);

Q1. *(10 points)* Apply following operations on the above database. 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 and in case of Reject state the error that occurred. Please note that all operations are independent.

a) INSERT INTO ORDER_DETAIL (oid, pid, quantity, discountPercent) VALUES (1, 70, 10,15);

Accept O **Explain:** PK-Unique constraint violation. Tuple# 2 with PK value (1, 70) already exist.

Reject O

b) UPDATE ORDER_DETAIL SET discountPercent = '20';

Accept O **Explain:** Modify discountpercent attribute value of all tuples of order_detail relation to 20.

Reject O

c) UPDATE ORDER SET oid = 4 WHERE oid=5;

Accept O **Explain:** Modify oid attribute value of all matching tuples (i.e. t# 3) of parent relation order and also matching tuples (i.e. t# 4,5,6) of child relation order_detail to 4.

Reject O

d) DELETE FROM customer WHERE cname = 'Izaan';

Accept O **Explain:** Remove all matching tuples (i.e. t# 4 with cid=600) of parent relation customer and also modify cid attribute value of all matching tuples (i.e. t# 2 with oid=3) of child relation order to NULL.

Reject O

e) DELETE FROM order;

Accept O **Explain:** Remove all tuples of parent relation order and child relation order_detail.

Reject O

Roll No. _____Name _____ Section ___

Q2. *(10 points)* Write the result of the following queries for the Database State given above and explain in one sentence what these queries are doing.

ONLY FOR SECTION (A, B, C, D)

a. City $\mathcal{F}_{COUNT(*)}$ ((CUSTOMER $\bowtie_{CUSTOMER.cid=ORDER.cid}$ ORDER) $\bowtie_{ORDER.oid= ORDER\_DETAIL.oid}$ ORDER_DETAIL)

b. $\Pi_{Oid,Pid,Cid,Price}$ ($\sigma_{Price>100}$ (ORDER $\bowtie_{ORDER.oid= ORDER\_DETAIL.oid}$ (ORDER_DETAIL $\bowtie_{ORDER\_DETAIL.pid=PRODUCT.pid}$ PRODUCT)))

ONLY FOR SECTION (E, F)

a.
```
SELECT c.cname, c.city
FROM customer c
WHERE c.cid = (
            SELECT o.cid
            FROM order AS o
            WHERE o.oid = (
                        SELECT od.oid
                        FROM order_detail
od
                        WHERE quantity =
'1'
                        )
            );
```

b.
```
SELECT o.oid, c.cname, o.odate
FROM order o
INNER JOIN customer c ON o.cid=c.cid
 ORDER BY o.oid DESC;
```

Ans:

a. City wise total no of order details.

City	Count(*)
Lahore	4
Islamabad	3

b. All products having price>100 with order details if exist.

OID	PID	CID	PRICE
1	10	200	250
3	10	600	250
5	10	300	250
7	10	800	250
NULL	80	NULL	400

Roll No. _____Name _____ Section ___

Q3. *(15 points)* Specify the following queries in ***SQL***

a. List the orders placed by the customer with cid =300 in the month of February 2018.

b. Find the id of the customers who have bought the products of *Nestle* and *Dunkin Brands*.

c. For each product, find the number of orders placed for it and also find the total quantity of each product sold till now. The output of this query (i.e. part C) for the above relational database state would be

ProductID	***No. of Orders***	***Total Quantity Sold***
10	4	8
70	1	6
40	1	4
50	1	5

Ans:

a.

```
SELECT *
FROM order
WHERE cid=300 AND odate LIKE '2018-02-__' ;
                    -- another method:  odate LIKE '2018-02-%'
                    -- another method:  DATEPART(YEAR, odate)=2018 AND
                    DATEPART(MONTH, odate=07)
                    -- another method:  odate BETWEEN '2018-02-01' AND '2018-02-28';
```

b.

```
SELECT cid
FROM order o JOIN order_detail d ON o.oid=d.oid JOIN product p ON d.pid=p.pid
WHERE p.company IN ('Nestle', 'Dunkin Brands');

-- another method:
SELECT cid
FROM order
WHERE oid IN (SELECT oid FROM order_detail
            WHERE pid IN (SELECT pid FROM
                        WHERE company IN ('Nestle', 'Dunkin Brands')));
```

c.

```
SELECT pid AS "Product ID", COUNT(*) AS "No of Orders" , SUM(quantity) AS "Total
Quantity Sold"
FROM order_detail
GROUP BY pid;
```

Roll No. _____Name _____ Section ___

Roll No. [redacted] Name [redacted] Section [redacted]

National University of Computer and Emerging Sciences, Lahore Campus

Course:	Database Systems	Course Code:	CS2005
Program:	BS(CS, DS, SE)	Semester:	Spring 2023
Duration:	60 Minutes	Total Marks:	25
Paper Date:	28-Feb-23	Weight	15%
Section:	ALL	Page(s):	2
Exam:	Midterm-I		

Instruction/Notes: **Solve the questions in the given order.**
You will not get any credit if you do not show proper working, reasoning, and steps as asked in the question statements.

Consider the following database for an Online fruit and vegetable shop FreshFruVeg . A customer can order fruits and vegetables, and the shop delivers the required items on the same day.

The attribute CID is a foreign key in the ORDER table, and attributes OID and IID are foreign keys in the ORDERdetail table. The attribute AmountKg indicates the amount in kilograms ordered by the Customer. The price of the items (fruit/vegetable) are not fixed and may differ daily depending on the economic changes.

ORDERdetail

OID	IID	AmountKg	PricePerKg
1	1	1	100
1	3	2	95
3	5	2.5	50
2	1	6	95
1	5	1	80
1	4	2	200
2	4	1.5	55
4	8	2	75

ORDER

OID	CID	date
1	4	12-jan-2023
2	4	28-dec-2022
3	5	10-jan-2023
4	2	12-jan-2023

CUSTOMER

CID	Name	Age	Gender
1	Tahreem	25	F
2	Izaan	50	M
3	Isbah	42	F
4	Ismail	25	M
5	Alia	18	F
6	Khadija	25	F

ITEMS

IID	IName	Type
1	Apple	Fruit
8	Orange	Fruit
3	Bringle	Vegetable
5	Ocra	Vegetable
6	Potato	Vegetable
4	Strawberry	Fruit

Q1. *(5 points)* Write the result of the following queries for the database state given above and **explain in one sentence what these queries are doing.**

a. Select OID from Order join Customer on Order. CID = Customer.CID where Gender ='M'
Except (Select O.OID from Orderdetails as O join Item as I on O.IID = I.IID where I.Type = 'fruit' **Intersect**
Select O.OID from Orderdetails as O join Item as I on O.IID = I.IID where I.Type = 'vegetable')

b. Select O.OID, O.CID
From Order O join Orderdetail OD on O.OID=OD.OID
Groupby O.OID, O.CID
Having sum(OD.AmountKg * OD.PricePerKg) > 300

Q2. *(15 points)* Specify the following queries in ***SQL***

a. Print the CID of the teenage customers who have placed an order before 1-Jan-2023.
b. Retrieve the name of Items that are not ordered by any customer.
c. Print the CID of the Customers who have placed more than three orders in a day.

PTO for Question 3

Roll No. _____ Name _____ Section ____

Q3. *(5 points)* Apply the following operations on the above database. **State clearly if the operation would be carried out successfully or not.**
Explain your answer briefly. In case of a successful operation, indicate the changes that will be made to the above database (i.e., clearly point out which rows are updated/deleted). In case of failure, explain why it failed.

Please note that all operations are independent.

Assume the referential integrity constraint on foreign keys (ORDERdetail.OID, ORDERdetail.IID, ORDER.CID) is ON DELETE/UPDATE CASCADE.

a) INSERT INTO Order VALUES (6, 8, 12-Jan-2023)

b) DELETE FROM Order WHERE OID= 2

c) DELETE FROM Customer WHERE Age=25

d) UPDATE OrderDetail SET PricePerKg = 100 Where IID >4

e) UPDATE OrderDetail SET IID = 4 Where IID = 5

Roll No. _____Name _____ Section ___

National University of Computer and Emerging Sciences, Lahore Campus

Course:	**Database Systems**	**Course Code:**	**CS203**
Program:	**BS(Computer Science)**	**Semester:**	**Spring 2019**
Duration:	**60 Minutes**	**Total Marks:**	**30**
Paper Date:	**Wed 27-Feb-2019**	**Weight**	**15%**
Section:	**ALL**	**Page(s):**	**5**
Exam:	**Midterm-I**		

Instruction/Notes: Scratch sheet can be used for rough work however, all the questions and steps are to be shown on question paper. ***No extra/rough sheets should be submitted with question paper***.
You will not get any credit if you do not show proper working, reasoning and steps as asked in question statements.

We want to design a website to help students grasp the Database concepts. We will call our site 'Web-For-DB-Dummies'. It will contain articles on the various topics of Database Systems. A registered user can be author, editor or just a reader. Any registered user can submit an article, after approval from an Editor (of our site) it will be uploaded. A user can rate an article on a scale of 1-5.

NOTE: Primary keys (PKs) are underlined and foreign keys (FKs) are in *italic* font. Assume referential integrity constraint(RIC) on FKs (*Topic.EditorID, Article.AuthorID* and *Article.TNo*) are On Delete Set Null and On Update Cascade, and RIC on FKs (*ArRating.ANo* and *ArRating.UID*) are On Delete/Update Cascade.

The schema and state of our website is as follows:

USER

UID	UName	Gender
1	Sara	F
2	Zara	F
5	Ali	M
3	Ahmad	M
9	Aliya	F
13	Tania	F
6	Hamza	M

ARTICLE

ANo	Title	*AuthorID*	*TNo*
1	Why we need Relational Algebra?	9	3
2	All about Query Execution	13	8
3	What is Conceptual DB Model?	6	6
4	Nested SQL Queries	9	7
5	Transaction Processing	9	9

TOPIC

TNo	TName	*EditorID*
1	Intro to DB	6
5	Basic SQL	5
7	Advanced SQL	9
9	Transactions	13
6	ER Model	1
8	Query Execution	13
3	Relational Algebra	9

ArRATING

ANo	*UID*	Rating
1	2	3
1	9	3
3	2	3
2	2	4
2	6	5
2	13	2
3	13	5
4	2	5
4	6	5

Roll No. _____Name _____ Section ___

Roll No. _____Name _____ Section ___

Q1. *(10 points)* Apply following operations on the above database. 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 article (ANo, TNo) VALUES (9, 9);

Accept O **Explain:**

Reject O

b) INSERT INTO arRating VALUES (3, 2, NULL);

Accept O **Explain:** PK-Unique constraint violation. Tuple# 3 with PK value (3, 2) already exist.

Reject O

c) DELETE FROM user WHERE name='Aliya';

Accept O **Explain:** Remove all matching tuples of parent relation user (i.e. t#5), child relation arRating (i.e. t#2), and also update EditorID & AuthorID attributes of all matching tuples (i.e. t# 3, 7 of Topic & t# 1, 4, 5 of Article) to NULL.

Reject O

d) UPDATE arRating SET ANo = 4 WHERE rating=4;

Accept O **Explain:** PK-Unique constraint violation. Tuple# 8 with PK value (4, 2) already exist.

Reject O

e) DELETE FROM article WHERE TNo=7;

Accept O **Explain:** Remove all matching tuples of parent relation Article (i.e. t#4) and child relation arRating (i.e. t#8, 9 with ANo=4).

Reject O

Roll No. _____Name _____ Section ___

Q2. *(10 points)* Write the result of the following queries for the Database State given above and explain in one sentence what these queries are doing.

a. $R1 \leftarrow \Pi_{UID, TNo, Tname}(\sigma_{AuthorID = EditorID \wedge Gender = `F`} USER) \bowtie_{UID=AuthorID} ARTICLE) \bowtie_{TNo=TNo} TOPIC))$
$R2 \leftarrow {}_{UID}\mathcal{F}_{count(*)} R1$

b. SELECT ano, editorid
FROM article AS A JOIN (SELECT ano, AVG(rating) FROM arrating GROUP BY ano HAVING AVG(rating)>=4) AS highAR ON A.ano=highAR.ano JOIN topic AS T ON A.tno=T.tno;

Ans:

a)

R1

UID	TNo	Tname
9	3	Relational Algebra
9	7	Advanced SQL
13	8	Query Execution

R2

UID	COUNT(*)
9	2
13	1

b)

HighAR

ANo	AVG(Rating)
~~1~~	~~3~~
~~2~~	~~3.6~~
3	4
4	5

ANo	Title	AuthorID	TNo	ANo	AVG(Rating)	TNo	Tname	EditorID
~~3~~	~~What is Conceptual DB Model?~~	~~6~~	~~6~~	~~3~~	~~4~~	~~6~~	~~ER Model~~	~~1~~
~~4~~	~~Nested SQL Queries~~	~~9~~	~~7~~	~~4~~	~~5~~	~~7~~	~~Advanced SQL~~	~~9~~

Final Result:

ANo	EditorID
3	1
4	9

Roll No. _____Name _____ Section ___

Q3. *(10 points)*

a. We wish to find users who gives very high rating. Write a **SQL Query** to list down the names of the USERs who always gives a rating of 4 or 5. For example, in the above database state only user with UID = 6 (name Hamza) has given high rating on every article he rated.

b. Write a **Relational Algebra Query** to list down the IDs and name of the authors who have written articles on the Topic named "Intro to DB" and also on the Topic named "Basic SQL".

Ans:

a)

Option1:

```
SELECT UName FROM user JOIN arRating ON user.UID=arrating.UID WHERE rating>=4
EXCEPT
SELECT UName FROM user JOIN arRating ON user.UID=arrating.UID WHERE rating<4;
```

Option2:

```
SELECT UName
FROM user
WHERE UID IN      (SELECT   UID   FROM   arRating
                EXCEPT
                SELECT   UID   FROM   arRating   WHERE   rating<4);
```

b)

$$R1 \leftarrow \Pi_{AuthorID,\ UName}(USER \bowtie_{UID=AuthorID} ¿_{TName='Intro\ to\ DB'} TOPIC \bowtie_{TNo=TNo} ARTICLE))$$

$$R2 \leftarrow \Pi_{AuthorID,\ UName}(USER \bowtie_{UID=AuthorID} ¿_{TName='Basic\ SQL'} TOPIC \bowtie_{TNo=TNo} ARTICLE))$$

$$Result \leftarrow R1 \cap R2$$

Roll No. _____Name _____ Section ___

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Q3 attached

National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Database Systems	Course Code:	CS2005
Degree Program:	BS(Computer Science)	Semester:	Spring 2022
Exam Duration:	60 Minutes	Total Marks:	30
Paper Date:	Thu 24-Mar-2022	Weight	15%
Section:	ALL	Page(s):	4
Exam Type:	Midterm-1	Total Questions:	3

Name: [redacted] Roll No: [redacted] Section: BS SE 4A

Instruction/Notes: Scratch sheet can be used for rough work however, all the questions and steps are to be shown on question paper. *No extra/rough sheets should be submitted with question paper.* You will not get any credit if you do not show proper working, reasoning and steps as asked in question statements.

Q1. *(5 points)* Write SQL statement to create the Student_Representative table given in Question#2. Also specify primary key constraint on Year & AdvisorID columns, foreign key constraint on SID column, foreign key constraint on AdvisorID column, and CHECK constraint on Year column that ensures that Year between 2015 to 2025.

```
create table Student_Representative
(
    SID int,
    Year int,
    AdvisorID int,
    primary key (~~SID~~ Year, AdvisorID)
)

Alter table Student_Representative add
constraint Foreign key (SID) references
Student (SID)

Alter table Student_Representative add
constraint FK_AID Foreign key (AdvisorID)
references Faculty (FacultyID)

Alter table Student_Representative ~~alter~~
~~column Year~~ add constraint CHCK_YR
check (Year > 2015
AND
Year < 2025)
```

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Roll No: [redacted]

Q2. *(10 points)* Consider the following relational database that keeps track of the student representatives of different departmets. Each student representative is selected for a period of one year and works under the supervision of a faculty member, Advisors. The attribute AdvisorID is a foreign key (from Faculty relation).

Student

SID	SName	SDept
1	Hamid	CS
2	Sara	CS
3	Nirma	EE
4	Saba	CV
5	Hamza	EE
6	Ali	MG
7	Kamal	CS
8	James	MG

Student_Representative

SID	Year	AdvisorID
1	2020	1
5	2020	6
1	2021	2
3	2021	2
8	2021	2
7	2018	4
5	2019	5

Faculty

FacultyID	FName	FDept
1	Shoaib	CS
6	Ahmad	EE
3	Sobia	MG
2	Azhar	EE
5	Sadia	CS
4	Romania	MG

Print the result of the following SQL queries for the database state given above.

a.

```
SELECT Year, SDept AS Department, SName AS StudentRep
FROM student S JOIN student_Representative SR ON S.SID=SR.SID JOIN faculty F ON F.facultyID=SR.advisorID AND SDept=FDept
ORDER BY Year DESC, SDept;
```

b.

```
SELECT S.SID, SName, FacultyID, FName
FROM student S FULL OUTER JOIN student_Representative SR ON S.SID=SR.SID FULL OUTER JOIN faculty F ON F.facultyID=SR.advisorID
WHERE SR.SID IS NULL;
```

Part a

Year	Department	StudentRep
2021	EE	Nirma
2021	MG	James
2020	CS	Hamid ✗
2020	EE	Hamza
2018	CS	Kamal ✗

Part b

2	Sara	NULL	NULL
4	Saba	NULL	NULL
6	Ali	NULL	NULL
3	Sobia	null	null

Roll No: [redacted] BSSE 4A

Q3. *(15 points)* Consider the above database, write the SQL statement for the following:

a. Print the name of all the students who were never selected as student representatives.
b. List the name of the faculty member who advised more than one student representative in a year.
c. Find the names of the students who were student representatives for the years 2022 and 2021.

10

(a)
```
Select distinct SName
From Student
where SID IN (
        Select SID From Student
        except
        Select SID From
        Student_Representative
)
```

(b)
```
Select FName
From Faculty
where FacultyID IN (
        Select AdvisorID, count(SID)
        From Student_Representative
        group by AdvisorID
        having count(*) > 1
)
```
year — SID

(c)
```
Select SName From Students
inner join Student_Representative
on Student_Representative.SID = Students.SID
where year = 2022 AND year = 2021
```


FAST School of

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.

National University of Computer and Emerging Sciences, Lahore
Spring Semester 2015

Course: CS203- **DATABASE SYSTEMS** **Time Allowed:** ***90 min.***
Date: *16 March, 2015*
Max Points: 40

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

RollNo	**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

SRollNo	**Year**	**Dept**
1	2010	CS
5	2010	EE
1	2011	CS
3	2011	EE
8	2011	M
7	2014	CS
5	2013	EE

Faculty

Fid	**FName**	**FDept**
1	Shoaib	CS
6	Ahmad	EE
3	Sobia	M
2	Azhar	EE
5	Sadia	CS
4	Romania	M

Department

DName	**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: Reject ….key 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…

delete row from student _rep

8	2011	M

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

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

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

Question 4*(2+3+3= 8 points)*
Consider the relational state of the bank database.

Branch

BranchName	**BranchCity**
Faisal Town	Lahore
Model Town	Lahore
Mall Road	Lahore
Super Market	Islamabad
Melody	Islamabad

Customer

CustomerName	**CustomerCity**
c1	Lahore
c2	Islamabad
c3	Lahore
c4	Islamabad
c5	Lahore
c6	Lahore

Account

Account#	**BranchName**
ac1	Faisal Town
ac2	Super Market
ac3	Super Market
ac4	Melody
ac5	Model Town
ac6	Model Town
ac7	Super Market
ac8	Melody

Depositor

CustomerName	**Account#**
c1	ac1
c1	ac2
c2	ac3
c2	ac4
c2	ac5
c3	ac6
c4	ac7
c4	ac8

Loan

Loan#	**BranchName**
L1	Faisal Town
L2	Melody
L3	Super Market
L4	Faisal Town
L5	Melody
L6	Mall Road

Borrower

CustomerName	**Loan#**
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) Result1(BranchCity, BranchName, NoOfAccounts) ← BranchCity, BranchName $\mathcal{F}_{COUNT(*)}$ (Branch * Account)

b) Result2← $\pi_{CustomerName,\ CustomerCity}$ (Customer * ($\pi_{CustomerName}$ (Borrower) ∩ $\pi_{CustomerName}$ (Depositor)))

c) Result3← $\pi_{CustomerName,\ CustomerCity,\ Account\#}$ ($\sigma_{CustomerCity=\ "Lahore"}$ (Customer) ⟕ $_{CustomerName=customerName}$ 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

National University of Computer and Emerging Sciences, Lahore
Mid-1, Fall 2012

Course: CS204- DATABASE SYSTEMS Max Points: 30 Time Allowed: 90 min.

Section: _____ Name: _____ Roll No: _____

Consider the following Movie database for all the questions; for simplicity assume that the title of a movie is unique. The length of the movie is its running time in minutes, and networth of the studio is its monetary value in dollars. Foreign keys are studioName, actorSSN, and movieTitle.

Movie

Title	Year	Length	StudioName	ProductionCost
Star Wars	2005	130	Fox	750000
Addams Family	1982	108	Paramount	155000
Wayne's World	1992	95	Paramount	72000
Mighty Ducks	2012	NULL	Disney	NULL

StarsIn

ActorSSN	MovieTitle
1	Star Wars
1	Wayne's World
2	Addams Family
2	Wayne's World
3	Star Wars
3	Addams Family
3	Wayne's World
4	Addams Family

Actor

SSN	Name	Gender	Address
1	Carrier Fisher	F	123 Maple, Hollywood
2	Mark Hamil	M	456 Oak Rd., Brentwood
3	Harrison Ford	M	789 Palm, Beverly Hills
4	Julia Ann	F	45 Maple, Hollywood
5	Robert Hook	M	92 Palm, Beverly Hills

Studio

Name	Address	Networth
Fox	Hollywood	9000000
Warner Brothers	Hollywood	500000
Disney	Buena Vista	7500000
Paramount	Hollywood	9200000

Question 1 *(10 points)*
Consider the above database schema; Write the following queries in SQL:

a) List the number of movies produced by each studio, consider only the studio that have networth at least 1million US dollars and produced at least 10 movies.

b) Find the male actors who work on all the movies produced by 'Disney' studio in year 2000.

Question 2 *(10 points)*
Given the above relational state, write the result of the following relational algebra expressions. Also show the result of intermediate relations:

a) $M1 \leftarrow \pi_{MovieTitle}$ (StarsIn)

$S1 \leftarrow \pi_{StudioName}$ (M1 $\bowtie_{MovieTitle=title}$ Movie)

$RESULT \leftarrow S1 - \pi_{Name}$ (Studio)

b) $RESULT \leftarrow \pi_{Name, Title}$ (Movie $\setminus_{Title=MovieTitle}$ ($\sigma_{Gender=M}$ (Actor $\setminus_{ssn=actorSsn}$ StarsIn))

Question 3 *(10 points)*
Suppose each of the following update operations are applied directly to the database state shown above and all these operations are independent from each other. Assume for all foreign key columns, applicable referential action for ON DELETE and ON UPDATE is CASCADE. Tell if the operation would be done successfully (i.e. acceptable) or not. Explain your answer briefly. Also state all the integrity constraints violated by each operation, if any.

a) INSERT INTO movie VALUES ('Harry Potter', 2001, 90, NULL, 115500000).

Accept O **Explain:**
Reject O

b) UPDATE starsIn SET actorSSN=5 WHERE movieTitle='Addams Family'.

Accept O **Explain:**
Reject O

c) UPDATE movie SET studioName='Van Beuren' WHERE Title='Mighty Ducks'.

Accept O **Explain:**
Reject O

d) DELETE FROM studio WHERE name='Paramount'.

Accept O **Explain:**
Reject O

e) DELETE FROM starsIn WHERE movieTitle='Star Wars'.
Accept O **Explain:**
Reject O

National University of Computer and Emerging Sciences, Lahore
Spring Semester 2012

Course: CS204- DATABASE SYSTEMS Time Allowed: *90 min.*
Max Points: *40*

Midterm 1

Section: _____ Name: _____ Roll No: _____

Question 1: *(15 points)*

Suppose each of the following update operations are applied directly to the database state shown above. Tell if the operation would be done successfully (i.e. acceptable) or not. Explain your answer briefly. Also state all the integrity constraints violated by each operation, if any.

STUDENT

RollNo	Name	Login	Age	Gpa
150	Tahree	tahreem@cs	18	3.3
155	Isbah	isbah@cs	19	3.1
160	Izaan	izaan@ee	17	2.6
165	Isbah	isbah@ee	19	3.6
170	Alia	alia@math	18	3.3

GRADE

RollNo	Course Code	Letter Grade
150	cs204	A
150	cs102	B
155	cs102	A
155	cs409	C

COURSE

Course	Title	CrHrs
cs102	CP	4
cs204	DB	4
cs409	DW	4

a) Insert <'cs502', 'ADB', NULL> into COURSE.

Accept ○ **Reason:**
Reject ○

b) Insert <165, 'cs304', A> into GRADE.

Accept ○ **Reason:**
Reject ○

c) Insert <180, 'Tahreem', 'tahreem@cs', 18, 3.3> into STUDENT.

Accept ○ **Reason:**
Reject ○

d) Insert <155, 'Raza', 'raza@cs', 25, 3.5> into STUDENT.

Accept ○ **Reason:**
Reject ○

e) Update the RollNo of the STUDENT tuple with age=18 to 170, if the applicable referential action is CASCADE.

Accept ○ **Reason:**

Reject ○

f) Update the CourseCode of the COURSE tuple with CourseCode=’cs102’ to ‘cs302’, if the applicable referential action is CASCADE.

Accept ○ **Reason:**
Reject ○

g) Update CourseCode of the GRADE tuple with LetterGrade=’B’ to NULL.

Accept ○ **Reason:**
Reject ○

h) Delete the COURSE tuple with CourseCode=’cs409’, if the applicable referential action is CASCADE.

Accept ○ **Reason:**
Reject ○

i) Delete the STUDENT tuple with RollNo=165, if the applicable referential action is RESTRICT.

Accept ○ **Reason:**
Reject ○

j) Delete the GRADE tuple with LetterGrade=’A’.

Accept ○ **Reason:**
Reject ○

Question 2: *(5 points)*

Consider the following current state of the R relation.

R

A	B	C	D
a1	b1	c2	d1
a1	b2	c1	d1
a1	b3	c1	d2
a2	b4	c2	d1

Specify all possible keys (i.e. minimal superkeys) for this current state of relation. You may assume that no future instances of this relation will violate the keys that can be inferred to hold in the current state.

Question 3: *(5+5= 10 points)* Roll No: _____

Given the following relational state, show the result of each relational algebraic expression. Also show the result of intermediate relations.

T1

A	B
1	4
2	4
3	4
1	5
2	5

T2

B
3
4
5

a) R1 ← π_{A} (T1)
R2 ← π_{B} ((R1 **x** T2) - T1)
R ← T2 **–** R2

b) RESULT(Bvalue, Frequency) ← B $\mathcal{F}_{COUNT(A)}$ (T1 * T2)

Question 4: *(5+5 = 10 points)* Roll No: _____

Consider the following relations for a database that keeps track of business trips of salespersons in a sales office (primary keys are underlined):

SALESPERSON (CNIC, Name, Start-Year, Dept-No)

TRIP (CNIC, From-City, To-City, Departure-Date, Return-Date, Trip-ID)

EXPENSE (Trip-ID, Account#, Amount)

Write the following queries **in relational algebra**:

a) Retrieve the name(s) of salesperson(s) who took trips to 'Karachi'.

b) Retrieve the name(s) of salesperson(s) who took no trip.

Roll No. _____ Name _____ Section ____

National University of Computer and Emerging Sciences, Lahore Campus

Course:	**Database Systems**	**Course Code:**	**CS2005**
Program:	**BS(Computer Science)**	**Semester:**	**Spring 2024**
Duration:	**60 Minutes**	**Total Marks:**	
Paper Date:	**28-Feb-2024**	**Weight**	**15%**
Section:	**ALL**	**Page(s):**	
Exam:	**Midterm-I**		

Instruction/Notes: A scratch sheet can be used for rough work; however, all the questions and steps are to be shown on the question paper. No extra/rough sheets should be submitted with question paper.
You will not get any credit if you do not show proper working, reasoning, and steps as asked in the question statements.

Consider the following simplified database schema for a forum post system like ***Stack Overflow***. A forum post system is an online platform where users can engage in discussions by posting messages. Users can create newposts or reply to existing posts.
In the DB schema given below:

- The Post table stores information about forum posts. The AuthorID is the ID of the User who created the post.
- The User table stores information about users.
- The Reply table stores replies to forum posts. A user can write a reply to an existing reply, meaning that replies are hierarchical and can be organized into parent-child relationships. Each reply can have zero or more replies, and each reply is associated with a parent reply. The column ParentReplyID indicates the parent reply to which the current reply is a response. If a reply is a direct response to the main post, then the "ParentReplyID" is NULL.

```
CREATE TABLE Post (
    PostID INT PRIMARY KEY,
    Title VARCHAR(255),
    Content TEXT,
    AuthorID INT,
    CreatedAt DATETIME

);
```

```
CREATE TABLE Reply (
    ReplyID INT PRIMARY KEY,
    PostID INT,
    ReplyText TEXT,
    AuthorID INT,
    ParentReplyID INT,
    CreatedAt DATETIME
);
```

```
CREATE TABLE User (
    UserID INT PRIMARY KEY,
    Username VARCHAR(50),
    Email VARCHAR(100),
    Gender CHAR(1)
);
```

Q.1 Add the following constraints in the above-mentioned DB schema

a. The column 'UserId' in user table is a foreign key in Post table with name author Id and referential integrity constraint is on Delete cascade.
ALTER TABLE post ADD CONSTRAINT fk_authorP_id FOREIGN KEY (authorId) REFERENCES user (userid) ON DELETE CASCADE on UPDATE CASCADE;

b. The column 'UserId' in user table is a foreign key in Reply table with name author Id and referential integrity constraint is on Delete cascade.
ALTER TABLE reply ADD CONSTRAINT fk_authorP_id FOREIGN KEY (authorId) REFERENCES user (userid)
ON DELETE CASCADE on UPDATE CASCADE;

c. The column 'PostId' in post table is a foreign key in Reply table with name postId and referential integrity constraint is on Delete cascade.
ALTER TABLE reply ADD CONSTRAINT fk_authorP_id FOREIGN KEY (postId) REFERENCES post (postId) ON DELETE CASCADE on UPDATE CASCADE;

d. `ParentReplyID is a foreign key (that references replyID from same table. SELF reference….`

e. ALTER TABLE reply ADD CONSTRAINT fk_parentr_id FOREIGN KEY (`ParentReplyID`) REFERENCES Reply (ReplyId) ON DELETE CASCADE on UPDATE CASCADE;

Roll No. _____ Name _____ Section ____

Q.2 Question on queries*(15 points)* Specify the following queries in ***SQL***

a. List the IDs and Names of the Female **Users who have not created any posts**.

b. Print IDs of the **Replies** that have received two or more replies.

c. List the usernames of users who have replied to their posts.

SOLUTION

a)
```
SELECT u.UserID, u.Username
FROM User u LEFT JOIN Post p ON u.UserID = p.AuthorID
WHERE p.PostID IS NULL AND u.Gender = 'F';
```

b)
```
SELECT ParentReplyID
FROM Reply
GROUP BY ParentReplyID
HAVING COUNT(ReplyID) >= 2;
```

c)
```
SELECT u.Username
FROM User u JOIN Reply r ON u.UserID = r.AuthorID JOIN Post p ON r.PostID = p.PostID
WHERE u.UserID = p.AuthorID;
```

Roll No. _____ Name _____ Section ____

Q3. Write the result of the following queries for database state given above and explain in one sentence what these queries are doing?

User table:

UserID	UserName	Gender	Email
1	Alice	Female	alice@example.com
2	Bob	Male	bob@example.com
3	Charlie	Male	charlie@example.com

Post table:

PostID	Title	CreatedAt	AuthorID	Content
1	Introduction	2024-02-20	1	Welcome to our platform!
2	Tips and Tricks	2024-02-21	2	Here are some tips for you.
3	Question about AI	2024-02-22	3	I have a question about AI.
4	Programming Question	2024-02-23	1	I need help with programming.
5	Data Science	2024-02-24	2	Let's discuss data science.

Reply table:

ReplyID	PostID	AuthorID	ParentReplyID	ReplyText	CreatedAt
1	1	2	NULL	Welcome, Alice!	2024-02-20
2	1	1	NULL	Thanks, Bob!	2024-02-21
3	1	3	1	Hello, everyone!	2024-02-22
4	1	2	2	Hi, Alice!	2024-02-22
5	2	1	NULL	Great tips, Bob!	2024-02-21
6	2	3	5	I agree!	2024-02-22
7	3	2	NULL	Can someone help me?	2024-02-22
8	3	1	NULL	Sure, what's up?	2024-02-22
9	3	3	7	What do you need help with?	2024-02-22

Roll No. _____ Name _____ Section ____

a)

```
SELECT UserID AS ID , UserName AS user_name, count (*) as num_post
 FROM User u
JOIN   Post p   ON u.user_id = p.author_id
 GROUP BY UserID, UserName
HAVING COUNT(*) > 1
ORDER BY UserID desc, UserName desc;
```

Answer: This query will return the users who have posted more than once, sorted by the number of posts they have made.

User_id	User_name	num_post
2	Bob	2
1	Alice	2

b)

```
SELECT p.PostID,  p.Title, p.CreatedAt, p.AuthorID, p.Content,u.UserName AS AuthorName,
 COUNT(r.ReplyID) AS ReplyCount
FROM  Post p
LEFT JOIN  User u ON p.AuthorID = u.UserID
LEFT JOIN  Reply r ON p.PostID = r.PostID
GROUP BY  p.PostID, p.Title, p.AuthorID,  CreatedAt, Content, UserName,
ORDER BY ReplyCount DESC;
```

Answer: showing each post along with its author's name and the number of replies it has received.

PostID	Title	CreatedAt	AuthorID	Content	AuthorName	ReplyCount
1	Introduction	2024-02-20	1	Welcome to our platform!	Alice	4
2	Tips and Tricks	2024-02-21	2	Here are some tips for you.	Bob	2
3	Question about AI	2024-02-22	3	I have a question about AI.	Charlie	3
4	Programming Question	2024-02-23	1	I need help with programming.	Alice	0
5	Data Science	2024-02-24	2	Let's discuss data science.	Bob	0

c)
```
SELECT u.UserName AS user_name,  p.Title AS title,  r.ReplyText AS text
FROM  User u
JOIN  Post p ON u.UserID = p.AuthorID
JOIN  Reply r ON p.PostID = r.PostID
WHERE  p.Title <> 'Introduction'  AND r.ParentReplyID IS NULL;
```

Answer:This query retrieves the usernames, post titles, and top-level reply texts for posts that are not titled 'Introduction'.

User_name	title	text
Bob	Tips and Tricks	Great tips Bob!
Charlie	Questions about AI	Can someone help me?
charlie	Questions about AI	Sure,what's up?

Q.4 Considering the constraints applied on the schema (Q.1) and data populated (Q.3).

Apply following operations on the above database. State if the operation would be carried out successfully or not. In case of successful operation indicate the changes that will be made to the above database. Also state all the integrity constraints violated by each operation, if any. Please note that **all operations are independent**.

a. DELETE FROM user WHERE username='Bob';

Successful, eight rows deleted

b. INSERT INTO reply VALUES (10,6,'hello',3,NULL,'2024-02-13');

Failed, reference integrity issue

c. UPDATE post SET postId=7 WHERE title='introduction';

Failed, reference integrity issue

d. DELETE FROM post WHERE postId=4;

Successful, one row deleted from post table