Year : III		**Date:** 20.03.19
Course No : CS F212		**MAX Marks**: 10(5%)
Course Title : Database Systems		**Duration:** 20 minutes

ID NO:_____   Name:_____

I. Consider the following Relational Schema: (1+2+2M)

Student(**idno**, name, sex, cgpa).
Exams(**idno, courseno, grade**)

(here the fields *idno, name, courseno, grade, sex* are of type **varchar** and *cgpa* is of type float),

a) Write your Query in TRC (tuple relational calculus) for the following:
    "All **male** students with **cgpa** greater than 6.5".

b) Write your Query in TRC (tuple relational calculus) for the following:
    "List the names of all students who took at least one exam".

c) Write your Query in DRC (Domain Relational Calculus) for the following:
    "List the names of all students who took at least one exam".

II. Consider the **Infostudents table** given below and write **each** of the queries in **SQL**:

Infostudents Table   (1+1.5+1.5+1M)

StudentID	StudentName	ParentName	Address	City	PostalCode	Country	Fees
01	Haznitiz	Emiz	Dellys Road	Afir	35110	Algeria	42145
02	Shubham	Narayan	MG Road	Bangalore	560001	India	45672
03	Salomao	Valentim	Mayo Road	Rio Claro	27460	Brazil	65432
04	Vishal	Ramesh	Queens Quay	Toronto	416	Canada	23455
05	Park Jimin	Kim Tai Hyung	Gangnam Street	Seoul	135081	South Korea	22353

1. Alter the schema of the table and add the Date of Birth field to the table.

2. Display all details of the Infostudents table in alphabetical order of country and in reverse alphabetical order of student name.

3. Display the count and the number of students from each city who pay a fees greater than 23000.

4. Display details of Students who are from any of the following countries Algeria, India, Brazil.

BITS PILANI, DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
SECOND SEMESTER 2018 - 2019
COURSE : DATABASE SYSTEMS (CS F212)
COMPONENT : Test 1 (CLOSED BOOK)   DURATION : 50 Minutes
WEIGHTAGE : 20% (40 Marks) DATE : 25.02.2018 TIME: 8.30-9.20 pm.
This question paper has 3 pages.

Answer All Questions

1. What is Schema in Relational Databases and what does it define?   [3 M]

2. How does a Relational Database ensure Data Integrity ?   [3 M]

3.Draw an **E-R Diagram** and **Covert** it into **Relational Tables** for the following problem: [8 M]

A cooking club organizes several dinners for it's members. The purpose of the club is to allow several members to get together and prepare a dinner for the other members. The club president maintains a database that plans each meal and tracks which members attends each dinner, and also keeps track of which members creates each dinner.

- Each dinner is attended by many members and any member may attend many dinners.

- Each dinner has an invitation. The invitation includes the date of the dinner and location.

- A member receives many invitations, and each invitation is mailed to many members.

- Each dinner is based on a single entrée (main dish) and a single dessert. This entrée and dessert can be used again for other dinners. Each Dinner has a price associated with it.

- An ENTREE is described by ENTREE_CODE, ENTREE_DESCRIPTION and ENTREE_PRICE.

- A DESSERT is described by DISSERT_CODE, DISSERT_DESCRIPTION and DISSERT_PRICE.

4. Draw an EER diagram for the following description of a law firm: [6 M]

Each case handled by the firm has a unique case number; a date opened, date closed, and judgment description are also kept on each case. A case is brought by one or more plaintiffs, and the same plaintiff (the suing party) may be involved in many cases. A plaintiff has a requested judgment characteristic. A case is against one or more defendants, and the same defendant may be involved in many cases. A plaintiff or defendant may be a person or an organization. Over time, the same person or organization may be a defendant or a plaintiff in cases. In either situation, such legal entities are identified by an entity number, and other attributes are name and net worth.

PTO

5. Consider the following table.

Stud ID	Stud Name	Course ID	Course Name	Instructor	Office	Room	Credit
224	Waters	CIS20	Intro CIS	Greene	CBA001	205G	5
224	Waters	CIS40	Database Mgt	Hong	CBA908	311S	5
224	Waters	CIS50	Sys.Analysis	Purao	CBA700	139S	5
351	Byron	CIS30	COBOL	Hong	CBA908	629G	3
351	Byron	CIS50	Sys.Analysis	Purao	CBA700	139S	5
421	Smith	CIS20	Intro CIS	Greene	CBA001	205G	5
421	Smith	CIS30	COBOL	Hong	CBA908	629G	3
421	Smith	CIS50	Sys.Analysis	Purao	CBA700	139S	5

   a. Is this table following a good design? Justify your answer.

   b. How could you have a better design? show by example.

   c. Give one example of **updation anomaly** in this table.

   d. Give one example of a suitable **domain constraint** that you can set on the table

                               (2+2+2+2M)

6. Consider the following Relational Tables:

User

Id	Name	Age	Gender	OccupationId	CityId
1	John	25	Male	1	3
2	Sara	20	Female	3	4
3	Victor	31	Male	2	5
4	Jane	27	Female	1	3

Occupation

OccupationId	OccupationName
1	Software Engineer
2	Accountant
3	Pharmacist
4	Library Assistant

City

CityId	CityName
1	Halifax
2	Calgary
3	Boston
4	New York
5	Toronto

P.T,O.

i) Write down the **results** of the following Relational Algebra Expressions:

(note: The symbol **P** denotes PROJECT operation and **R** denotes SELECT operation)

a. $P_{Name}(R_{Age>25}(User))$

b. $R_{Id>2 \vee Age!=31}(User)$

c. $R_{User.OccupationId=Occupation.OccupationId}(User \ X \ Occupation)$

d. $User \bowtie Occupation \bowtie City$

e. $P_{Name,Gender}(R_{CityName="Boston"}(User \bowtie City))$

$(1+1+2+2+2 \ M)$

ii) Write Relational Algebra Expression for the following query:

Give a **count** of the number of *male* users. (2 M)

iii) **Update** the *OccupationName* of person with *OccupationId* 3 from Pharmacist to Dentist.

(2 M)

END

BITS PILANI, DUBAI CAMPUS
Dubai International Academic City
Second Semester 2018 – 2019
Comprehensive Exam (Closed Book)

Year : II	**Date:** 21/05/2019
Course No : CS F212	**MAX Marks:** 80 (40%)
Course Title : Database Systems	**Duration:** 3 Hours

Note: Answer all questions. Each part caries 40 Marks
Answer Part A and Part B in separate booklets provided to you

---

PART A (40 Marks)

Answer all questions

1. a) List any two features supported by *Object-Relational Data Models* ?

   b) What does a data model describe in a DBMS?   [2 +2 M]

2. Draw an **E-R Diagram** and **Covert** it into **Relational Tables** for the following problem:

   [6+3 M]

> ArtBase is a company that plans to build a software product for art galleries. Galleries keep information about artists, their names (which are unique), birthplaces, age, and style of art. For each piece of artwork, the artist, the year it was made, its unique title, its type of art (e.g., painting, lithograph, sculpture, photograph), and its price must be stored.
>
> Pieces of artwork are also classified into groups of various kinds, for example, *portraits, still lifes, works by Picasso*, or *works of the 19th century*; a given piece may belong to more than one group.Each group is identified by a name (like those just given) that describes the group.
>
> Finally, galleries keep information about customers. For each customer, galleries keep that person's unique name, address, total amount of dollars spent in the gallery (very important!), and the artists and groups of art that the customer tends to like.
>
> Each piece of artwork had to be painted by exactly one artist. Several piece of artwork can have the same title. (Example: "What is Love?" by Cheryl D, "What is Love?" by Joe Brown)

3. Given a schema R(A, B, C, D, E), and the following set of FDs:

$\{A \to E, E \to CD, BC \to A, D \to B\}$

Find the $(A)^+$, $(E)^+$, $(BC)^+$, $(CD)^+$ (i.e. attribute closures of each of the given combination of attributes) and state whether they are possible candidate keys.   [8 M]

4. Consider the relation *PLAYER* with relational schema:

PLAYER (Player-no, Player-name, Team, Team-color, Coach-no, Coach-name, Player-position, Team-captain) and set of functional dependencies as follows;

$F = \{Player\text{-}no \to Player\text{-}name, \quad Player\text{-}no \to Player\text{-}position, \quad Player\text{-}no \to Team, \quad Coach\text{-}no \to Coach\text{-}name, \quad Team \to Team\text{-}color, \quad Team \to Coach\text{-}no, Team \to Team\text{-}captain\}$

Convert the relation PLAYER into **3NF relational design**.   [7 M]

5. **Writing of** Queries in Relational Algebra, Tuple Relational Calculus and SQL and writing the output:

An employee details database contains three tables as follows:

EMPLOYEE(**empid**, empname, division, birthdate)
SOCIETYMEMBER(**empid, societyname**)
SOCIETY(**societyname**, annual_subscription_amount)

a) **Write each** of the following queries in **Relational Algebra, Tuple Relational Calculus and SQL.** (refer the data set given in this question)   [9 M]

1. Print the empid, *empname* and *societyname* **for each** employee. (Note: An employee may be a member of zero or more societies).

2. Print *the empname, societyname* and *annual_subscription_amount* for each employee.

b) Write **the output for the two SQL queries** as in 5 a).:(refer the data set below) [3M]

EMPLOYEE

empid	empname	division	birthdate
1	santhosh	PS	12/01/1984
2	razak	ARC	22/12/1966
3	gaurav	INSTRUCTIONS	01/09/1988
4	swarna	Student Welfare	01/10/1991
5	angel	Student Welfare	01/10/1990
6	vilas	Sports	01/10/1993
7	nandkumar	IT Support	20/07/1985

SOCIETYMEMBER

empid	societyname	empid	societyname
7	HOUSING	5	COOPERATIVE
5	HOUSING	2	COOPERATIVE
4	RED CROSS	7	RED CROSS
2	HOUSING	7	THRIFT

SOCIETY

| societyname	annual_subscription_amount
THRIFT	1200
COOPERATIVE	1250
HOUSING	1300
RED CROSS	1350

PART B (40 Marks)

Answer all questions

1. Consider a disk with a sector size of 512 bytes, 2000 tracks per surface, 50 sectors per track, five double-sided platters, and average seek time of 10 msec.

a.. What is the capacity of a track in kilo-bytes ? What is the capacity of each surface in kilo-bytes? What is the capacity of the disk in kilo-bytes ?

b. If the disk platters rotate at 5400 rpm (revolutions per minute), what is the maximum rotational delay in seconds ?

c. If one track of data can be transferred per revolution, what is the data transfer rate in kilo-bytes per second ?

[3+1+1M]

2. Consider the B+ tree index of order $d = 2$ shown in the figure below.

a. Show the B+ tree that would result from inserting a data entry with key 3 into the original tree. How many page reads and page writes does the insertion require?

b. Show the B+ tree that would result from deleting the data entry with key 8 from the original tree, assuming that the left sibling is checked for possible redistribution.

[3+3M]
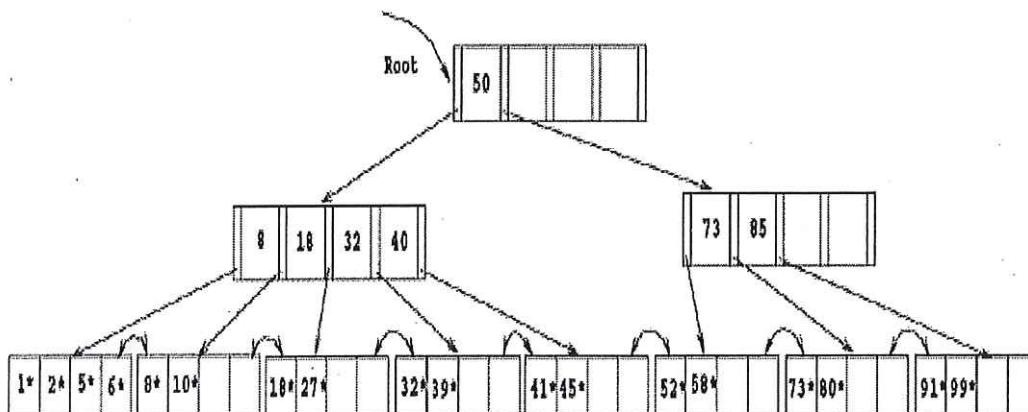
3. Suppose that extendable hashing is being used on a database file that contains records with the following search key values: 2, 3, 5, 7, 11, 17, 19, 23, 29, 31

a) Construct the extendable hash structure for this file if the hash function is h(x) = x mod 7 and each bucket can hold three records.

b) Show how the structure from part a) changes after inserting a record with the search key value of 16 and then deleting the record with the search key value of 11.

c) Why is a hash structure not the best choice for a search key on which range queries (i.e. select * from relation where key > a and key <=b) are likely?

[3+3+2M]

4.a. Consider the given table. Use a bitmap index to create the required bitmap and answer the following query.

SELECT * FROM STUDENT WHERE GENDER = 'F' AND SEMESTER =4;

| STUDENT | | | | | |
STUDENT_ID	STUDENT_NAME	ADDRESS	AGE	GENDER	SEMESTER
100	Joseph	Alaiedon Township	20	M	1
101	Allen	Fraser Township	21	F	1
102	Chris	Clinton Township	20	F	2
103	Patty	Troy	22	F	4

b. Explain the significance of Query Optimization with an example   [3+2M]

5.a. Consider the following transactions T1 and T2:
T1: Read(A)
Read(B)
if A==0 then B→B+1;
Write(B)

T2: Read(B)
Read(A)
If B==0 then A→A+1;
Write(A)

Add *lock* and *unlock* instructions to these transactions so that they observe the two phase locking protocol.

b. Can the execution of these transactions (in 5 a). result in a deadlock? Draw the *Wait For Graph*.

c. What are the *conflicts* and *implied transaction precedence* for the following schedule:

S: r1(A); r2(B); w1(A); w2(A); w3(A); w3(B); r1(B)   ?

d. Draw the Precedence Graph for the schedule (as in 5.c) and indicate if it is conflict serializable.

[2+2+3+3M]

6. a. Explain why checkpoints are important in Database Recovery?

b. Explain the key concepts of the working of the Undo, Redo and Undo Redo logging mechanism.   [2+4M]

*****************************ALL THE BEST***************************

BITS PILANI, DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
SECOND SEMESTER 2018 - 2019
COURSE : DATABASE SYSTEMS (CS F212)
COMPONENT : Test 2 (OPEN BOOK)   DURATION : 50 Minutes
WEIGHTAGE : 15% (30 Marks)   DATE : 09.04.2019 TIME: 8.30-9.20 pm.
This question paper has 2 pages (4 questions). Text/Ref books/Lecture Notes permitted.

Answer All Questions

1. Consider the relation scheme **R = {E, F, G, H, I, J, K, L, M, N}** and the set of functional dependencies **{{E, F} -> {G}, {F} -> {I, J}, {E, H} -> {K, L}, K -> {M}, L -> {N} on R.**

a. Find $\{E,F\}^+$

b. Find $\{E\}^+$

c. $\{E, F, H\}^+$

d. $\{E,F,H,K,L\}^+$

e. List the key and the candidate key of R, state your reason for picking the key.(1+1+2+2+2M)

2 . Given a relation schema $R(A, B, C, D, E)$ and the following functional dependencies:

A->BC

CD->E

B->D

E->A

a) Show that the decomposition of R into (A, B, C) and (A, D, E) is a lossless-join decomposition.

b) .Show that the decomposition (A, B, C) and (C, D, E) of the relation R with the functional dependencies also as listed above is not a lossless-join decomposition. Show using a counter example if needed.   [3 + 4 M]

P.T.O.

3. Consider the following relational schema:

---

salesman(salesman_id, name, city, commission)

customer (customer_id, cust_name,city, grade, salesman_id)

Write SQL queries for each of the following: [3 + 3 M]

a) Using LEFT JOIN, Display a list in *ascending order* for the customer who works either through a *salesman* or by own. The list should show all relevant attributes *salesman* and *customer*.

b) Using RIGHT JOIN, Display a list in *ascending order* for the **salesman** who works **either** for one or more *customers* or not yet started working for any of the customers. The list should show all relevant attributes *salesman* and *customer*.

4. Consider the following relational schema: [3+3+3 M]

Product (BarCode, PName, Price, QuantityInStock)

Sale (SaleID, DeliveryAddress, CreditCard)

SaleItem (SaleID, BarCode, Quantity)

---

a) Write a SQL ***Stored Procedure*** called ***spInsertProduct*** that inserts a new product into the database, under some conditions. The stored procedure has as input parameters the barcode, the product name, price, and quantityInStock. The stored procedure should insert a row in the Product table only if the price is greater than 0 and the quantity is greater or equal to 0.

b) Write a **Trigger** called ***updateAvailableQuantity*** that updates the remaining available quantity in the Product table, for every product sold. The trigger should be executed after each insert operation on the *SaleItem* table: for the product with the given barcode (the one inserted into *SaleItem*), update the available quantity in Product table to be the old quantity minus the sold quantity.

c) Write a Nested SQL Query for the following scenario: List all products, with *barcode* and *name, saleid, quantity* sold and *DeliveryAddress* for the sales containing that product, if any (products that were never sold should still be listed in your result).

END