BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI, DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
SECOND SEMESTER 2020 – 2021
DEPARTMENT OF COMPUTER SCIENCE

Questions: 4
Pages: 2

COURSE : Database Systems (CS F212)	
COMPONENT : Test 1 (Open Book)	**WEIGHTAGE :** 20% (40 Marks)
DATE : 10-March-2021 (8:30 am to 9:20 am GST)	**DURATION :** 50 Minutes

Read the instructions before attempting:

1. Write down any assumptions that you make.
2. Write your name and id on top of each page of answersheet.
3. Scan all the answers, merge and upload as 1 document in the assignment section.
4. Late submissions are not accepted.

Q1. a Construct an ER diagram for a Car Racing game as per the descriptions given below. (8M)

Race cars details such as Reg. No, color, manufacturer, type should be maintained. Details about people involved in the car racing business such as owners, trainers, and racing drivers should be maintained. Participating race cars can be owned by a person or a company. An identifier, name, address, and phone number should be maintained about every person/company. If a person is a trainer, the database should indicate the racing drivers trained by that person. A trainer can train many racing drivers, but a racing driver is only trained by one person. A driver can be employed by more than one owner. An owner can employ more than one driver. Information is always recorded about date of joining and salary of a driver. Every race track has a race schedule indicating the date of each race day and the list of races for each race day. A race day typically has 10 scheduled races, where each race has a race number (from 1 to 10) and a prize amount of AED25000. Every race has several entries. Each entry indicates the driver, trainer, and track position of the car at the start of the race. Only selected cars will be used for any of the scheduled races. After the race, the entry records the finishing position (first, second, third, etc.). Every driver and every trainer must be able to produce a history of the races in which they have participated. Represent the entities, participation, generalization and specialization, cardinalities, weak entity and associated relationship sets.

b. Convert the representations of the ER Model/diagram (any 4 entity sets) into Relational DDL Schemas with at least two constraints in each. (4M)

Q. 2 Attempt the following question. (4x1.5=6M)

Consider the following relational database consisting of the four relational schemas:

```
guest (guest-id, guest-name, gender, guest-city)
touragency (touragency-id, touragency-name, touragency-city)
hotel (hotel-id, booking-date, no-of-days)
booking (guest-id, touragency-id, hotel-id, booking-status)
```

Write the relational algebra for the given queries:

a. Get the id of hotels that are booked on either of the dates 01/01/2021 or 31/12/2021 or both for 2 days stay.

b. Find the id, name and city of all male guests who have done booking with tour agency="Ryna Tours".

c. Display the touragency id which operates from at least two different cities.

d. Find all guests names who have a booking with all tour agencies located in Dubai city.

Q. 3 Consider the following relational database consisting of the three relation schemas:

```
doctor (doc-name, doc-street, doc-city)
practices (doc-name, clinic-name, salary)
clinic (clinic-name, clinic-city)
```

Write the Tuple relational Calculus and Domain Relational Calculus for the given queries:

a. Find the names and cities of residence of all doctors who practice at "Aster" and earn more than AED 80,000 per annum. 2+2=4M

b. Find the names of all doctors who live in the same city as the clinic where they practice. 2+2=4M

Q4. Consider the following schema.

```
Product (ProductID, productName, SupplierID, CategoryId, Unit, Price)
Suppliers(SupplierID, SupplierName, ContactName, Address, City,
          PostalCode, Country, Phone)
OrdersDetails(OrderDetailID, OrderID, ProductID, Quantity)
Customers(CustomerID, CustomerName, ContactName, Address, City,
PostalCode, Country)
```

Write SQL Query for the following questions. (7x2=14M)

a. Find the list of the suppliers with a product price between 20 and 22.

b. Find the list of the product names if it finds ANY records in the OrderDetails table that quantity > 20.

c. Find the list of the product names if it finds ANY records in the OrderDetails table that quantity less than the average quantity.

d. Find the list of customers that are not from the same city.

e. Find the list of all customers from the country Germany and suppliers from the 'Madrid' city of the country Spain.

f. Find the country names having more the 5 customers and less than 10 customers

g. Find the list of customers which live in either Strasbourg or Lille city

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SECOND SEMESTER 2020 – 2021
DEPARTMENT OF COMPUTER SCIENCE

Questions: 6
Pages: 2

COURSE : Database Systems (CS F212)	
COMPONENT : Test 2 (Open Book)	**WEIGHTAGE :** 20% (40 Marks)
DATE : 18-April-2021 (8:30 am to 9:20 am GST)	**DURATION :** 50 Minutes

Read the instructions before attempting:

1. Write down any assumptions that you make & mention inadequate data if any.
2. Write your name and id on top of each page of answersheet.
3. Scan all the answers, merge and upload as 1 document in the assignment section.
4. Late submissions are not accepted.

Q.1 Consider the relation r (X, Y, Z, W) and a set F = {Y ⇔ W, XY ⇒ Z} where the symbol ⇔ means that Y ⇒ W and W ⇒ Y simultaneously.

a) What are the candidate keys of this relation? (2+2)
b) What are the prime attributes and non-prime attributes in this relation? (1+1)
c) What is the highest normal form of this relation? Justify. (2)

Justify your answer in detailed manner; each step carries marks.

Q.2 Consider the following set *FD* of functional dependencies:

FD= {
E -> FG
F ->G
E ->F
EF->G
}

What is the minimum canonical cover of the relation? (2+2+2+2)

Q.3 Given the relational scheme R(A, B,C,D) and the FDs A ⇒ B and BC ⇒ D. Determine which of the dependencies shown below can be derived from these FDs by application of the inference axioms.

a. AC ⇒ D
b. B ⇒ D
c. AD ⇒ B (3+3+3)

Q.4

Considering the relation Student_Department given below, answer the following queries:

a. Mention the name of the anomaly when the Student_city value changes from Delhi to Ahmedabad in Tuple5. Justify your answer. (2M)
b. Mentioning the name of anomaly, explain why it would be a problem if the university wishes to add the details of a newly started department called chemical engineering but no student is enrolled in that department so far? (2M)

	Student_Id	Student_Name	Student_City	Deptartment	Department_Hod	Block_No
Tuple 1	001	Sachin	Delhi	Computer Engineering	Dr. Ramesh	Block A
Tuple 2	002	Priya	Pune	Civil Engineering	Dr. Suresh	Block C
Tuple 3	004	Devika	Noida	Electrical Engineering	Dr. Lata	Block B
Tuple 4	003	Jyoti	Jaipur	Mechanical Engineering	Dr. Praveen	Block F
Tuple 5	001	Sachin	Delhi	Civil Engineering	Dr. Suresh	Block A
Tuple 6	006	Ravi	Lucknow	BioTechnical Engineering	Dr. Gandhi	Block H
Tuple 7	005	Aryan	Mumbai	Computer Engineering	Dr. Ramesh	Block A
Tuple 8	004	Devika	Noida	Computer Engineering	Dr. Ramesh	Block A

Q.5. Consider the following IPL relational schema and the sample instance.

Match_Schedule

Match_ID	Team1	Team2	Date	Venue	winner
8	CSK	PK	2021-04-16	Mumbai	Null

PointsTable

TeamName	Played	Won	Lost	Points
CSK	1	0	1	0
PK	1	1	0	2

Team

TeamName	Owner	Coach	Captain
CSK	CSK C ltd	Fleming	MS Dhoni

Player

Player_ID	Player_Name	TeamName	Role
007	MS Dhoni	CSK	Batsman

If the value for winner is updated as CSK in Match_Schedule table, then the corresponding entries in the points table need to be updated automatically as below. Create a trigger (name should be Trigger_YourReg_No. Ex. Trigger_2019A7PS0001U) for this. (6M)

PointsTable

TeamName	Played	Won	Lost	Points
CSK	2	1	1	2
PK	2	1	1	2

Q.6. Consider the following Retail shop schema.

```
Product(P_ID, P_Name, cost, selling_price, quantity, threshold)
Supplier(S_ID, S_Name, Phone, S_address)
Purchase_monthly(P_ID, P_Name)
```

Write a MySQL stored function (name should be Fun_YourReg_No. Ex. Fun_2019A7PS0001U) to calculate profit of the products. Write the function call also to display the result. (5M)

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DEPARTMENT OF COMPUTER SCIENCE

Questions: 20

Pages: 5

COURSE : Database Systems (CS F212)	
COMPONENT : COMPRE (Open Book) / MCQ	WEIGHTAGE : 40% (80 Marks) / 20 Marks
DATE : 25-05-2021	DURATION : 30 Minutes

20x1 = 20marks

Q1. Which of the following is the correct mapping between the ER Model and Relational Model?

Set-1	Set-2
A. Entity type	1. Primary or (Secondary) Key
B. Key attributes	2. Domain
C. Composite attribute	3. Relation and Foreign Key
D. Multivalued attribute	4. Set of simple component attributes
E. Value set	5. Relation

A: A-3; B-1; C-4; D-5; E-2
B: A-3; B-1; C-4; D-2; E-5
C: A-5; B-1; C-4; D-3; E-2
D: A-5; B-1; C-3; D-4; E-2
E: A-4; B-3; C-5; D-1; E-2
F: A-2; B-4; C-1; D-3; E-5

Q2. Given:

Query1: SELECT Trainer_name FROM Trainer t WHERE t.sal = ANY
(SELECT sal FROM Trainer WHERE t.name='Mr. B');

Query2: SELECT Trainer_name FROM Trainer t WHERE t.sal IN (SELECT sal FROM Trainer WHERE t.name='Mr. B');

Query3: SELECT Trainer_name FROM Trainer t WHERE t.sal = ALL
(SELECT sal FROM Trainer WHERE t.name='Mr. B');

Which one of the following is correct?

a) Query1 and Query2 are same
b) Query2 and Query3 are same
c. Query1, Query2 and Query3 are same
d. Query1 and Query3 are same
e) syntax error in one of the queries
f) none of these

Q3.Deadlock in database system is an example of

A)user error b) Consistency error C) System error
D)atomicity error E) Durability error F) none of these

Q4.Consider the following Instructor table

Instructor

I_ID	Instructor_Name	Instructor_Phone	Salary
Ins1111	Zubair Banaras	455355	1000
Ins1112	Sajjad Ahmad	355455	2000
Ins1113	Amir Ali	122366	3000
Ins1114	Irshad Khan	322166	nuLL

Suppose the following SQL queries executed sequentially, what will be the output after the select query.

update Instructor set Salary=Salary+500;

select avg(salary) from Instructor;

a. 2000 b. 1500 c.1875 d.2500 e. syntax error f.none of these

Q5. Consider T1-table has ‘m’ rows and T2-table has ‘n’ rows. What will be the maximum and minimum number of rows for the join of T1-table with T2-table.

a m+n and 0 b mn and 0
c m+n and m-n d mn and m+n
e mn and m f mn and n

Q6. Which one of the following is true?
S1: B tree eliminates the redundant storage of search key value
S2: B tree contains redundant search key
S3: B tree takes constant time for lookup operation
A: S1 only B: S2 only c: S3 only
D: S1 & S2 E: S1 & S3 F: None of these

Q7. Consider the Instructor table

I_ID	Age	Job	PayBand	Phone
1001	27	Consultant	Level1	11111
2001	22	Supervisor	Level1	22222
1051	28	Doctor	Level2	33333
1004	32	Engineer	Level4	44444
1003	24	Manager	Level3	55555

Assume that an index file created and the values in the file are 1,5,2,3 and 4. From which column, the index is constructed?
A: I_ID B: Age C: Job D: Payband E: Phone F: None of these

Q8. Atomicity is managed by
(a) Transaction management component (b) Recovery management component
(c) Concurrency control component (d) Users
e) Database administrator f)None of these

Q9. Consider the following schema
Trainer(T_name, salary, Institute_ID), and
Institute(Institute_ID, I_name, address)
Which one of of the following queries is false w.r.to basic relational algebra operations
(σ, π, x, $\bowtie$, $\cup$, $\cap$, -) ?
(a) Finding Department address of every trainer
(b) Finding Trainers whose name is the same as their Institute name
(c) Finding the sum of all the trainers' salaries
(d) Finding All trainers of a given institute
e) Finding the salary of given trainer
f none of these

Q10. Consider the relation schema R(A, B, C) and the statements

A	B	C
1	1	1
1	1	0
2	3	2
2	3	2

S1: A functionally determines B and B functionally determines C

S2: A functionally determines B and B does not functionally determines C
S3: B does not functionally determines C
S4: A does not functionally determines B and B does not functionally determines C
Which one of the following is true?
A: S1 only B: S2 only c: S3 only
D: S4 only E: S1 & S2 F: S2 & S3

Q.11. The Primary keys of the relations R1(P, Q, R) and R2(R, S, T) are P and R respectively. The relation R1 has 3000 tuples and R2 has 3500tuples. The maximum size of the join R1 ⋈ R2 is
(a) 3000 (b) 3500 (c) 6500 (d) 6000 e)500
f) none of these

Q12. Which of the following have the same expressive power?
I. Domain relational calculus restricted to safe expressions
II. Tuple relational calculus restricted to safe expressions
III. Relational algebra
(a) II and III only (b) l and II only (c) I and III only (d) I, II and III
e) none of these f) III only

Q13. Given a block can hold either 4 records or 20 key pointers. A database contains n records, then how many blocks do we need to hold the data file and the dense index
(A) 13n/30
(B) 6n/20
(C) n/10
(D) n/30
E) n/20
F)none of these

Q14.A Bank wants to save any transaction done in last 1 hour permanently into the database? Which command will be used:

A. Commit B:Rollback C:Savepoint D:Grant E:revoke F: None

Q15.A software company wants to remove a relation forms the MYSQL database? Which command will be used:

Delete

A. Drop
B. Remove
C. Alter
D. truncate
E. None of the these

Q16. A software company wants to view the total view of the database content?

A. Physical view
B. Abstract view
C. Internal view
D. External view

E. High-level view

F. None of the these

Q17. There is a start-up company, they want to write a fresh database schema. Which of the following command will be used.

A. High level language

B. Middle level language

C. DDL

D. TRC

E. DRC

F. None of the these

Q18. Which of the following statement is FALSE?
S1: Every relation in 3NF is also in 2NF
S2: A relation is in 3NF, if there is no transitive dependency for non-prime attributes as well as it is in second normal form.
S3: Every relation in BCNF is also in 3NF
A: S1 only B: S2 only c: S3 only
D: S1 & S2 E: S1 & S3 F: None of these

Q19. Consider the given relation R(A,B,C,D) and FD's (AB->C,B->D,D->B). How many candidate keys are there in this relation:

A) 1

B) 2

C) 3

D) 4

E) 5

F) None of these

Q. 20. Consider the given relation R(A,B,C,D) and FD's (AB->C,B->D,D->B). The candidate key(s) in this relation is/are:

A. AB,AC,B,D

B. AC,AD,D

C. AB,AD

D. BD,AC,B

E. AB

F. None of these

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Questions: 5
Pages: 2

COURSE : Database Systems (CS F212)	
COMPONENT : COMPRE (Open Book) / **Section-1**	**WEIGHTAGE :** 40% (80 Marks)/ **30 Marks**
DATE : 25-05-2021 (9:00 am to 10:10 am GST)	**DURATION :** 70 Minutes

Read the instructions before attempting:

1. Write down any assumptions that you make & mention inadequate data if any.
2. Write your name and id on top of each page of answersheet.
3. Scan all the answers, merge and upload as 1 document in the assignment section.
4. Late submissions are not accepted.

Q.1 Consider the given schedule S with three transactions T1, T2, T3 over three shared variables X,Y,Z.

T1	T2	T3
R(Y)		
		R(Z)
R(X)		
	W(X)	
W(X)		
	W(Y)	
		W(Y)
W(Y)		
		W(Y)
		W(Z)

a. List all the conflicting operations and determine the dependency between the transactions T1, T2 and T3 over the shared variable (X/Y/Z) [2]
b. Draw the complete precedence graph writing all the shared variable on the edges between the nodes. [3]
c. Is this schedule conflict serializable? Justify your answer. [2]
d. What would be the order of execution of the transactions? [1]

Q2: Follow the below steps.

1) Select last three-digit number of your roll number. If there will be mismatch found in your roll number then this question won't be evaluated.
2) Add the same number which you have selected in step 1.
3) Add 20 to the total obtained from step 2.
4) Divide the number obtained from step 3 by 2.
5) Subtract the number selected in step 2.
6) Final output obtained from the step 5 is the first element of the B+ tree.
7) Let's suppose the number is X.

The number of pointers in a node are 3. Now, answer the following questions.

A) Write the steps how you computed the value of X. The series is X, X+10, X+15, X+20, X+5, X+25, X+35, X+40, X+45.
B) Create a B^+ tree for the series obtained step 6. Please show all the steps while creating B+ tree for all the six elements. Each step contains marks.
C) Delete the element X+25. Draw the B^+ tree after deletion.

D) Delete the element X+10. Draw the B^+ tree after deletion.
E) Insert the element X+3. Draw the B+ tree after insertion.

(2+2+2+2+2)

Q3: The maximum number of pointers in a B+ Tree are 7. What will be the minimum number of keys required in any non-root node? Write the proper calculation along with the formula.

(1+1)

Q4:
Determine the highest normal for the given relation R(A, B, C, D) and Functional Dependency set FD = { AB -> C, AB -> D, B -> C, C->D }.

a) Identify the prime and non-prime attributes.
b) Identify the candidate key and super key in this relation.
c) Identify the highest normal form. Provide proper justification of your answer.

(1+1+2)

Q5:
Consider the following elements: 16,5,7,20,22,31,7,9,24,27 and construct the extendible hash structure. Suppose the bucket size is 3 and the Hash Function returns the X LSBs, where X denotes the global depth. Here, global depth denotes the directory and local depth denotes the buckets. Local depth is always equal or less than global depth.

(6)

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Questions: 4
Pages: 2

COURSE : Database Systems (CS F212)	
COMPONENT : COMPRE (Open Book) / Section-2	**WEIGHTAGE :** 40% (80 Marks) / 30 Marks
DATE : 25-05-2021 (9:00 am to 10:10 am GST)	**DURATION :** 70 Minutes

Read the instructions before attempting:

1. Write down any assumptions that you make & mention inadequate data if any.
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Q.1 Consider the given relational schema
Resident(resident_id, resident_name, resident_location)
NewspaperOrder(resident_id, newspaper_name, no_of_days, bill_amount)
Newspaper(newspaper_name, press_loc, editor_name)

Write the Tuple relational Calculus, Domain Relational Calculus and SQL for the given queries
i. What are the names of residents who have ordered newspaper from both newspaper company named "Gulf News" and "Khaleej Times"? [2+2+1]
ii. Who is the editor for at least two different newspapers? [2+2+1]

Q2. Consider the following RTA_License schema and the procedure to get a license. Each student has to clear the tests in the following order 1. Knowledge Test, 2. Initial Driving Assessment, 3. 60d Parking, 4. Parallel Parking, 5.Road Test. He/She will get the license immediately after clearing the Road Test.

Student

S_ID	SName	Registration_Date	S_Status	Gender	Language
14524	Arun	5th January, 2020	Pass	Male	English
65452	Nasir Hamed	3rd May, 2021	Ongoing	Male	Arabic
23423	Priya	12th, September, 2020	Ongoing	Female	Telugu
34534	Ghawer	1st April, 2020	Fail	Male	English
45674	Amit Joshi	12th, December, 2020	Pass	Male	Marati
456455	Shalini	07th, February, 2021	Ongoing	Female	Hindi

Instructor

I_ID	Instructor_Name	Instructor_Phone	No. of students got license
Ins1111	Zubair Banaras	455355	3
Ins1112	Sajjad Ahmad	355455	5
Ins1113	Amir Ali	122366	7
Ins1114	Irshad Khan	322166	9

Training

S_ID	I_ID	Training_slot_No	Training_Date	Location
14524	Ins1111	14	24th June, 2020	DIAC
65452	Ins1113	24	17th May, 2021	Al Quasis
23423	Ins1111	37	30th April, 2021	Al Nahda
34534	Ins1114	5	15th July, 2020	DIAC
45674	Ins1112	18	1st March, 2021	Al Quasis
456455	Ins1112	9	18th May, 2021	Al Quasis

Test

S_ID	TestName	TestDate	Result
14524	Road Test	30th June 2020	Pass
65452	Knowledge Test	16th May 2021	Pass
23423	Parallel Parking	17th May 2021	Fail
34534	Parallel Parking	25th October 2020	Pass
34534	Road Test	12th December 2020	Fail
45674	Road Test	12th March 2021	Pass

Draw an ER diagram for the given relational schema. [4]
Specify any two constraints can be included in the diagram. Justify your answer. [2]

Q3. Consider the previous RTA_License schema. Choose the correct MySQL construct(Function / procedure/ Triggers) to implement the following. When a student successfully completes roadtest, the number of students value in the instructor table should be updated automatically. (4)

Q4. Consider the following schema.
Vehicle(Manufacturer, Model, type)
Car(Model, color, EngineSpeed, cost)
Bus(Model, color, EngineSpeed, type, SeatingCapacity, cost)
Truck(Model, color, EngineSpeed, cost)

a.Write a MySQL query to display the makers and the speed of buses with a seating capacity of 45 persons. (2)

b. Write a MySQL query to display the models and the cost of all vehicles manufactured by the company 'Ford'. (3)

c. Write a MySQL query to display the makers of cars with a speed of at least 80mph using subquery (3)

d. Write a MySQL query to display the trucks with the highest price. (2)

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