



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

FIRST MID SEMESTER EXAMINATION- SEPT, 2023

COURSE TITLE: ICS213 – Database Management System

Date & Time: 04.09.2023 @09:30 - 11.00 AM

Max. Marks: 50

Course Instructor(s): Dr. Mirza Ghalib / Dr. Sivaiah Bellamkonda

Batch: 1 & 2

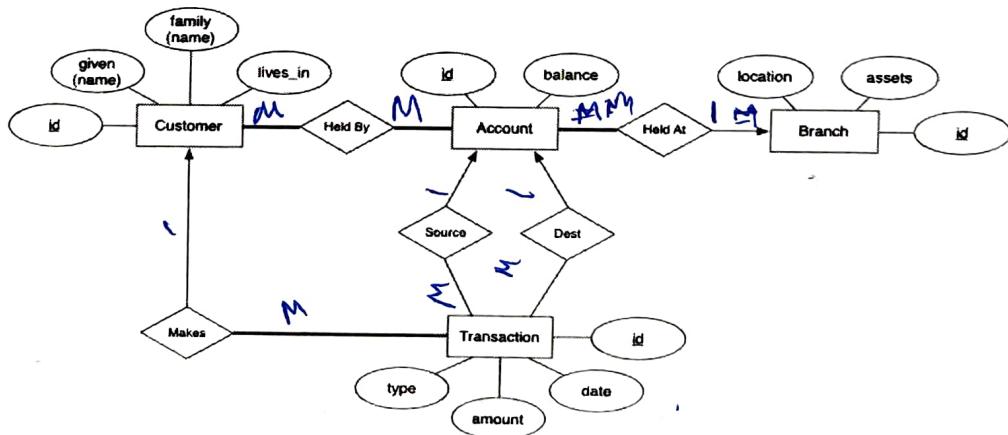
Answer all Questions

- ✓ 1. A) Discuss levels of abstraction in DBMS. **4M**
- B) Discuss any three constraints in relational databases. **6M**
- ✓ 2. A university registrar's office maintains data about the following entities: **10M**

- a) courses, including number, title, credits, syllabus, and prerequisites;
- b) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom;
- c) students, including student-id, name, and program; and
- d) instructors, including identification number, name, department, and title.

Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints.

3. A) Explain extended ER features with suitable examples. **4M**
- B) Convert the following ER-Diagram to a relational database schema with proper explanation: **6M**



4. Given the following schema:

Sailors(sid: integer, sname: string, rating: integer, age: real)

Boats(bid: integer, bname: string, color: string)

Reserves(sid: integer, bid: integer, day: date)

- A) Write a relational algebra query to find the names of sailors who reserved boat ID (bid) 232 on 23-11-2020 and 23-11-2022. **4M**
- B) Write a relational algebra query to display the names of sailors who reserved a red boat. **3M**
- C) Write a relational algebra query to find the name of the sailors who have reserved at least one boat. **3M**

5. Given the following schema:

Students(sid: string, sname: string, age: real, branch: string, semester: int)

Courses(cid: string, cname: string, credits: int, passmark: int)

Enrollment(sid: string, cid: string, score: int)

- A) Write SQL queries to create tables, use appropriate domain, primary and foreign key constraints. **3M**
- B) Write an SQL query to find names of students who enrolled at least one course. **2M**
- C) Write an SQL query to display details of ~~sailors~~ ^{Students} who passed all enrolled courses. **2M**
- D) Consider a hypothetical scenario where there is one to one relationship between Students and Courses. What constraints are required on the relation "Enrollment" to ensure that the one-to-one cardinality constraint is enforced? **3M**



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

SECOND MID SEMESTER EXAMINATION- OCTOBER, 2023

COURSE TITLE: ICS213 – Database Management System

Date & Time: 07.10.2023 @09:30 - 11.00 AM

Max. Marks: 50

Course Instructor(s): Dr. Sivaiah Bellamkonda & Dr. Mirza Ghalib

Batch: 1 & 2

Answer all Questions

1. A) Given the following schema:

```
Sailors(sid:integer, sname:string, rating:integer, age:real)
Boats(bid:integer, bname:string, color:string)
Reserves(sid:integer, bid:integer, day:date)
```

Write SQL Query for the following:

- i. Find the names of sailors who are older than the oldest sailor with a rating of 10. 2M
- ii. Find the age of the youngest sailor for each rating level. 2M

- B) Consider the following relations containing airline flight information:

```
Flights(flno:integer, from:string, to:string, distance:integer, departs:time,
arrives: time)
Aircraft(aid:integer, aname:string, cruisingrange:integer)
Certified(eid:integer, aid:integer)
Employees(eid:integer, ename:string, salary:integer).
```

If possible, write a relational algebra query for the following:

- i. Find the aids of all aircraft that can be used on non-stop flights from 'Bonn' to 'Madras'. 2M
- ii. Find the total amount paid to employees as salaries 2M

- C) Consider the following schema:

```
Suppliers(sid: integer, sname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)
```

Write a TRC and a DRC query for the following:

- i. Find the sids of suppliers who supply some red or green part. 4M

2. A) Consider a database that has the relation schema

EMP(EmpId, EmpName, DeptName).

An instance of the schema EMP and an SQL query on it are given below:

EMP		
EmpId	EmpName	DeptName
1	XYA	AA
2	XYB	AA
3	XYC	AA
4	XYD	AA
5	XYE	AB
6	XYF	AB
7	XYG	AB
8	XYH	AC
9	XYI	AC
10	XYJ	AC
11	XYK	AD
12	XYL	AD
13	XYM	AE

SQL: SELECT DeptName, COUNT(*) AS NumberOfEmployees
 FROM EMP GROUP BY DeptName
 HAVING COUNT(*) = (SELECT MAX(EmployeeCount)
 FROM (SELECT COUNT(*) AS EmployeeCount FROM EMP
 GROUP BY DeptName) AS Subquery);

What is the output of the above SQL query and show the process of computation?

5M

B) List all the non-trivial functional dependencies in the following table:

5M

CarReg	hireDate	Make	model	custNo	custName	outletNo	outletLoc
MS34 0GD	14/5/03	Ford	Focus	C100	Smith, J	01	Bearsden
MS34 0GD	15/5/03	Ford	Focus	C201	Hen, P	01	Bearsden
NS34 TPR	16/5/03	Nissan	Sunny	C100	Smith, J	01	Bearsden
MH34 BRP	14/5/03	Ford	Ka	C313	Blatt, O	02	Kelvinbridge
MH34 BRP	20/5/03	Ford	Ka	C100	Smith, J	02	Kelvinbridge
MD510PQ	20/5/03	Nissan	Sunny	C295	Pen, T	02	Kelvinbridge

3. A) Relation R has eight attributes ABCDEFGH.
 Fields of R contain only atomic values.

$F = \{CH \rightarrow G, A \rightarrow BC, B \rightarrow CFH, E \rightarrow A, F \rightarrow EG\}$
 is a set of functional dependencies (FDs) so that F^+ is exactly the set of FDs that hold for R.
 Find out all the candidate keys for R.

5M

- B) Let R(A, B, C, D, E, P, G) be a relational schema in which the following functional dependencies are known to hold:

$$AB \rightarrow CD, DE \rightarrow F, C \rightarrow E, P \rightarrow C \text{ and } B \rightarrow G.$$

Is the above schema in 2NF? If the answer is yes, give proper justification. If the answer is no, further decompose the relation in 2NF.

5M

4. A) Given the relation schema R = (A, B, C, D, E, F, G, H) and the following set of functional dependencies:

$$F = \{ A \rightarrow B, ABCD \rightarrow E, EF \rightarrow G, EF \rightarrow H, ACDF \rightarrow EG \}$$

Compute the canonical cover for F.

8M

- B) Convert the schema given in part A to the third normal form.

5M

5. Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic values.

$F = \{CH \rightarrow G, A \rightarrow BC, B \rightarrow CFH, E \rightarrow A, F \rightarrow EG\}$
 is a set of functional dependencies (FDs) so that F^+ is exactly the set of FDs that hold for R.
 What is the normal form of R, give proper justification of your answer?

5M

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM
Department of Computer Science and Engineering

END SEM EXAMINATION- NOVEMBER, 2023

COURSE TITLE: ICS213-DATABASE MANAGEMENT SYSTEMS

Date & Time: 20.11.2023 & 09:30AM -12:30PM

Max. Marks: 100

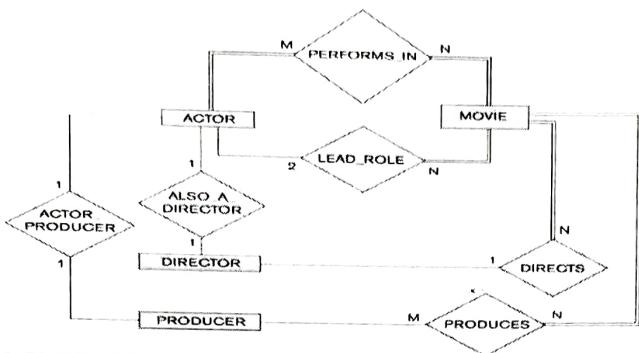
Course Instructor: Dr. Ghalib Mirza, Dr. Sivaiah Bellamkonda & Dr. Priyadarshini

Batch(s): 1,2 & 3

Answer all Questions

- 1 ✓ Map the following ER to relational schema:

10M



- 2 ✓ A) List and discuss various levels of data abstraction in DBMS.
 B) Discuss various users of DBMS.

6M

4M

- 3 ✓ Let r be a relation with attribute set R and s be a relation with attribute set S such that $S \subseteq R$.

5M

- A) Let $r(A, B, X, Y)$ and $s(X, Y)$ be the relations displayed below. Compute $r \div s$.

<i>r</i>			
<i>A</i>	<i>B</i>	<i>X</i>	<i>Y</i>
<i>a</i>	<i>b</i>	<i>w</i>	<i>x</i>
<i>c</i>	<i>d</i>	<i>y</i>	<i>z</i>
<i>a</i>	<i>b</i>	<i>y</i>	<i>z</i>
<i>e</i>	<i>f</i>	<i>w</i>	<i>x</i>
<i>c</i>	<i>d</i>	<i>w</i>	<i>t</i>

<i>s</i>	
<i>X</i>	<i>Y</i>
<i>y</i>	<i>z</i>
<i>w</i>	<i>x</i>

- B) Verify the following equation in the above table:

5M

$$r \div s = \Pi_{R-S}(r) - \Pi_{R-S}((\Pi_{R-S}(r) \times s) - \Pi_{R-S,S}(r))$$

4. An election database includes the following two tables:

Candidates (CandidateID, CandidateName)

Votes (CandidateID, PollingBoothID, NumberOfVotes)

The second table is updated booth by booth. Whenever counting is completed in a polling booth, an entry is added to the second table for each candidate who has got a nonzero number of votes, listing out the number of votes he got at that booth. For candidates who poll zero votes at a booth, no entry is recorded in Votes. We need to periodically compute the current status of all candidates by “joining” these two tables to create a table of the form

Status (CandidateID, CandidateName, TotalVotesTillNow)

- A) Explain why a natural join is not adequate for this purpose.
 B) What kind of join should we use to ensure that every candidate is included in the status table, including those who have yet to poll any votes across all booths?
 C) Write an SQL query to compute the Status table.
 D) Write a trigger solution to automatically update Status table whenever Votes table changes.

2M

2M

2M

4M

5) Consider a university database with relations

- student(sid, name)** — student ID and name for each student
- course(cid, title)** — course ID and title for each course
- passed(sid, cid)** — which courses each student has cleared already
- core(cid)** — IDs of core courses

Write relational algebra, TRC, DRC expressions and SQL to compute each of the following relations:

- A) IDs of students who have not yet cleared any course. 4M
- B) IDs of students who have not yet cleared all core courses. 4M
- C) IDs of core courses that are still pending for at least one student. 2M

6) A database of movies currently showing in the city has a table of the form **Playing (Title, Theatre, Location)**, where **Title** is the name of the movie, **Theatre** is the name of the cinema theatre and **Location** is the place where the theatre is located (a mall or multiplex).

We assume that no pair of movies currently running have the same title and no two cinema theatres have the same name. A cinema theatre may be showing different movies in different time slots, but no location has two cinema theatres showing the same movie.

- A) What functional dependencies can you infer from these constraints? 2M
- B) Compute a BCNF decomposition of the table Playing. 2M
- C) Explain whether your BCNF decomposition is dependency preserving. 2M
- D) Test if your decomposition using test for lossless join property algorithm. 4M

7. A) Let $R = ABCDE$, $R1 = AD$, $R2 = AB$, $R3 = BE$, $R4 = CDE$, and $R5 = AE$. Let the functional dependencies be: $A \rightarrow C$, $B \rightarrow C$, $C \rightarrow D$, $DE \rightarrow C$, $CE \rightarrow A$.
Apply test for lossless join property algorithm to test if the decomposition of R into $\{R1, \dots, R5\}$ is a lossless join decomposition.

B) Consider the following functional dependencies over the attributes (A, B, C, D, E) . 5M

$$\begin{aligned} A &\rightarrow BC \\ CD &\rightarrow E \\ B &\rightarrow D \\ E &\rightarrow A \end{aligned}$$

Compute the attribute closure x^+ for each attribute $x \in \{A, B, C, D, E\}$.

8) Consider the schedule S1 and S2 given below. Draw the precedence graph of S1 and S2 and state whether each schedule is serializable or not? If serializable, write the order. 10M

S1: $r1(X); r2(Z); r1(Z); r3(X); r3(Y); w1(X); w3(Y); r2(Y); w2(Z); w2(Y)$

S2: $r1(X); r2(X); r2(Z); r1(Z); r3(X); r3(Y); w1(X); w3(Y); r2(Y); w2(Z); w2(Y)$

9) Give your analysis on the following schedule:

T1	T2
Lock-X(A) <granted>	Lock-S(A)
Read(A)	
A:=A-50	
Write(A)	
Lock-X(B) <granted>	
Unlock(A)	<granted>
	Read(A)
	Lock-S(B)
Read(B)	
B:=B+50	
Write(B)	
Unlock(B)	
	<granted>
	Unlock(A)
	Read(B)
	Unlock(B)

- A) Specify rules for 2PL. Is the above schedule in 2PL? Explain reasons why YES/NO. 2M
 B) Specify rules for Strict 2PL. Is the above schedule in 2PL? Explain reasons why YES/NO. 2M
 C) What is the test for Serializability? Is above schedule serializable? Show reasons. 6M

10. Consider mark entry portal of IIIT Kottayam which maintains a table for **student_marks** with 10 columns (**Roll_No, Name, Sub1, Sub2, Sub3, Sub4, Sub5, Total, Perc, and Grade**) .

- A) Write SQL to create table and insert only Roll_No and Name of four students into **student_marks** table 2M
 B) Create a stored procedure on **student_marks** table in such a way that whenever faculty enters subject marks for those four students, **Total, Perc**, and **Grade** should get calculated and updated in the same table. The criterion for calculating **Total, Perc**, and **Grade** is as given below: 4M

Total = Sub1 + Sub2 + Sub3 + Sub4 + Sub5

Perc = (Total)/5

Grade:

```

IF Perc ≥ 90 → 'Excellent'
IF Perc ≥ 75 & Perc < 90 → 'Very good'
IF Perc ≥ 60 & Perc < 75 → 'Good'
IF Perc ≥ 40 & Perc < 60 → 'Average'
IF Perc < 40 → 'Not promoted'

```

- (C) There are multiple users that can connect to the mark entry portal. However, the privileges for accessing the **student_marks** table are not same for all the users. Creating and accessing privileges for different users are as given below: 4M

User	Privileges
Student	Read-only
Administration	Read-only
Faculty	Select student_marks table Update Sub1, Sub2, Sub3, Sub4, Sub5 columns in student_marks table Execute the stored procedure
Exam cell	Create, select, update Student_id, Name columns, delete a row, drop student_marks table Create, modify, execute, drop the stored procedure

Write the queries for creating the users and grant privileges accordingly.



Roll No:..... 2023BCS 0003

Name:.....

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

Department of Computer Science & Engineering

MID SEMESTER EXAMINATION- SEPTEMBER, 2024

COURSE TITLE: ICS 213 - DATABASE MANAGEMENT SYSTEMS

Time: 9.30 AM – 11.00 AM

Max. Marks: 50

Course Instructor: Dr. Selvi Chandran / Dr. Krishnendhu S. P. / Dr. Priyadarshini S

Batch: I, II, III

Answer all Questions

1. The **Motor Vehicle Branch** administers driving tests and issues driver's licenses. Any person who wants a driver's license must first take a learner's exam at any Motor Vehicle Branch in the province. If he/she fails the exam, he/she can take the exam again any time after a week of the failed exam date, at any branch. If he/she passes the exam, he/she is issued a license (type = learner's) with a unique license number. A learner's license may contain a single restriction on it. The person may take his/her driver's exam at any branch any time before the learner's license expiry date (which is usually set at six months after the license issue date). If he/she passes the exam, the branch issues him/her a driver's license. A driver's license must also record if the driver has completed driver's education, for insurance purposes.

A. Create an Entity Relationship (ER) diagram following these steps. **(10 marks)**

- Find out the entities in the specification
- Find out the relationships among the entities.
- Figure out attributes of the entities and (if any) of the relationships.
- Figure out mapping cardinalities/ constraints between entities and relationships.

B. Create a relational schema for the ER diagram created in 1.A. **(5 marks)**

2. Consider the following relations:

Department:

Dno	Dname	Location
1	Accounting	Chennai
2	Research	Howrah
3	Sales	Mumbai
4	Programming	Kolkata
5	Marketing	New Delhi

Employee:

Eno	Ename	Job_type	Hire_date	Dno	Commission	Salary
36	Sonu	Clerk	1981-12-01	4	0	1000
49	Poulastaa	Sales_man	1981-02-20	3	300	2000
52	Aritro	Sales_man	1981-02-22	3	500	1300
56	Rahul	Manager	1981-04-02	2	0	2300
65	Amit	Sales_man	1981-04-22	3	1400	1250
69	Ronit	Manager	1981-05-01	5	0	280
82	Sandip	Manager	1981-06-09	1	0	2900
83	Subhamoy	President	1981-11-01	1	0	2950
84	Anshu	Clerk	1983-01-12	2	0	1150
88	Swastik	Analyst	1982-12-09	2	0	2850
90	Wribhu	Clerk	1981-12-03	3	0	950

Table 2.1: Company Database

Write a SQL query and its output to the following questions based on table 2.1.

- A. Create an employee and department table where the Dno of the employee table references the Dno of the department table. Also, the attribute ‘commission’ takes a default value of null. (4 marks)
 - B. Display the employee name and salary of all the employees earning more than Rs. 2850. (2 marks)
 - C. Display the employee names and department numbers of all the employees in departments 1 and 3 in the alphabetical order of their names. (2 marks)
 - D. Display the name and Hire Date of every employee who was hired in 1981. (2 marks)
 - E. Display the number of managers without listing their names. (2 marks)
 - F. List the department, and details where at least two employees are working. (2 marks)
 - G. Increment the salaries of all Clerks by 2%. (2 marks)
 - H. List the employees who are working as Managers. (2 marks)
 - I. Differentiate delete, drop, and truncate. (2 marks)
3. Write a SQL query and Relational Algebra expression to the following questions based on table 2.1.
- A. Display Ename, Salary and Commission for all employees whose Commission Amount is greater than their Salary increased by 5%. (3 marks)
 - B. Display Ename, Job, Dno, and Dname for all the employees working at the Mumbai location. (3 marks)
 - C. Display the Ename, Dno, and Salary of any employee whose Dno and salary matches both the Dno and the salary of any employee who earns a commission. (3 marks)
 - D. Display the number of employees performing the same Job type. (3 marks)
 - E. List all information of the employee table along with Dname and Location of all the employees Working Under ‘ACCOUNTING’ & ‘RESEARCH’ in the ascending order of Dno. (3 marks)

ALL THE BEST



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY KOTTAYAM

Department of Computer Science & Engineering

END SEMESTER EXAMINATION - ODD 2024-'25

NOVEMBER 2024

COURSE TITLE: ICS 213 - DATABASE MANAGEMENT SYSTEMS

Date & Time: 16.11.2024 & 9.30 AM-12.30 PM

Max. Marks: 100

Course Instructor: Dr. Selvi C, Dr. Krishnendhu S P, Dr. Priyadarshini S

Batch: 2023 - I, II, III

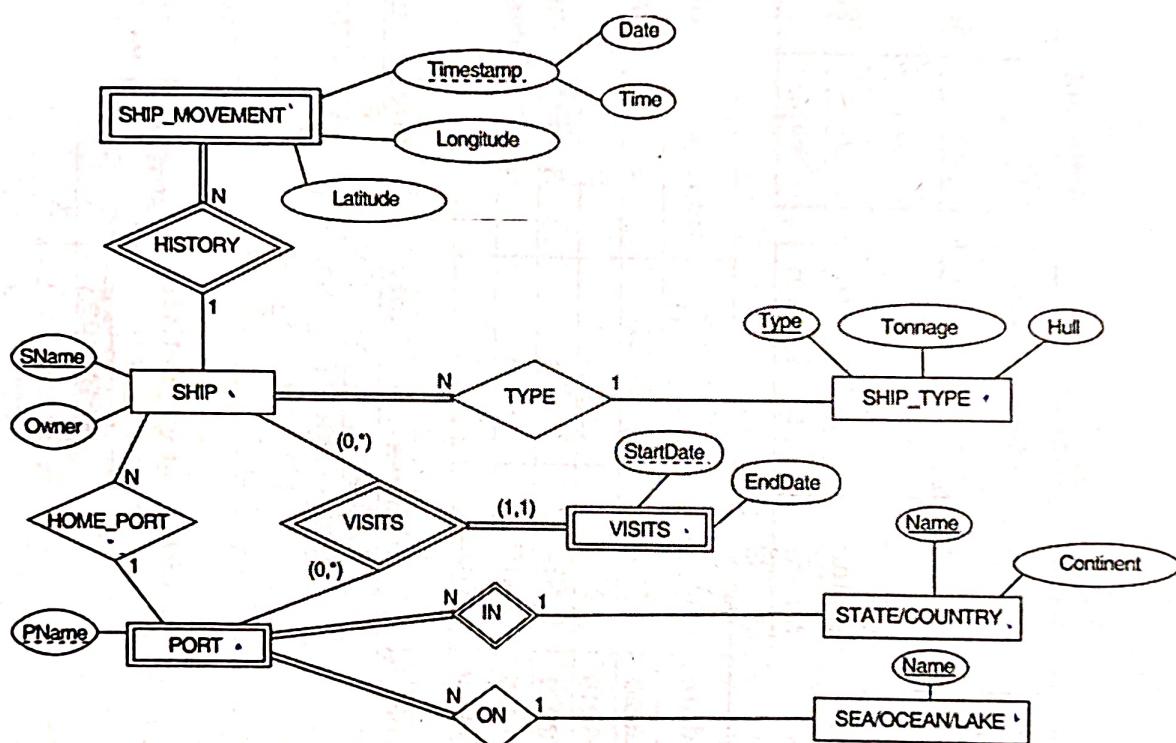
Answer All Questions

1.

- a. Explain the following terms and identify them in the given ER diagram:

- i. Entity
- ii. Relationship
- iii. Attributes

(3 Marks)



- b. Convert the above-given ER diagram into a relational database schema (Indicate primary keys and referential integrity constraints). (7 Marks)

2.

- a. Write SQL queries for the Bank Database:

- i. Using join, display the account ID, federal ID, and product name for each non-business customer. (3 marks)
- ii. Display the employee ID, first name, last name, and their department name and branch name to which the employee is assigned; without performing any join operation. (3 marks)

Bank Database

Branch

branch_id	b_name	address	city	state	zip
1	Main Branch	123 Main St	New York	NY	10001
2	West Branch	456 West End Ave	Los Angeles	CA	90001
3	East Branch	789 East Road	Boston	MA	2101
4	South Branch	101 South St	Miami	FL	33101

Employee

emp_id	fname	lname	start_date	end_date	superior_emp_id	dept_id	title	assigned_branch_id
1	John	Doe	15-01-2020	NULL	NULL	1	Manager	1
2	Jane	Smith	20-05-2019	NULL	1	2	Developer	1
3	Robert	Johnson	01-06-2021	NULL	1	3	Analyst	2
4	Emily	Davis	15-03-2018	NULL	1	4	Operations	3
5	Michael	Brown	10-08-2022	NULL	3	2	Developer	2

Customer

cust_id	fed_id	cust_type_id	address	city	state	postal_code
1	123-45-6789	I	111 Oak St	New York	NY	10002
2	987-65-4321	B	222 Pine Ave	Los Angeles	CA	90002
3	555-55-5555	I	333 Maple Dr	Boston	MA	2102
4	111-11-1111	B	444 Cedar Rd	Miami	FL	33102

Account

account_id	product_id	cust_id	open_date	close_date	last_activity_date	status	open_branch_id	open_emp_id	avail_balance	pending_balance
1	S001	1	01-01-2022	NULL	01-10-2023	ACTIVE	1	2	5000	0
2	C001	2	10-05-2021	NULL	10-08-2023	ACTIVE	2	3	10000	0
3	L001	3	15-07-2020	NULL	15-06-2023	CLOSED	3	4	0	0
4	M001	4	20-10-2021	NULL	20-07-2023	FROZEN	1	5	200000	5000

iii. Create a view named CustomerAccountSummary that shows the following information for each active account: the account ID, customer federal ID, customer type (individual or business), product name, account status, available balance, and pending balance. (4 marks)

iv. Assume there is a Transaction table with a column account_id that references Account(account_id). Write a trigger that automatically updates the last_activity_date in the Account table whenever a transaction is recorded on an account. The trigger should set last_activity_date to the current date each time a new row is inserted into the Transaction table. (5 marks)

b. Write a relational algebra expression to find the names of customers who have both a Savings Account and a Checking Account, and are associated with at least one branch in "New York" (for either account). Display the customer's federal ID, customer type, and the names of the two products they have. (5 marks)

c. Write a Domain and Tuple Relational Calculus expression for the scenario explained in question 2.b. (5 marks)

3.

a. Consider a relational schema A with attributes P, Q, R, S, T, U and functional dependencies are $P \rightarrow QR$, $Q \rightarrow T$, $RS \rightarrow TU$. Prove that functional dependency $PS \rightarrow U$ holds in Relation A. (2 Marks)

b. Find the minimal cover or irreducible set from the relation R (M, N, O, P) with the following functional dependencies $MN \rightarrow OP$, $NO \rightarrow P$. (8 Marks)

4.

a. Consider a relational schema A with attributes P, Q, R, S, T and functional dependencies are $PQ \rightarrow R$, $R \rightarrow S$, $Q \rightarrow TP$. Find out candidate key, super key, prime and non-prime attributes. (7 Marks)

b. Consider a relational schema R with attributes A, B, C, D, E, F and functional dependencies are $F = \{A \rightarrow B, C \rightarrow DE, AC \rightarrow F\}$. The relation R is decomposed into $R_1(BE)$ and $R_2(ACDEF)$. Find whether the decomposition is Lossless or Lossy? (3 Marks)

5. Consider a relational schema A with attributes P, Q, R, S, T, U and functional dependencies are $PQ \rightarrow R$, $PR \rightarrow Q$, $PS \rightarrow T$, $Q \rightarrow S$, $QR \rightarrow P$, $T \rightarrow V$. Decompose the relation R till BCNF. **(15 Marks)**

6. Check both conflict and view serializability for the given schedule

S: $R_1(x), R_2(x), W_2(x), W_3(x), W_1(x)$ **(15 Marks)**

7.

- a. For each of the given schedules S_1, S_2 , state which of the following properties hold:
conflict serializable, recoverable, cascadeless, or strict. **(5 Marks)**

S₁ $T_1: R(X), T_2: W(X), T_1: W(X), T_2: Commit, T_1: Commit$

S₂ $T_1: R(X), T_2: R(X), T_1: W(X), T_1: Commit, T_2: W(X), T_2: Commit$

- b. Consider the following two transactions:

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 transactions T_1 and T_2 , so that they observe the two-phase locking protocol. Show the execution of these transactions resulting in a deadlock. **(5 Marks)**

- c. The Timestamp of transaction T_1 is 20, T_2 is 30 and T_3 is 10. Using Basic Timestamp Ordering Protocol (BTSP) check the above timestamp order of transaction execute the below schedule S. **(5 Marks)**

S: $R_3(Y), R_3(Z), R_1(X), W_1(X), W_3(Y), W_3(Z), R_2(Z), R_1(Y), W_1(Y), R_2(Y), W_2(Y), R_2(X), W_2(X)$.

ALL THE BEST
