VIT-AP UNIVERSITY	Final Assessment Test – Winter 2023-24 Semester - May 2024	
	Max Marks: 100	Duration: 3 Hours
Course Code: CSE2007	Course Title: Database Management Systems	
Question Paper ID: 009821	Exam Type: CLOSED BOOK	School: SCOPE
Date: 09/05/2024	Slot: A1+TA1	Session: FN

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General Instructions if any:

1. "*fx* series" - non Programmable calculator is permitted: No
2. Reference tables permitted: No

Section - 1: Answer any 10 questions. (10 × 10 = 100 Marks)

		Marks	CO	BL
Q1.	You have a database company. Your current project is to design a database for art galleries for capturing all the information galleries need to maintain. 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. Artwork is also classified into groups of various kinds. A given art piece may belong to more than one group. Each group is identified by a name that describes it. Galleries keep information about customers. For each customer, galleries keep that person's unique name, address, and total amount of rupees spent buying the art from the gallery. Draw the ER diagram for the art gallery database.	10	1	4
Q2.	Suppose you are designing a database for a library management system. Details about the books and library members are maintained by the library. Members can issue books. They have to return the books on time. Explain the different integrity constraints required with examples in the context of the library management system. Write down the roles of database administrator in the above database.	10	1	4
Q3.	Convert the ER diagram to a relational model.	10	2	3
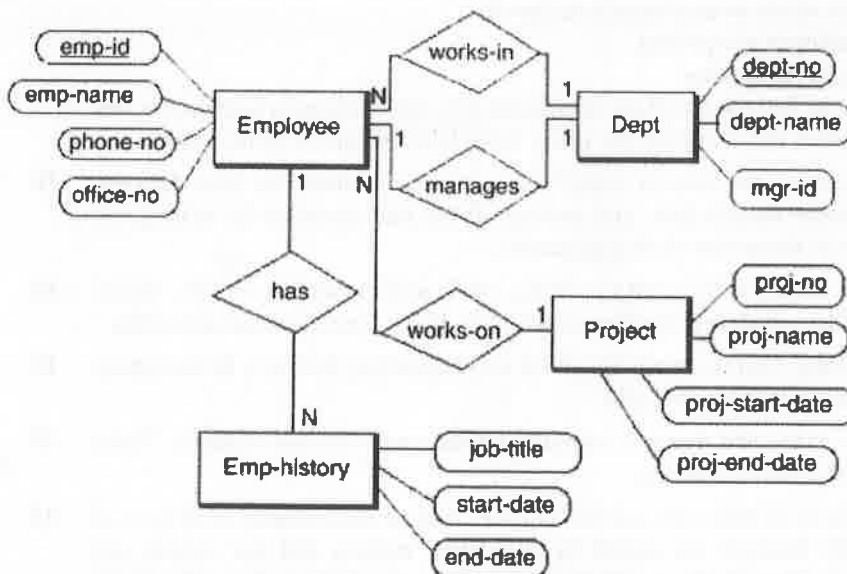
Q4.	Consider the following relational database schema consisting of the four relation schemas: passenger (passanger_id, name, gender, city) agency (agencyid, agency_name, agency_city, agency_state) flight (flight_id, fdate, time, source, destination) booking (passanger_id, agency_id, flight_id, fdate) Answer the following questions using relational algebra queries. a) Find the details of all female passengers who are associated with agency named MakeMyTrip. b) Find the agency names who do not have any bookings for passenger with id 768. c) Find the agency names that located in the same city as passenger with name Rahul. d) Find the passenger names for those who do not have any bookings in any flights.	10	2	4
Q5.	Consider a relation Student (StudentID, ModuleID, ModuleName, StudentName, StudentAddress, TutorId, TutorName) with the following functional dependency. StudentID → StudentName, StudentAddress, TutorId, TutorName ModuleID → ModuleName TutorID → TutorName Normalize the above table upto 3rd Normal Form.	10	3	4
Q6.	What are the properties for a decomposition to be lossless and dependency preserving? Let R = {ssn, ename, pnumber, pname, plocation, hours} and R is decomposed into three relations R1, R2, and R3 as follows; R1 = EMP = {ssn, ename} R2 = PROJ = {pnumber, pname, plocation} R3 = WORKS_ON = {ssn, pnumber, hours} Assume that the following functional dependencies are holding on relation R. ssn → ename pnumber → {pname, plocation} {ssn, pnumber} → hours. Find whether the decomposition into R1, R2, and R3 is lossless join decomposition or not.	10	3	4
Q7.	Given the following relations Employee(Eno, Ename, Contact) Proj_Assigned(Eno, Project_No, Designation, PDuration) Where, Eno is Employee number, Ename is Employee name, Project_No is Project Number in which an employee is assigned, Designation is the role of an employee in a project, PDuration is duration of the project in months. Write a relational algebra query to find the list of all employees who are working in a project as the manager which is more than 2 years old. Optimize the query using heuristic query optimization.	10	4	4
Q8.	What are the different join operation we have in SQL. Take a sample database for food delivery system. Write the tables with some sample data and explain all the join operation by writing the appropriate SQL query. Also write the output of all join queries.	10	4	2
Q9.	For the following schedule S: r2(Y), w2(Y), r3(Y), r1(X), r4(X),w1(X), w4(Y), w3(Y), r2(X), r1(Y), w1(Y), w4(X) Check if the schedule is conflict serializable. If yes Find the serial schedules.	10	5	4
Q10.	What is the use of 2-Phase locking. Can we avoid Deadlock and Cascading Rollback In two phase locking. Give your answer by using suitable example.	10	5	1
Q11.	What is the difference between static and dynamic hashing. Explain with suitable example. Write down the properties of static and dynamic hashing.	10	6	1
Q12.	Suppose we have a database file of 45,000 rows and 10 columns. Size of each column is 20 byte. If the disk block size is 1.25KB. Records are stored in unsapnned manner and the records are unsorted. Secondary indexing is done on the search field which has all unique values. The block pointer is 10 byte. What would be the number of disk accesses to do a successful lookup for a record	10	6	3

End of Question Paper

Final Assessment Test – Winter 2023-24 Semester - May 2024	
Max Marks: **100**	Duration: **3 Hours**

Course Code: **CSE2007**	Course Title: **Database Management Systems**	
Question Paper ID: **009709**	Exam Type: **CLOSED BOOK**	School: **SCOPE**
Date: **10/05/2024**	Slot: **A2+TA2**	Session: **FN**

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General Instructions if any:

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2. Reference tables permitted: No

	Section - 1: Answer any 10 questions. (10 × 10 = 100 Marks)	Marks	CO	BL
Q1.	Consider a system for an online marketplace where users can buy and sell handmade crafts. How does three schema architecture facilitate Data Independence in the database system? Provide concrete examples from both the business and technical perspectives to illustrate your answer.	10	1	2
Q2.	Major airline companies that provide passenger services in Singapore are UniAir, TransAsia Airways, Far Eastern Transport, Great China Airlines, etc. Singapore Federal Flight Administration (SFFA) keeps a database with lots of information on all airlines. The information consists of: Each airplane has an identification number, name of the contact person, and telephone number. For each aircraft identification number, capacity and model are recorded. Each employee has an employee identification number, name, address, birthday, sex, position with the company and qualification. Each route has a route identification number, origin, destination, classification (into domestic or international route), distance of the route and price charged per passenger. Each airline keeps the information about their buy/sell transactions (for example, selling an airplane ticket is a sell transaction, and paying for maintenance is a buy transaction). Each transaction has a transaction identification number, date, description, and amount of money paid/received. Design a suitable ER diagram for the above scenario with all possible entities, attributes and the corresponding relationship with its participations.	10	2	2

Q3.	Considering the following Library Relational schema. Write the queries in relational algebra format.
	    Book(<u>Book_id</u>, title, publisher)
	    Book_Authors(<u>Book_id</u>, author_name)
	    Book_loans(<u>Book_id, Card_no</u>, Date_out, Due_date)
	    Borrower(<u>Card_no</u>, Name, address)
		10	2	4

a. Find the books written by 'Ramakrishnan' or published by 'Tata Mcgraw hill'.
b. List the titles of the books borrowed by members whose names start with the letter 'A'.
c. Find the books published by 'pearson education' which are taken by a person named 'John'.
d. Find the members who have taken more than three books.
e. Find the card numbers for which the members have taken all the books of 'Wiley' Publications.

Q4. Map the following ER diagram to a relational model. Identify the relationship and map the   **10**   **2**   **2**
cardinality. Represent primary key and foreign key in the schema.
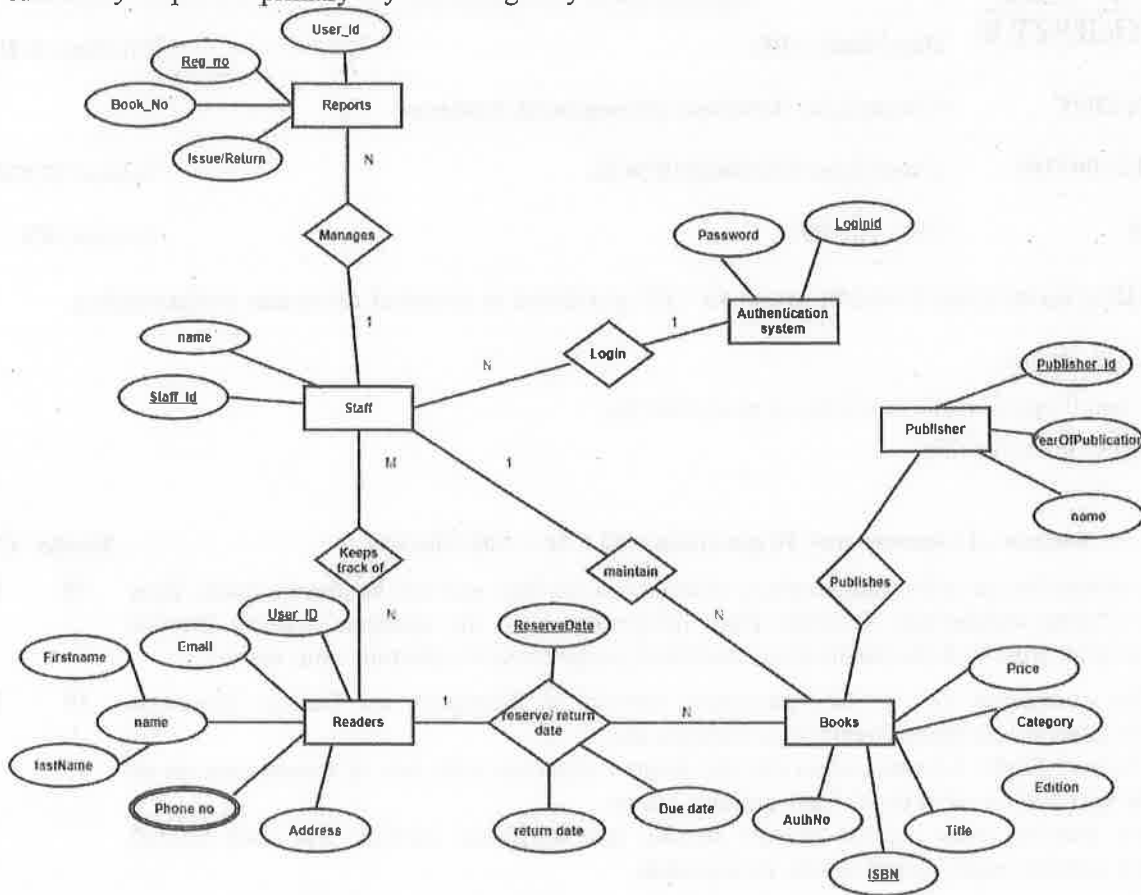
Q5. A relation R has attributes A, B, C, D, E, and satisfies the following FDs: **10**   **3**   **3**
A ->BC
B ->D
CD -> E
E ->A
a) Show that (A, B, C) and (A, D, E) are a lossless decomposition of R.
b) Show that (A, B, C) and (C, D, E) are not a lossless decomposition of R.

Q6. A) A relation schema R = (A, B, C, D, E) and for the following set of functional dependencies: **10**   **3**   **3**
       F = {A → BC, B → C, A → B, AB → C }.
       Compute the minimal cover for F.

B) Consider the following relation scheme R (A, B, C, D, E, F, G, H, I, J}
together with the following functional dependencies:
{F-> H, E),
{{C, G, A} -> {B, D, J}},
{{B}->{A, I}},
{B, G} ->{C}.
Use Armstrong's axioms to prove formally that this set of functional dependencies implies that {B, G} -> {D}.

Q7. Draw the initial query tree for the following query and show the steps to optimize the query.   **10**   **4**   **3**
       SELECT P.PNO, P.DUM, E.LNAME, E.ADDRESS, E.DOB FROM PROJECT P,
DEPARTMENT D, EMPLOYEE E WHERE P.DUM=D.DNO AND D.MGRSSN=E.SSN AND
P.LOCATION='HYDERABAD'.

Q8. Consider the relational database, where the primary keys are underlined. Give an expression in SQL   **10**   **4**   **4**
for each of the following queries:
Employee (employee_id, name, department_id, salary)
Department (department_id, name, location)
Project (project_id, name, department_id)
Works_on (employee_id, project_id, hours)

a) Display the project IDs and names for all projects
b) Find the names of employees who work on more than one project.
c) Calculate the total salary expenditure for each department.
d) Display the names of employees along with the names of departments and their locations.
e) Find the names of employees who work on projects in the 'Marketing' department located in 'New York'.

Q9. Determine whether the given schedule   **10**   **5**   **2**
$$S = r1(X) \ w2(Y) \ w1(X) \ r3(Y) \ r2(X) \ r4(Z) \ w4(Z)$$
Satisfies the requirements of the Two-Phase Locking (2PL) protocol. Describe the
lock acquisition and release sequence in this schedule with 2PL.

Q10. A) Draw the Serializable graphs for the schedule S1 and state whether each schedule is conflict   **10**   **5**   **3**
serializable or not. If a schedule is conflict serializable,
write down the order in which the transaction can be executed.
S1:r1(X);r2(Z);r1(Z);r3(X);r3(Y);w1(X);w3(Y);r2(Y);w2(Z);w2(Y)

B) Elaborate on recovery techniques (deferred and immediate) for single and multi-user
transactions.

Q11. An ordered file of 1,00,000 records is stored in a disk with block size 2048 bytes. File records are   **10**   **6**   **3**
fixed and are un-spanned with record length 256 bytes. Suppose the index file has key field of 10
bytes and pointer of 6 bytes, Compare the performance of accessing data file directly and by
primary index.

Q12. Define dynamic hashing? Explain how dynamic hashing dynamically adjusts hash table size to   **10**   **6**   **2**
accommodate data growth.

End of Question Paper

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Section - 1: Answer any 10 questions. (10 × 10 = 100 Marks)

		Marks	CO	BL

Q1. 1. You are tasked with designing a database for a library system. The library system has the following requirements: — **10 2 2**

- The library contains multiple books, each identified by a unique ISBN, title, author(s), and publication year.
- Each book belongs to a specific category (e.g., Fiction, Non-fiction, Science, History).
- Library members can borrow books. Each member has a unique ID, name, address, and contact number.
- Books can be borrowed by multiple members, and each member can borrow multiple books.
- The library keeps track of the borrowing history, including the date a book was borrowed and the date it was returned.

Design an Entity-Relationship (ER) diagram for the library system based on the provided requirements. Include all necessary entities, attributes, relationships, and cardinalities.

Q2. Describe the components of the Three Schema Architecture and explain how they facilitate data independence in a database system. — **10 1 2**

Q3. Convert the given ER diagram into Relational Mapping — **10 2 4**
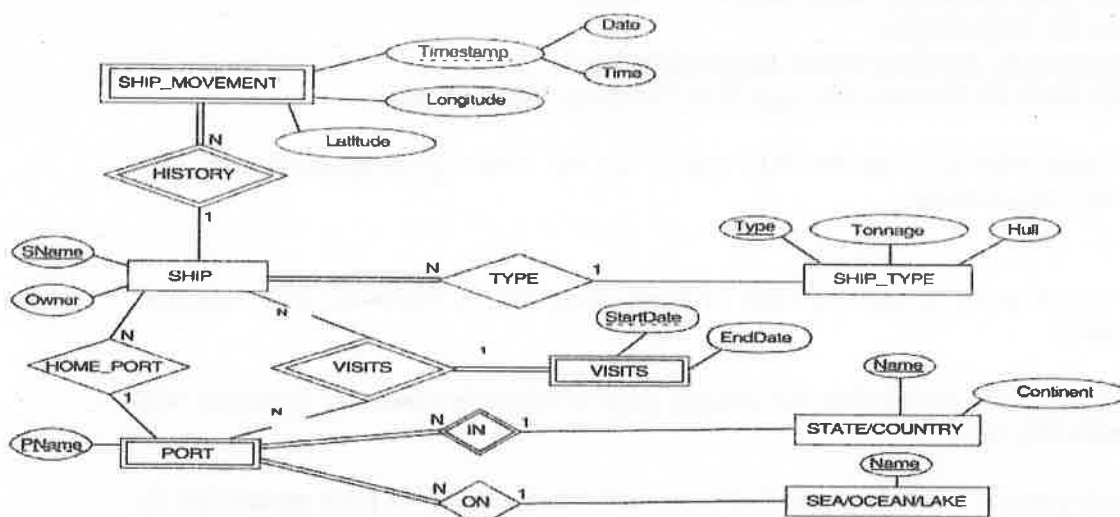
Q4. Consider the following relational schema representing a university database system: 10   2   2

Student (student_id, name, major, GPA)
Course (course_id, title, department, credits)
Enrollment (student_id, course_id, semester, grade)

Perform the following queries using tuple relational calculus:

a) Retrieve the names of students who have not enrolled in any courses during the 'Spring 2024' semester.
b) Find the names of students who have never earned a grade below 'B' in any course they have taken.
c) Retrieve the titles of courses that have been taken by students majoring in 'Computer Science' with a GPA less than 3.0.
d) Find the names of students who have taken courses from at least two different departments.

Q5. a) Identify the highest normal form for the given relation below :   10   3   3

$R = (P, Q, R, S, T)$
$FD = (P \rightarrow QRST, QR \rightarrow PRT, S \rightarrow T)$

b) For the given relation and functional dependencies find all the candidate keys and prime attributes.

$R = (M, N, O, P)$
$FD = (M \rightarrow N, N \rightarrow O, O \rightarrow M)$

Q6. a) Find the Equivalence of functional dependencies sets given below   10   3   3
R(A,B,C,D)
$FD1 = (A \rightarrow B, B \rightarrow C, A \rightarrow C)$
$FD2 = (A \rightarrow B, B \rightarrow C, A \rightarrow D)$

b) Check whether the below given relation is in 3NF? If not explain the reason for not being in 3NF.
$R (G, H, I, J, K, L)$
$FD = (GH \rightarrow IJKL, HJ \rightarrow L)$

Q7. Consider the following relational schema representing a database for a library management system.   10   4   2

Books (Book ID, Title, Author ID, Genre, Price)
Authors (Author ID, Author Name)
Borrowers (Borrower ID, Borrower Name, Membership Type)
Loans (Loan ID, Book ID, Borrower ID, Loan Date, Due Date, Returned Date)

Using the provided schema, write the SQL queries for the below given questions with each involving at least one sub query:

a)   Write a sub query to find the titles of books borrowed by borrowers with 'Premium' membership type.

b)   Write a sub query to calculate the average price of books borrowed by borrowers with 'Premium' membership type.

c)   write a sub query to count the number of loans made for books with a price greater than the average price of all books.

c)   Write a sub query to list the names of authors who have written books with a price higher than the average price of all books.

Q8. Consider the following relational schema representing a database for a vehicle management system: **10**   **4**   **2**

Vehicles (VehicleID, Model, ManufacturerID, Year, Price)
Manufacturers (ManufacturerID, ManufacturerName, Country)
Orders (OrderID, CustomerID, VehicleID, OrderDate, Quantity)

a)   Write the SQL query and its corresponding relational algebra to draw a query tree for the following query:
How many vehicles of each model were ordered in 2023, along with their manufacturers and manufacturing years?

b)   Apply heuristic query optimization techniques to find the optimal query tree.

Q9. How does concurrency control in database systems address the challenges posed by issues such as lost updates, temporary updates, incorrect summaries, and unrepeatable reads, ensuring data consistency and integrity in multi-user environments? Explain the issues with examples.   **10**   **5**   **2**

Q10. a) Check whether the given schedule S is conflict serializable or not. Using the precedence graph find the execution order of different transaction.   **10**   **5**   **2**

T1	T2	T3	T4
			R(A)
	R(A)		
		R(A)	
W(B)			
	W(A)		
		R(B)	
	W(B)		

b) Differentiate between Deferred update and immediate update with suitable examples.

Q11. Consider that the data-file has 850000 records of employees. The employee-records are ordered based on non-key field dept_no (i.e., department number) and size of that field is 6 bytes. Each of the employee records has size of 120 bytes. Consider none of the records are allowed to cross block boundaries. Consider clustering index structure for the data file has been created to speed up the retrieval of the records where indexing field is based on the dept_no and a block pointer which is 6 bytes long. Assume the Block size is 10 Kilobytes. Consider, there are 50 employees working in each of the department. How many block accesses will be needed to access a record from the data file by searching the clustering index?   **10**   **6**   **4**

Q12.   **10**   **6**   **2**

Discuss the concept of internal hashing in a database management system (DBMS). Explain the structure and functionality of internal hashing. Illustrate with examples how internal hashing enhances the efficiency of data retrieval and storage management within a DBMS

End of Question Paper

VIT-AP UNIVERSITY

Final Assessment Test – Winter 2023-24 Semester - May 2024	
Max Marks: **100**	Duration: **3 Hours**

Course Code: **CSE2007**	Course Title: **Database Management Systems**	
Question Paper ID: **009725**	Exam Type: **CLOSED BOOK**	School: **SCOPE**
Date: **12/05/2024**	Slot: **B2+TB2**	Session: **FN**

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General Instructions if any:

1. "*fx* series" - non Programmable calculator is permitted: No
2. Reference tables permitted: No

Note: Assume data wherever necessary. Any assumptions made should be clearly stated.

Section - 1: Answer any 10 questions. (10 × 10 = 100 Marks)

		Marks	CO	BL
Q1.	Consider the following case study and draw an ER diagram step by step. Represent participation type of each entity in the relation, constraints, and the cardinality of each relation.	10	2	4

An **online retail store** can use a relational database to manage product inventory, customer data, and orders. The 'Products' table would contain information about each product like id, name, price, number of items available in the store, and category id of the product. In each category, there are many products available. The 'Customers' table would store customer information, and the 'Orders' table maintain information about the customer, date of order, and total cost of order. The details of each order is maintained in 'OrderItem' table. This setup allows the store to maintain accurate records of customer transactions and inventory.

		Marks	CO	BL
Q2.	Explain DBMS component modules and their interactions with a suitable diagram.	10	1	1

Q3. Convert the following ER diagram into a relational data model included with constraints.   10   2   3
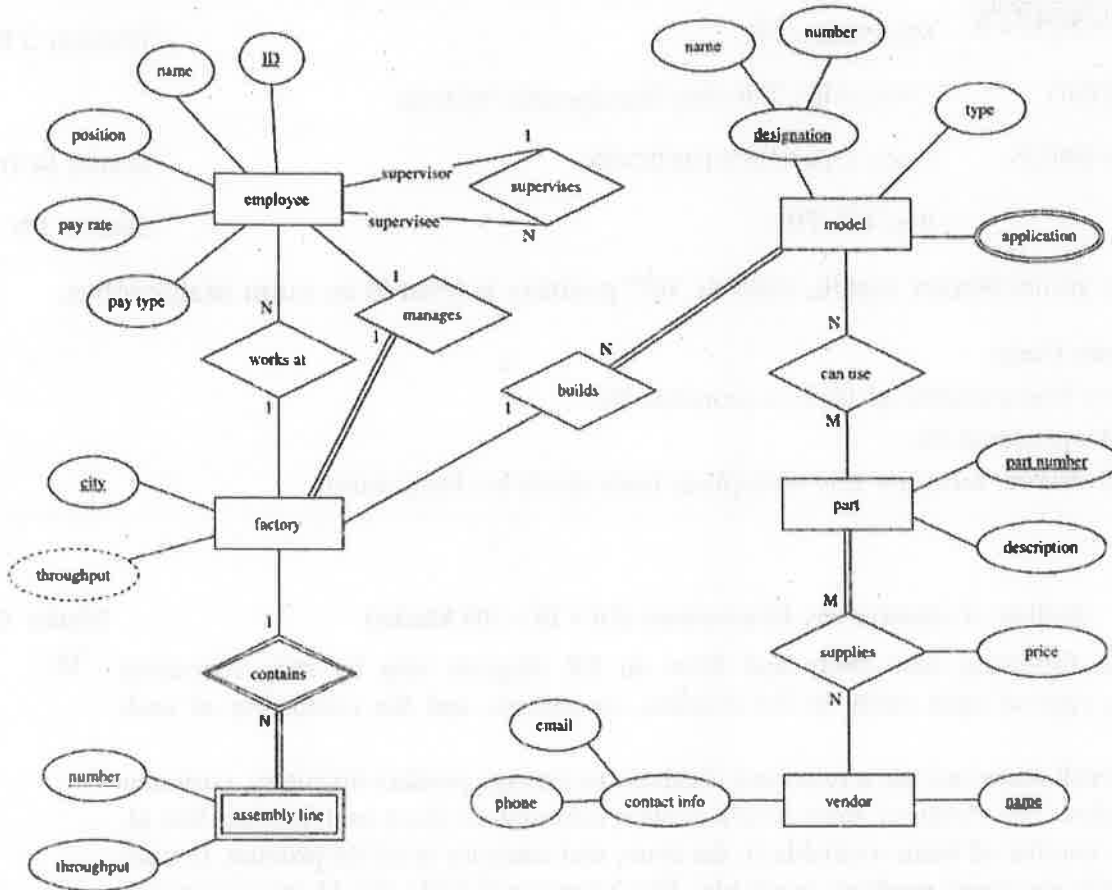
Q4. Consider the following GRADEBOOK relational schema describing the data for a grade   10   2   4 book of a particular instructor. The attributes A, B, C, and D of COURSES store grade cut-offs.

CATALOG(Cno, Ctitle)
STUDENTS(Sid, Fname, Lname, Minit)
COURSES(Term, Sec_no, Cno, A, B, C, D)
ENROLLS(Sid, Term, Sec_no)

Specify the following queries in Relational Algebra on the GRADEBOOK database schema.
a. Retrieve the names of students enrolled in the Automata class during the fall 2009 term and Python class during the Winter 2010 using set operations.
b. Retrieve the Sid values of students who have enrolled in CSE2006 and CSE2007.
c. Retrieve the names of students who have not enrolled in any class.
d. Retrieve the names of students who have enrolled in all courses in the CATALOG table.

Q5. a. Consider the relation scheme R = {E, F, G, H, I, J, K, L, M, N} and the set of functional   10   3   3 dependencies
F = {EF -> G, F -> IJ, EH -> KL, K -> M, L -> N} on R. List all candidate keys of R?

b. Find the canonical cover of the following set of functional dependencies. F= { A -> BC, B -> C, A -> B,AB -> C }

Q6.   a. Consider the relational schema R=(A,B,C,D,E) with its set of functional dependencies F $= \{A \rightarrow BC, C \rightarrow DE\}$. Decompose the relation R up to BCNF.

     b. Find the highest normal form of a given relation R(A,B,C,D,E) with the following set of functional dependencies:

     F = {A->D, B->A, BC->D, AC->BE}

                                                10   3   3

Q7.   Consider the following database schema: 10   4   3

     Depositer(customer_id,customer_name,customer_age)
     Branch(branch_id,branch_name,branch_city)
     Account(account_number,customer_id,branch_id)

     a. Write an SQL Query and equivalent relational algebra expression to find all customer names who have account in either Vijayawada city or Hyderabad city.

     b. Construct a Heuristic optimized query tree for the relational algebra expression found in (a). Delineate the process step by step.

Q8.   Consider the following schema and answer the queries in SQL: 10   4   4

     Resort(resortNo, resortName, resortType, resortAddress, resortCity, numSuite)
     Suite(suiteNo, resortNo, suitePrice)
     Reservation(reservationNo, resortNo, visitorNo, checkIn, checkout, totalVisitor, suiteNo)
     Visitor(visitorNo, firstName, lastName, visitorAddress)

     a. List all details of all resorts in Mumbai which have number of suits greater than 30 and suite price between 1.5 Lakh to 2.0 Lakh.

     b. List all first names of all visitors who have booked suites and their cost is above 3 Lakh.

     c. Display all visitor's first names in the descending order of reservations whose reservations crossed certain threshold value given by user.

     d. Identify all visitors who reserved all resorts of 'Mumbai' city.

Q9.   Explain how serializabilty ensured by Two Phase Locking protocol? How the variants of Two Phase Locking protocol alleviates drawbacks of Basic 2PL with examples?   10   5   1

Q10. Explain Deferred update recovery protocol. From the following diagram, identify which   10   5   2
transactions are ignored, which transactions are redone and which (if any) are undone.
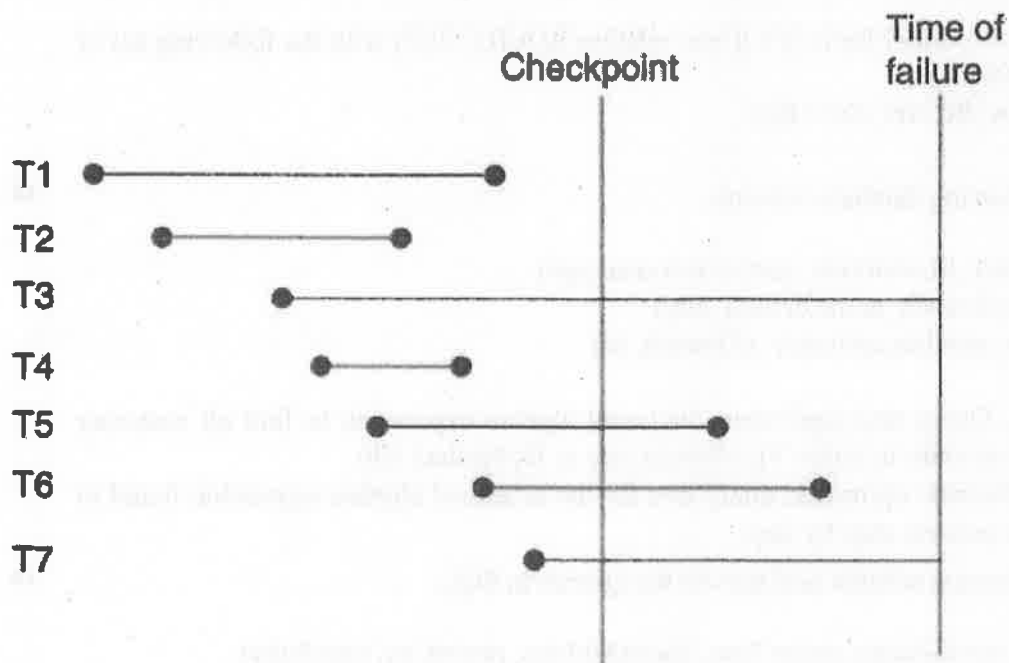
Q11. Define Indexing and What are the advantages of indexing in DBMS? How does multilevel   10   6   2
indexing improve the efficiency of searching an index file?

Q12. Explain Internal hashing technique and its' collision resolution approaches.   10   6   1

End of Question Paper

Max Marks: **100**	Duration: **3 Hours**

Course Code: **CSE2007**	Course Title: **Database Management Systems**	
Question Paper ID: **009895**	Exam Type: **CLOSED BOOK**	School: **SCOPE**
Date: **14/05/2024**	Slot: **C1+TC1**	Session: **AN**

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General Instructions if any:
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2. Reference tables permitted: No

<div align="center">Section - 1: Answer any 10 questions. (10 × 10 = 100 Marks)</div>

		Marks	CO	BL
Q1.	A) Name any five types of Database users and explain their interaction with the Database.	10	1	1
	B) Why Database is called self-describing? Explain the structure of the database catalog.			
Q2.	Draw the E-R Diagram for the below scenario (E-R diagram should have entity, attribute, and Relation, with cardinality). Write primary keys, foreign keys, and all other database constraints. Name, Release_year, Language, Age_group, Producer, Director and Duration can identify a movie. Actors can be identified by Name, Date of Birth, Address and work language. Movie_Theater can be identified by theatre Name, Established year, Address, Owner and ticket price. An actor will act in different movies with some characters and get remuneration. Movies will be released in some theatres and will be shown on multiple shows.	10	1	4
Q3.	Consider the given Database schema for answering the queries using relational algebra. Relational schema: Student(Sid, name, address, dob, gender, phone, email) Course(Cid, C_type, name, credit, offered_by, syllabus_by) Teacher(Tid, name, gender, phone, email, Dept) Registration(Sid, Cid, semester, slot, venue) Teach(Tid, Cid, semester, slot, venue) Pre_Anty_Requisite(Cid, Pre_Cid, Anty_Cid) Queries: a) Find the students, who have registered less than 8 credits in the Programcore Course type in win23-24. b) List the teacher who is teaching a course not offered by his department. c) Find the course details, which are offered by the ECE department but the syllabus made by CSE faculty. d) List the courses having prerequisites and anty-requisites.	10	2	2
Q4.	a) How intersection can be implemented using other relational operations. Explain with an example. b) Differentiate between Natural join, Full Outer Join and Equi Join. Explain with examples.	10	2	1
Q5.	A) Here is the FD set S={C→(B E); D →(A F); B →(A C); E →F}. Find all candidate keys using attribute closer and Find any 5 super keys. B) A relational schema R (A, B, C, D, E) have FD set P = {A → B, AB → C, D → AEC} and Q = {A → BC, D → AE}. Find out the FD equivalence between P and Q.	10	3	4
Q6.	The relation X(P, Q, R, S) have FD set A={P→(Q, S); Q→R; P→R}; a) Find the minimal cover of A. b) Find the current Normal form of X(before minimal cover), and normalise X up to 3NF.	10	3	4

Q7.	Consider the relational schema given below to answer the Queries using SQL. Employee(Eno, Name, Email, Office-location, Gender) Customer(Cno, name, email, address, phone, age) Product(Code, Name, Type, Size, Price, Vendor) Orders(OrderNo, Cno, Eno, Code, Type, Quantity, TotalPrice, OrderDate, Status) Payment(ReferenceNO, OrderNo, PayMethod, PaidAmount, DueAmount, PaymentDate) Queries: a) Find the customer names who made the order and it is handled by an employee from the same location. b) List the vendor-wise product name with type and price. c) List the customers, who made an order and paid the full amount. d) Find the product name with the code, which has been sold least quantity till date.	10	4	4
Q8.	Consider the relational schema given below and find the optimal query tree for the given query. Employee(Eno, Name, Email, Office-location, Gender) Customer(Cno, Name, email, address, phone, age) Product(Code, Name, Type, Size, Price, Vendor) Orders(OrderNo, Cno, Code, Type, Quantity, TotalPrice, OrderDate, Status) Payment(ReferenceNO, OrderNo, PayMethod, PaidAmount, DueAmount, PaymentDate) Query: SELECT C.Name FROM Customer C, Orders O, Payment P WHERE C.CNo = O.CNo and P.OrderNo= O.OrderNo and P.PaidAmount < P.DueAmount and O.OrderDate = P.PaymentDate and O.status= 'transite';	10	4	3

Q9. We have Transactions
$T_1(R(X); W(X); R(Y); W(Y))$,
$T_2(R(Z); W(Z); R(X))$ and
$T_3(R(Y); R(Z); R(X); W(Y); W(X))$.
If database system executes them as Schedule S= { $R_1(X)$, $R_2(Z)$, $W_2(Z)$, $W_1(X)$, $R_1(Y)$, $R_2(X)$, $R_3(Y)$, $R_3(Z)$, $R_3(X)$, $W_3(Y)$, $W_3(X)$, $W_1(Y)$}.

a) List all the problems (Dirty read, lost update, unrepeatable read, incorrect summary) may occur in S. Explain.
b) Find the Schedule S is conflict Serializable or not using a precedence graph.   10   5   3

Q10. Explain the shadow Paging database recovery system with a proper diagram.   10   5   2

Q11. Explain the Secondary Indexing method and Cluster Indexing method with a relevant diagram.   10   6   1

Q12. Relation Student has 4500 records with a record length 55 byte, block size is 2048 byte.   10   6   3
   A) How many blocks are required to store the relation?
   B) How many blocks are required to store the index table using primary indexing and how many block access are required to search any record? Where the index field size is 6 byte and the pointer size is 5 byte.

End of Question Paper

Course Code: **CSE2007**	Course Title: **Database Management Systems**	
Question Paper ID: **009724**	Exam Type: **CLOSED BOOK**	School: **SCOPE**
Date: **15/05/2024**	Slot: **C2+TC2**	Session: **FN**

Keeping mobile phone/smart watch, even in 'off' position is treated as exam malpractice.

General Instructions if any:

1. "*fx* series" - non Programmable calculator is permitted: No
2. Reference tables permitted: No

Section - 1: Answer any 10 questions. (10 × 10 = 100 Marks)	Marks	CO	BL

Q1. Describe the main components of a database management system (DBMS). Explain the function of each component and how they interact with each other. — **10 1 2**

Q2. Design an ER diagram for a hotel reservation system. Include entities such as guests(Guest_ID , Name, Address, Phone, Email), rooms (Room_Number, Type, Price, Capacity, Status), reservations(Room_Number, Check_in_date, Check_out_date, Total_Price), and payments(Amount, Payment_Date). Additionally, include a weak entity for room services ordered by guests. Specify attributes for each entity, and include details for the weak entity. find all relationships between the entities. — **10 2 3**

Q3. Convert the following ER diagram into a relation schema — **10 2 3**
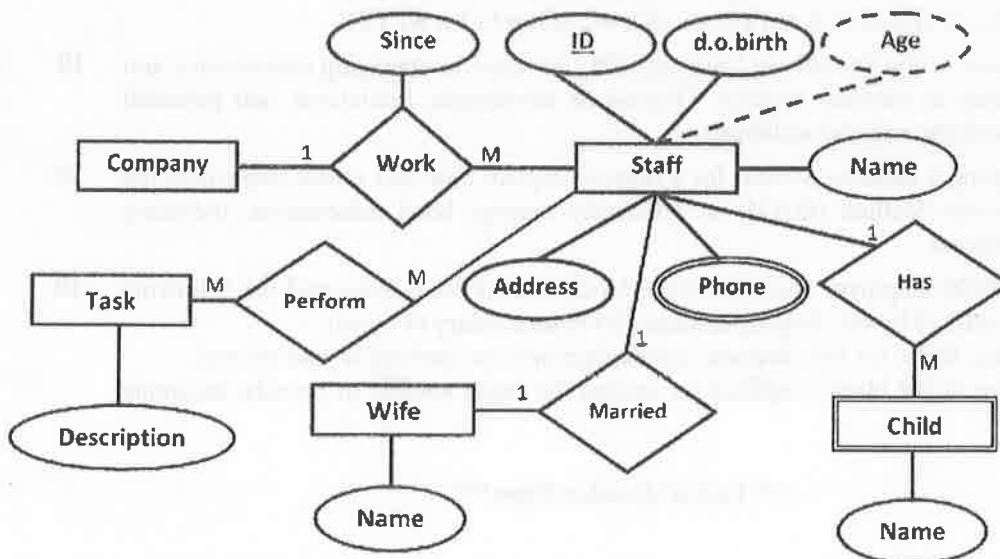
Q4. Consider the following schema — **10 2 4**
Student(sid, sname, age)
Course(cid, cname, credits)
Enrollment(sid, cid, grade)
a) Write a relational calculus expression to find the names of students who have enrolled in the course "Database Systems".
b) Write a relational calculus expression to find the names of students who are older than 20 and have taken more than 4 courses.
c) Find the names of students who have enrolled in a course worth more than 3 credits.
d) Find the names of students who have taken all courses with a grade of 'A'.

Q5. Consider a relation R(A, B, C, D, E) with functional dependencies {A → B, B → C, CD → E}. Determine if R is in BCNF and if not, decompose it into BCNF. Discuss the concept of dependency preservation. — **10 3 3**

Q6. Consider a relation R(A, B, C, D, E, F) with functional dependencies {A → B, B → C, C → D, D → E, E → F}.   **10   3   1**
a) Determine if the set of functional dependencies is equivalent to {AB → C, BC → D, CD → E, DE → F}.
b) Find a minimal cover for the given set {A → B, B → C, C → D, D → E, E → F} for the above relation.

Q7. Consider the following SQL query to retrieve all applicants who intend to enroll in the Software   **10   3   1**
Engineering degree program, reside in Vijayawada, and attend a college with a rank of 25 or lower.
The Relations are as follows:
Applicants (Id, name, city, Cid)
College (Cid, Cname, rank)
Programme (Id, major)
SELECT A.NAME FROM APPLICANTS A, COLLEGE C, PROGRAMME P WHERE A.CID = C.CID AND A.ID = P.ID AND A.CITY = 'Vellore' AND C.RANK < 25 AND P.MAJOR = 'Software Engineering';
Find the efficient execution plan for the above query and draw the optimized query tree.

Q8. Summarize the fundamentals of cost-based optimization in SQL query processing. Correlate the   **10   4   5**
cost-based optimization process, including how it works and the parameters taken into account when producing query execution plans.

Q9. Consider the three transactions T1, T2, and T3, and the schedules S1 and S2 given below. Draw the   **10   5   6**
serializability (precedence) graphs for S1 and S2, and state whether each schedule is serializable or not. If a schedule is serializable, write down the equivalent serial schedule(s).
T1: r1 (X); r1 (Z); w1 (X);
T2: r2 (Z); r2 (Y); w2 (Z); w2 (Y);
T3: r3 (X); r3 (Y); w3 (Y);
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 (Z); r3 (X); r1 (Z); r2 (Y); r3 (Y); w1 (X); w2 (Z); w3 (Y); w2 (Y);

Q10. Evaluate the effectiveness of the Two-Phase Locking (2PL) protocol in managing concurrency and   **10   5   4**
ensuring data consistency in database systems. Discuss its advantages, limitations, and potential trade-offs in terms of performance and scalability.

Q11. Suppose you are designing a database system for a library. Explain how you would implement the   **10   6   6**
Indexed Sequential Access Method (ISAM) to efficiently manage book information, including indexing and record retrieval.

Q12. Given a database of 10000 employee records with a block size of 4096 bytes and the following   **10   6   4**
record format: EmployeeID (4 bytes), EmployeeName (50 bytes), Salary (8 bytes).
A) Calculate the blocking factor for this database and explain how you arrived at your answer.
B) Calculate the number of file blocks required for storing the entire number of records, assuming unspanned organization.

End of Question Paper

	Final Assessment Test – Summer 2 2023-24 Semester - July 2024	
VIT-AP UNIVERSITY	Course code : CSE2007	Duration: 3 Hours
	Course Title : Database Management Systems	Max Marks: 100
	Exam Type: Close Book	School: SCOPE
Date: 20-07-2024	Slot: C Set – 2	Session: FN

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General Instructions if any:
1. *"fx series"* - non Programmable calculator are permitted : YES
2. Reference tables permitted : NO

PART – A: Answer any TEN Questions, Each Question Carries 10 Marks (10×10=100 Marks)

1	Answer the following. A) What is data abstraction? How this concept is implemented in DBMS. B) Write the responsibility of Database Administrator.	10M
2	Draw the E-R Diagram for the below scenario (E-R diagram should have entity, attribute, Relation with cardinality). Write primary keys, foreign keys, and all other database constraints. The flight database stores details about an airlines, flights, and seat bookings. Consider the following scenario list: • The airline has one or more airplanes. • An aeroplane has a model number, a unique registration number, and the capacity to take one or more passengers. • An aeroplane flight has a unique flight number, a departure airport, a destination airport, a departure date and time, and an arrival date and time. • Each flight is carried out by a single airplane. • A passenger has a name, surname, and a unique email address. • A passenger can book a seat on a flight.	10M
3	Consider the given Database schema for answering the queries using relational algebra. Relational schema: Movie (M_Name, Release_year, Language, Age_group, Producer, Director, Duration); Actors (A_Name, DOB, Gender, Address, Working_language); Movie_Theater (MT_Name, Established_year, Address, Owner, Ticket_price). Acted_on (A_Name, M_name, Remuneration, character); Release (M_name, MT_name, Number_of_show); Queries: a) Find all movie names released in 2020 in English or Hindi. b) List the theaters in Vijawarda showing the movie "Jurassic Park". c) Find the senior Most Female Actor. d) List the movie names, where remuneration is more than 10 lakh.	10M

4	Consider the Following ER diagram and map it into a relational model with proper constraints and justification.	10M
5	Given R(X, Y, Z, W) and Set of Functional Dependency FD = { X → Y, Y → Z, Z → X}. Find all candidate key(s) in above relation R using a given set of FDs.	10M
6	Let R (A, B, C, D, E, F, G, H) be a relational schema with FD set {C→A, B→D, CD→FG, G→FH, D→BE}. Find the current normal form and normalise R upto 3NF.	10M
7	Consider the relational schema given below to answer the Queries using SQL. Employee(Eno, Name, Email, Office-location, Gender) Customer(Cno, name, email, address, phone, age) Product(Code, Name, Type, Size, Price, Vendor) Orders(OrderNo, Cno, Eno, Code, Type, Quantity, TotalPrice, OrderDate, Status) Payment(ReferenceNO, OrderNo, PayMethod, PaidAmount, DueAmount, PaymentDate) Queries: a) Find the average age of all customers. b) List the vendor-wise product name with type and price. c) List orders, where the paid amount is greater than the Due amount. d) Find the product name with the code, which has been sold on 20th July 2024.	10M
8	Consider the relational schema given in question 7, and find the optimal query tree for the given query. **Query:** SELECT E.Name, C.name, O.OrderNo. FROM Employee E, Customer C, Orders O, WHERE C.CNo = O.CNo and O.Eno = E.Eno and O.TotalPrice < 20k and E.Gender = 'male' and O.status= 'Pending';	10M
9	We have three Transactions and if the database system executes them as Schedule S= { $R_3(B)$, $R_3(C)$, $R_1(A)$, $W_1(A)$, $W_3(B)$, $W_3(C)$, $R_2(C)$, $R_1(B)$, $W_1(B)$, $R_2(B)$, $W_2(B)$, $R_2(A)$, $W_2(A)$}. Find this Schedule S is a conflict Serializable or not using a precedence graph.	10M
10	Explain the shadow Paging database recovery system with a proper diagram.	10M
11	Explain the Primary indexing method with an example and proper diagram.	10M
12	Relation Student has 3900 records with below schema. Student (RegNO number, Name varchar(20), Address varchar(40), Degree varchar(10), Department(5), CGPA number). If the block size is 2048 bytes. A) Find the maximum size of each record possible. B) Find the maximum possible size of the student table. C) How many blocks are required to store the relation using an un-spaned record structure?	10M

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General Instructions if any:
1. Numerical questions - non-Programmable calculator are permitted: YES /~~NO~~
2. Reference tables are permitted: ~~YES~~ / NO

PART – A: Answer any **TEN** Questions, Each Question Carries 10 Marks (10×10=100 Marks)

1. A. Explain the roles of three types of database users. **(5 M)**
   B. Differentiate between total participation and partial participation using examples. **(5 M)**

2. Consider the bank database given below and answer the following questions. **(10 M)**
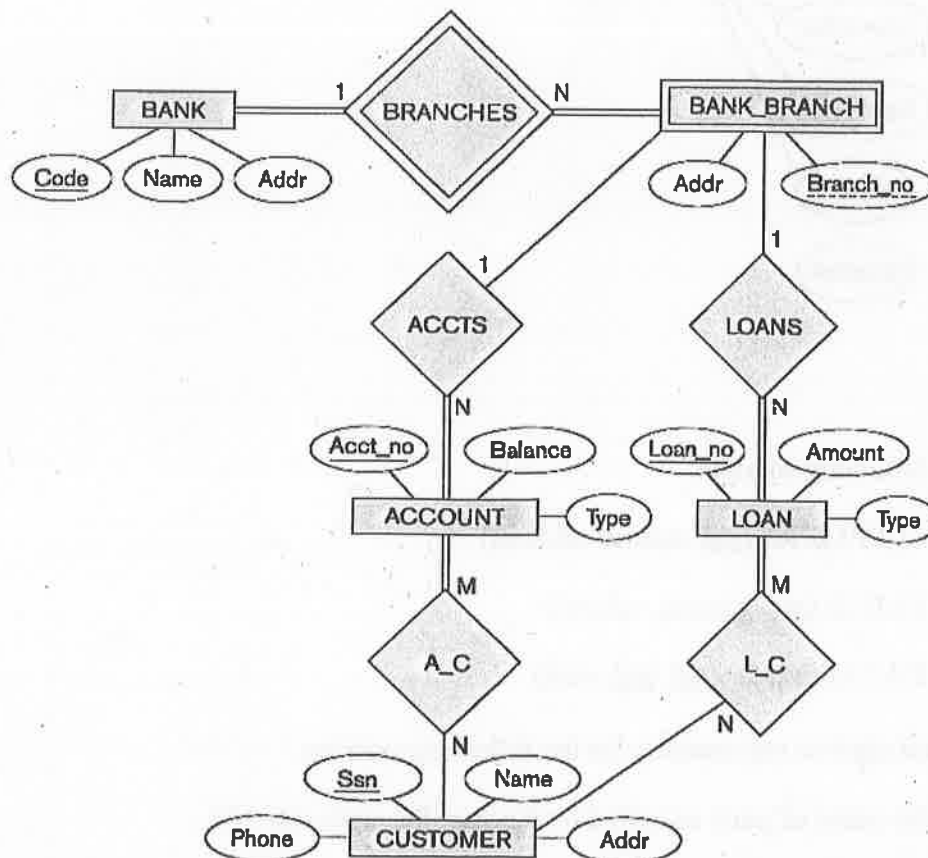
i. List the strong (regular) entity types in the ER diagram.
ii. Is there a weak entity type? If so, give its name, partial key, and identifying relationship.

iii. What relational model constraints do the partial key and the identifying relationship of the weak entity type impose in this diagram?

iv. Suppose that every customer must have at least one account but is restricted to at most two loans at a time, and that a bank branch cannot have more than 1,000 loans. How are these constraints represented using the (min, max) notation?

3. Using the standard procedure, convert the following ER diagram to relational schema. **(10 M)** Identify primary keys and foreign keys of the generated relations.
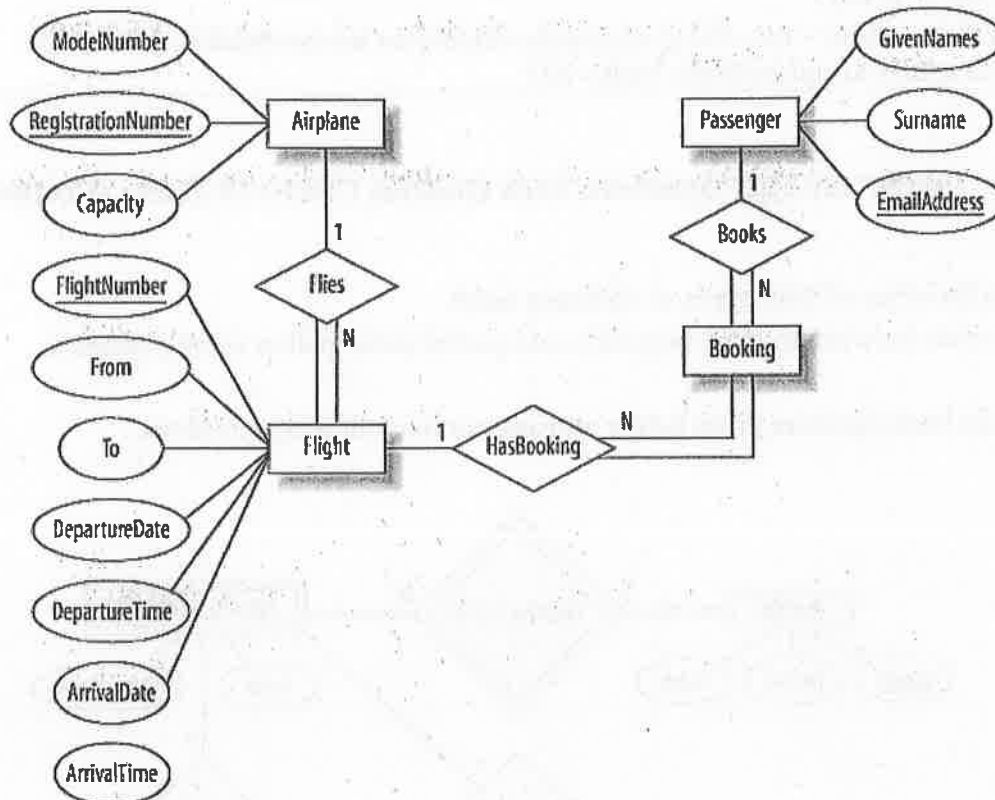
4. Consider the following schema: **(10M)**

    SUPPLIERS (<u>sid</u>, sname, address)

    PARTS (<u>pid</u>, pname, colour)

    CATALOGUE (<u>sid</u>, <u>pid</u>, cost)

Write relational algebra expressions for the following queries:

    i. Find the name of parts supplied by the supplier with sid=105.

    ii. Find the sids of suppliers who supply every part.

    iii. Find the names of suppliers supplying some green parts for less than Rs. 1000.

    iv. Find the sids of suppliers who supply some red parts and some green parts.

5. P and Q are two set of FDs for a relational schema R (A, B, C, D). P = {A → B, B → C, C → D} and Q = {A → BC, C → D}. Determine if P covers Q and if Q covers P. Additionally, check if P and Q are equivalent. **(10 M)**

6. Let R: (A, B, C, D, E), Rl: (A, D), R2: (A, B), R3: (B, E), R4: (C, D, E), and R5: (A, E). Let the FDs be: A → C, B → C, C → D, A → D, DE → C, CE → A. Check whether the decomposition of R into {Rl, R2, R3, R4, R5} is a lossless decomposition or not. **(10 M)**

7. Consider the schema for Company Database: **(10 M)**

> EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
> DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)
> DLOCATION (DNo, DLoc)
> PROJECT (PNo, PName, PLocation, DNo)
> WORKS_ON (SSN, PNo, Hours)

Write SQL queries to

i. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
ii. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.
iii. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department
iv. Retrieve the name of each employee who works on all the projects controlled by department number 5.
v. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

8. Consider three tables **(10 M)**

> COURSE (CNO, CNAME, CREDITS)
> STUDENT (ROLLNO, NAME, ADDRESS, SEM) and
> ENROLLMENT (CNO, ROLLNO, GRADE). Foreign keys have the same name as primary keys. Identify one initial canonical query tree for the following SQL expression and show the steps to optimize it using heuristics.
>
> SELECT S.NAME, S.ADDRESS, E.GRADE
> FROM COURSE C, STUDENT S, ENROLLMENT E
> WHERE S.ROLLNO =E.ROLLNO AND C.CNO = E.CNO AND CNAME='PDBD'

9. A. Illustrate lost-update and dirty-read problems with suitable examples. **(5 M)**
   B. Describe the different states of a transaction with the help of a neat diagram. **(5 M)**

10. Consider the following schedules. Determine whether each schedule is strict, cascadeless, **(10 M)** recoverable, or nonrecoverable. Justify your assumptions.

$S1: r_1(X); r_2(Z); r_1(Z); r_3(X); r_3(Y); w_1(X); c_1; w_3(Y); c_3; r_2(Y); w_2(Z); w_2(Y); c_2;$

$S2: r_1(X); r_2(Z); r_1(Z); r_3(X); r_3(Y); w_1(X); w_3(Y); r_2(Y); w_2(Z); w_2(Y); c_1; c_2; c_3;$

11. Explain the different types of single-level ordered indices with suitable examples. **(10 M)**

12. Consider an EMPLOYEE file with 10000 records where each record is of size 80 bytes. **(10 M)** The file is sorted on employee number (15 bytes long), which is the primary key. Assuming unspanned organization, block size of 512 bytes and block pointer size of 5 bytes, compute the number of block accesses needed for retrieving an employee record based on employee number using binary search if
   i.   No index is used
   ii. Primary-level index is used

QP MAPPING

Q. No.	E/A/T	Module Number	Marks	BL	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped
Q1	E	M1	10	2	CO1	1, 12	1, 4	1
Q2	T	M1	10	3	CO1	1, 2, 3, 12	1, 4	1
Q3	T	M2	10	3	CO2	1, 2, 3, 12	1, 4	1
Q4	A	M2	10	3	CO2	1, 2, 3, 12	1, 4	1
Q5	A	M3	10	3	CO3	1, 2, 3, 12	1, 4	1
Q6	A	M3	10	3	CO3	1, 2, 3, 12	1, 4	1
Q7	T	M4	10	3	CO4	1, 2, 3, 12	1, 4	1
Q8	A	M4	10	3	CO4	1, 2, 3, 12	1, 4	1
Q9	E	M5	10	2	CO5	1, 12	1, 4	1
Q10	A	M5	10	3	CO5	1, 2, 3, 12	1, 4	1
Q11	E	M6	10	2	CO6	1, 12	1, 4	1
Q12	A	M6	10	3	CO6	1, 2, 3, 12	1, 4	1

VIT-AP UNIVERSITY	Regular Arrear Examinations (2023-24) - July 2024	
	Maximum Marks: 100	Duration: 3 Hours
Course Code: CSE2007	Course Title: **Database Management Systems**	
Set No: 1	Exam Type : Close Book	School: SCOPE
Date: 09/08/2024	Slot: F	Session: FN

Keeping mobile phone/smart watch, even in 'off' position is treated as exam malpractice

General Instructions if any:
1. *"fx series"* - non Programmable calculator are permitted : NO
2. Reference tables permitted : NO

PART – A: Answer any <u>TEN</u> Questions, Each Question Carries 10 Marks (10×10=100 Marks)

1. Draw an ER diagram for the University database following the below schema structure using with all different components like strong and weak entities, key attributes, relationships. **(10 M)**
   College (<u>CName</u>, COffice, CPhone)
   Dept (DName, <u>DNo.</u>, DPhone)
   Course (<u>CId</u>, CName, Credit, CLevel)
   Instructor (<u>IId</u>, IName, IOffice, IPhone, Age, DOB)
   Student (<u>Regd no.</u>, Name, DNo., Phone, Age, DOB)
   Section (<u>Sid</u>, SName, Sem, Slot)

2. Suppose you're assigned to design a database system for an e-commerce organization. How would you categorize and elucidate the duties and functions of diverse database users within the organization? Explain how the three-schema architecture facilitates the e-commerce company in modifying their database structure to accommodate new data needs without disrupting their current applications. **(10 M)**

3. Suppliers (<u>sid</u>, sname, address) **(10 M)**
   Parts (<u>pid</u>, pname, color)
   Catalog (<u>sid, pid,</u> cost)
   Write the following queries in relational algebra
   a) Find the pids of parts supplied by at least three different suppliers.
   b) Find the pids of the most expensive parts supplied by suppliers named Sunil

4. Consider the following schema **(10 M)**
   Student (sid, sname, age)
   Course (cid, cname, credits)
   Enrollment (sid, cid, grade)
   a) Write a relational calculus expression to find the names of students who have enrolled in the course "Database Systems".
   b) Write a relational calculus expression to find the names of students who are older than 20 and have taken more than 4 courses.

5. Consider a relationship R= (P, Q, R, S, T, X) on which the following FDs hold {P→Q, QR→S, T→R, S→P}. Find all the possible candidate key and super key attributes for the relation R. **(10 M)**

6. For the relation R(A, B, C, D), the decomposed relations are D={AB, BC, CD} and the FDs hold: {A→B, B→C, C→D, D→A} present in the relation R. Check that the given decomposed relations are dependency preservation or not ? **(10 M)**

7. Consider the following relations **(10 M)**
   Employee (Fname, Lname, SSN, Salary, Bdate, Address)
   Project (Pname, Pnumber, Plocation, Dnum)
   Works (ESSN, Pno, Hours)

   Write the SQL query and it's corresponding Relation algebra to draw an initial query tree for the query Find the last name of employees born after 1957 who worked on a project named "Women Empowerment". Then apply heuristic query optimization on the above initial query tree to find the optimal query tree.

8. Consider the following relational schema. **(10 M)**
   Employee (empno,name,office,age)
   Books (isbn,title,authors,publisher)
   Loan (empno, isbn,date)
   Write the appropriate SQL queries for the following questions.
   a) Find the names of employees who have borrowed more than five different books published by McGraw-Hill?
   b) Find the names of employees who have borrowed all books Published by McGraw-Hill?

9. How does concurrency control in database systems address the challenges posed by issues such as lost updates, temporary updates, incorrect summaries, and unrepeatable reads, ensuring data consistency and integrity in multi-user environments? Explain the issues with examples. **(10 M)**

10. Consider the three transactions T1, T2, and T3, and the schedules S1 and S2 given below. Draw the serializability (precedence) graphs for S1 and S2, and state whether each schedule is serializable or not. If a schedule is serializable, write down the equivalent serial schedule(s). **(10 M)**
    T1: r1 (X); r1 (Z); w1 (X);
    T2: r2 (Z); r2 (Y); w2 (Z); w2 (Y);
    T3: r3 (X); r3 (Y); w3 (Y);
    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 (Z); r3 (X); r1 (Z); r2 (Y); r3 (Y); w1 (X); w2 (Z); w3 (Y); w2 (Y);

11. Discuss the concept of internal hashing in a database management system (DBMS). Explain the structure and functionality of internal hashing. Illustrate with examples how internal hashing enhances the efficiency of data retrieval and storage management within a DBMS. **(10 M)**

12. Consider a database of fixed-length records, stored as an ordered file. The database has records, with each record being bytes, of which the primary key occupies bytes. The data file is block-aligned in that each data record is fully contained within a block. The database is indexed by a primary index file, which is also stored as a block-aligned ordered file. The figure below depicts this indexing scheme. **(10 M)**

QP MAPPING

Q. No.	E/A/T	Module Number	Marks	BL	CO Mapped	PO Mapped	PEO Mapped	PSO Mapped
Q1	E	1	10	1	1	1	1	1
Q2	E	1	10	2	1	1	1	1
Q3	A	2	10	2	2	1,2	2	1
Q4	A	2	10	2	2	1,2	2	1
Q5	A	3	10	3	3	1,2,3,5	1,2	1
Q6	A	3	10	3	3	1,2,3,5	1,2	1
Q7	T	4	10	3	4	1,2,3,5	1,2	1
Q8	A	4	10	3	4	1,2,3,5	1,2	1
Q9	T	5	10	3	5	1,5	1,2	1
Q10	A	5	10	2	5	1,5	1,2	1
Q11	A	6	10	2	6	1,3,5	1,2	1
Q12	T	6	10	4	6	1,3,5	1,2	1