



School of Information Technology and Engineering

Fall Semester 2022-2023

Continuous Assessment Test – I

Programme Name & Branch : MCA (CA)

Course Name & code: Database Technologies (ITA5008)

Class Number (s): VL2022230106221 & VL2022230105096

Faculty Name: Dr. Bimal Kumar Ray & Dr. Tapan Kumar Das

Exam Duration: 90 Minutes

Maximum Marks: 50

Answer ALL Questions

1. Consider a CONFERENCE_REVIEW database in which researchers submit their research papers for consideration. Reviews by reviewers are recorded for use in the paper selection process. The database system caters primarily to reviewers who record answers to evaluation questions for each paper they review and make recommendations regarding whether to accept or reject the paper. The data requirements are summarized as follows.

Authors of papers are uniquely identified by e-mail id. First and last names are also recorded. Each paper is assigned a unique identifier by the system and is described by a title, abstract, and the name of the electronic file containing the paper. A paper may have multiple authors, but one of the authors is designated as the contact author. Reviewers of papers are uniquely identified by e-mail address. Each reviewer's first name, last name, phone number, affiliation, and topics of interest are also recorded. Each paper is assigned between two to four reviewers. A reviewer rates each paper assigned to him or her on a scale of 1 to 10 in four categories: technical merit, readability, originality, and relevance to the conference. Finally, each reviewer provides an overall recommendation regarding each paper. Each review contains two types of written comments: one to be seen by the review committee only and the other as feedback to the author(s).

Draw an entity-relationship diagram for the above data requirements. Indicate key constraints, cardinality constraints and participation constraints on the diagram. (10 Marks)

2. (a) Every key is a super key but every super key is not a key – justify. (2 Marks)

(b) What is meant by entity integrity constraint and referential integrity constraint? (3 Marks)

(c) Consider the following six relations for an order-processing database application in a company.

CUSTOMER(Cust_id, Cname, City)

ORDER(Order_no, Odate, Cust_id, Ord_amt)

ORDER_ITEM(Order_no, Item_no, Qty)

ITEM(Item_no, Unit_price)

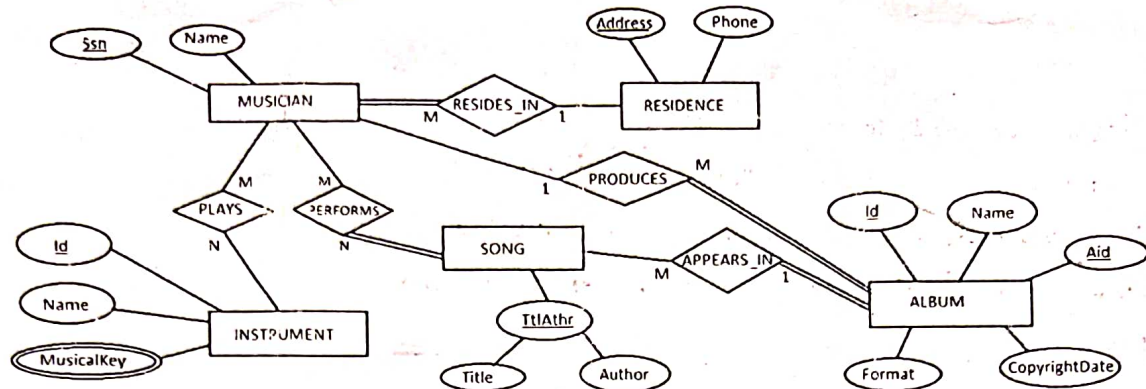
SHIPMENT(Order_no, Warehouse_id, Ship_date)

WAREHOUSE(Warehouse_id, City)

Specify the foreign keys for this schema.

(5 Marks)

3. Convert the following entity-relationship diagram into a relational database schema diagram.



(10 Marks)

4. (a) Identify three functional dependencies from the following relation.

X	Y	Z
x ₁	y ₁	z ₁
x ₁	y ₁	z ₂
x ₂	y ₁	z ₁
x ₂	y ₁	z ₃

Handwritten note: A B C D E F G H I

(3 Marks)

(b) Consider a relation schema R(A, B, C, D, E, G, H) and the following set of functional dependency.

$$\mathcal{F} = \{A \rightarrow BC, B \rightarrow CE, A \rightarrow EG, AC \rightarrow H, D \rightarrow B\}.$$

Find out a key of the schema and decompose it into the highest possible normal form. (7 Marks)

5. Consider the following relational database schema to record access of social networks. The primary keys are underlined. The foreign keys are self-explanatory.

USER(User_id, Name, Location, DoB, Profession),

ACCESSES(User_id, Web_site_address, Date_of_membership),

SOCIAL_NETWORK(Popular_name, Web_site_address, Rank_in_popularity, Date_of_inception),

Popular_name is a secondary key.

(a) Write down the necessary SQL statements for creating the above tables with the necessary primary key, secondary key and foreign key. (6 Marks)

(b) Write down a SQL statement to list the name and profession of all users from Canada. (2 Marks)

(c) Write down a SQL statement to list the popular name of the social network and its web site address in decreasing order of its rank in popularity. (2 Marks)

Handwritten notes: ASC, DSC, DESC

School of Information Technology and Engineering

Fall Semester 2022-2023

Continuous Assessment Test – II

Programme Name & Branch : MCA (CA)

Course Name & code: Database Technologies (ITA5008)

Class Number (s): VL2022230166221 & VL2022230105096

Faculty Name: Dr. Bimal Kumar Ray & Dr. Tapan Kumar Das

Exam Duration: 90 Minutes

Maximum Marks: 50

Answer ALL Questions

1. (a) Which of the three basic file organizations would you choose for a file where the most frequent operations are as follows?

(i) Search for records based on a range of field values.

(ii) Perform inserts and scans where the order of records does not matter.

(iii) Search for a record based on a particular field value.

[5]

(b) With the help of an example, explain the concept of hash based index. How does it differ from B-tree index?

[5]

2. Consider the following relational database schema. The schema captures information about employees, departments, and company finances (organized on a per department basis).

EMPLOYEE(E_Id, Ename, Salary, DoB, D_Id)

DEPARTMENT(Dept_Id, P_Id, Dname, Budget, Status)

PROJECT(Pj_Id, Pname, Code, Report)

DEPT_LOCATION(Dept_Id, Dept_Loc)

The primary keys are underlined. The attribute D_Id is a foreign key of the EMPLOYEE relation that refers to the DEPARTMENT relation and P_Id is the foreign key of the DEPARTMENT relation that refers to the PROJECT relation. The Dept_Id is a foreign key of DEPT_LOCATION that refers to DEPARTMENT.

Write down three evaluation plans for the following query, mention which of the three plans is the best evaluation plan and write down an execution plan for the best evaluation plan.

Display project name, department name and employee name for employees drawing a salary higher than \$50000 and for department located in Houston with budget higher than \$2000000. [10]

3. (a) How is a vertical partitioning of a relation specified? How can a relation be put back together from a complete vertical partitioning?

[5]

(b) What are the advantages and disadvantages of centralized two-phase locking, primary-copy two-phase locking and distributed two-phase locking protocol?

[5]

4. Consider the following relations.

Employee(Emp_id, E_name, Salary, Hire_date, City)

Project (Prj_id, Prj_name, Budget, Duration)

Works_on(Emp_id, Prj_id)

(i) Give an example of two simple predicates that would be meaningful for the Employee relation for horizontal partitioning.

(ii) How would a derived horizontal partitioning of Works_on be defined based on the partitioning of Employee relation?

(iii) Show predicates by which Project relation may be horizontally partitioned by budget.

(iv) Show how the Works_on relation may be further partitioned from the partitions in (ii) by adding the predicates in (iii). [10]

5. (a) How you would implement the SQL statement 'select * from employee order by salary' in a parallel database system? [5]

(b) Write the steps involved in implementation of parallel join. [5]



KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS TREATED AS EXAM MALPRACTICE

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. a) Explain the difference between two-tier and three-tier architectures. Which is better suited for Web applications? Why? [5]
b) Why would you choose a database system instead of simply storing data in operating system files? When would it make sense not to use a database system? [5]

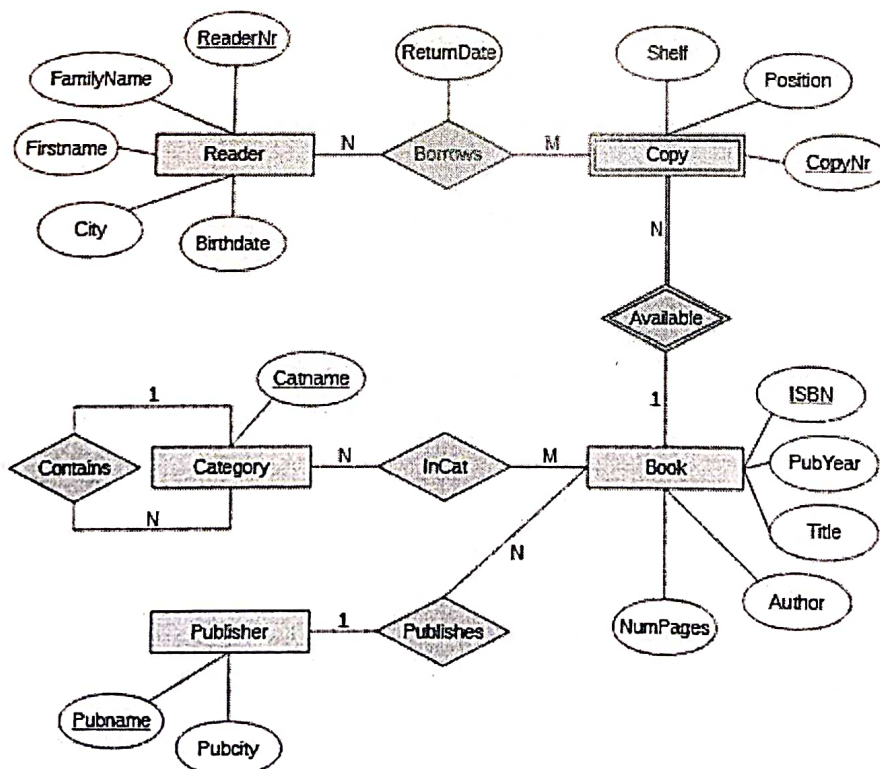
2. From the description given below, identify the entities and the relationships that exist between them. Use this information to create an Entity-Relationship (ER) diagram.

Authors are responsible for writing plays that are performed in theatres. Every time a play is performed, the author will be paid a royalty (a sum of money for each performance).

Plays are performed in a number of theatres; each theatre has maximum auditorium size, and many people attend each performance of a play. Many of the theatres have afternoon and evening performances.

Actors are booked to perform roles in the plays; agents make these bookings and take a percentage of the fee paid to the actor as commission. The roles in the plays can be classified as leading or minor roles, speaking or non-speaking, and male or female.

3. Reduce the following ER diagram to relational schema:



4. The following relation schema can be used to register information on the repayments on loans.

Repayment (borrower_id, name, address, loanamount, requestdate, repayment_date, repayment_amount)

A borrower is identified with an unique borrower_id, and has only one address. Borrowers can have multiple simultaneous loans, but they always have different request dates. The borrower can make multiple repayments on the same day, but not more than one repayment per loan per day.

State a key (candidate key) for Repayment.

Make the normalization to BCNF. Show the steps.

5. Answer the following queries in SQL using the relational schema

Vaccine(Vac_ID, Vac_Name)

Patient(Pat_ID, Name, age)

Taken(Pat_ID, date, vac_id)

- a) Find the name of the vaccination taken by the patient_ID "M105". [2]
- b) Find the average age of patients who are vaccinated. [2]
- c) List out all the patients and their age who have not yet taken the vaccination. [3]
- d) Count the number of patients who have vaccinated with "Pfizer". [3]

6. Consider the following schema:

Employee (SSN, FName, LName, Address, Dno, Mgrssn, Sal)

Department(Dnumber, Dname, Location, Dmgrssn)

SELECT FName, LName, Address FROM Employee, Department WHERE Dname='Finance' AND Salary > 100000 AND Dnumber=Dno;

Consider the above query.

Find out the best evaluation plan for the query using heuristic optimization. Show the initial query tree, all intermediate query trees and the optimal query tree.

7. Explain the types of fragmentation. Why fragmentations are useful in distributed database design?

8. Explain the need for the two-phase commit protocol and describe the two phases of the protocol with an example.

9. Describe the shared-memory, shared-disk and shared-nothing architectures for parallel database systems. Why is a shared-nothing architecture attractive for parallel database systems?

10. A car-rental company maintains a vehicle database for all vehicles in its current fleet. For all vehicles, it includes the vehicle identification number, license number, manufacturer, model, date of purchase, and color. Special data are included for certain types of vehicles:

- Trucks: cargo capacity
- Sports cars: horsepower, renter age requirement
- Vans: number of passengers
- Off-road vehicles: ground clearance, drivetrain (four- or two-wheel drive)

Construct an SQL schema definition for this database. Use inheritance where appropriate.

11. a) Describe the differences between the Document Type Definition (DTD) and the XML Schema with an example. [5]
b) Compare SQL vs NoSQL. [5]
12. What are the different types of data in a multimedia database store? Draw a typical architecture of multimedia database.

