[This question paper contains 12 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 4803   E

Unique Paper Code   : 32341403

Name of the Paper   : Database Management Systems

Name of the Course   : **B.Sc. (H) Computer Science**

Semester   : IV

Duration : 3 Hours   Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. **Section A** is compulsory.

3. Attempt any **four** questions from **Section B**.

4. Parts of a question must be answered together.

5. Marks are indicated against each question.

Section A

1. (a) When is it necessary to have a surrogate key while mapping EER to a relational database? Justify with an example.   (2)

P.T.O.

(b) In the relation R (A, B, C, D, E) given below:

A	B	C	D	E
a1	b1	60	d1	2
a2	b2	80	d2	3
a3	b1	50	d3	4

Which amongst the following dependencies are violated? Justify your answer.

(i) B –> C

(ii) D –> E (2)

(c) Why is it necessary to give role names in a recursive relationship? Justify with an example.

(2)

(d) Explain the usage of the following clauses in the SQL Query "ON UPDATE CASCADE" and "ON DELETE NULL". (2)

(e) Find out the closure of CD in the following relation R (A, B, C, D, E, F, G) for the given set of functional dependencies

F = {A –> BC, E –> C, CD –> AEG, ABG –> BD, DG –> BC}

Show the steps to compute the closure for CD. Using the closure, can we say that CD is a candidate key, if yes, Justify. (3)

(f) Consider the following Medical Database relations to keep track of Patients and Physicians :

Patient (PP#, PName)

Physician (Dname, Specialization)

Test (PP#, Test_name, Date, Time, Dname)

Identify the primary and foreign keys for the relations given above (State any assumptions made). (3)

(g) Give an example of the following with its proper notation used in ER Model

    (i) Identifying Relationship

    (ii) Complex attribute (3)

(h) Differentiate between the following : (6)

    (i) Database Definition language and Database Manipulation language

    (ii) Logical data independence and Physical data independence

    (iii) Database Intension and Database Extension

(i) Find the output of the following expressions in relational algebra on the tables A, B1, B2, B3 as given below :

(1+2)

A1	
S.No.	P.No.
S1	P1
S1	P2
S1	P3
S1	P4
S2	P1
S2	P2
S3	P2
S4	P2
S4	P4

B2

P.No.
P2

B1

P.No.
P2
P4

B3

P.No.
P1
P2
P4

    (i) B1-B2

    (ii) A/B3, where '/' is a division operator.

(j) Consider the Relation given below :

STUDENT_COURSE

Name	Course	Grade	Ph_no	Major	Department

Does this given relation STUDENT_COURSE suffer from any of the following anomalies? Justify your answers using appropriate example.

   (i) Insertion

   (ii) Deletion

   (iii) Modification   (3)

(k) Two transactions T1 and T2 are executing concurrently (assuming concurrency control is not in place) with initial value of X=15 and Y=5.

T1	T2
1. Read_item(X)	
2. X = X+10	
3. write_item (X)	
	4. Read_item(X)
	5. X = X+Y
	6. write_ item (X)
7. Read_item(X)	

Transaction T1 fails during the execution of statement number 7. After the completion of the transaction T2 what will be the value of X. Is this the correct value, if not, identify the name of the concurrency control problem.   (3)

Section B

2. (a) Consider a database PROJECT_EXAMINATION that maintains data about the project reports submitted for consideration by the examiners. Comments by the examiners are recorded for use in the project selection process. The database system caters primarily to examiners who record answers to pre-decided questions for each report they evaluate. The examiners make recommendations regarding whether to accept or reject the project. The data requirements are summarized as follows : (6)

- Students write the project reports.

- Students are uniquely identified by e-mail id. first and last names are also recorded.

- Each project is assigned a unique identifier by the system and is described by a title, abstract, and the name of the electronic file containing the project report.

- Multiple students may be involved in the same project, but one of the students is designated as the coordinator.

- Examiners of project reports are uniquely identified by e-mail address. Each examiner's first name, last name, phone number, areas of interest are also recorded.

- Each project report is assigned to two and four reviewers. An examiner rates each report assigned to him or her on a scale of 1 to 10 in four categories: technical merit, readability, originality, and presentation. Finally, each examiner provides an overall recommendation regarding each report.

Design an Entity–Relationship Diagram (ER) for the above database and identify existing composite attributes (if any).

(b) For the given binary relationship, suggest the cardinality ratio of the relationship based on the general context of entity types and state the context clearly : (4)

Entity Set1	Entity Set2
I. Country	President
II. Teacher	Course
III. Players	Team
IV. Book	Author

3. Consider the relation R, which has attributes to store timetable of courses and

(a) sections at a university;   (6)

R = {Course_no, Sec_no, Offering_dept, Credit_hours, Course_level, Instructor_ssn, Semester, Year, Days_hours, Room_no, No_of_students}.

Suppose that the following functional dependencies hold on R :

{Course_no} → {Offering_dept, Credit_hours, Course__level}

{Course_no, Sec_no, Semester, Year} → {Days_hours, Room_no, No_of_students, Instructor_ssn}

{Room_no, Days_hours, Semester, Year} → {Instructor_ssn, Course_no, Sec_no}

  (i) Identify the Primary key in relation R?

  (ii) Apply normalization to convert it into 3NF stating the reasons behind each decomposition (assume R is already in 1NF).

(b) Find the minimal cover of Functional dependency set F: $\{B \rightarrow A, \ D \rightarrow A, \ AB \rightarrow D\}$. (4)

4. (a) Map the following ER-diagram into a Relational database (Assume appropriate cardinality ratios for each of the given relationships), Here CCI denotes a ternary relationship between candidate, company and interview. (6)
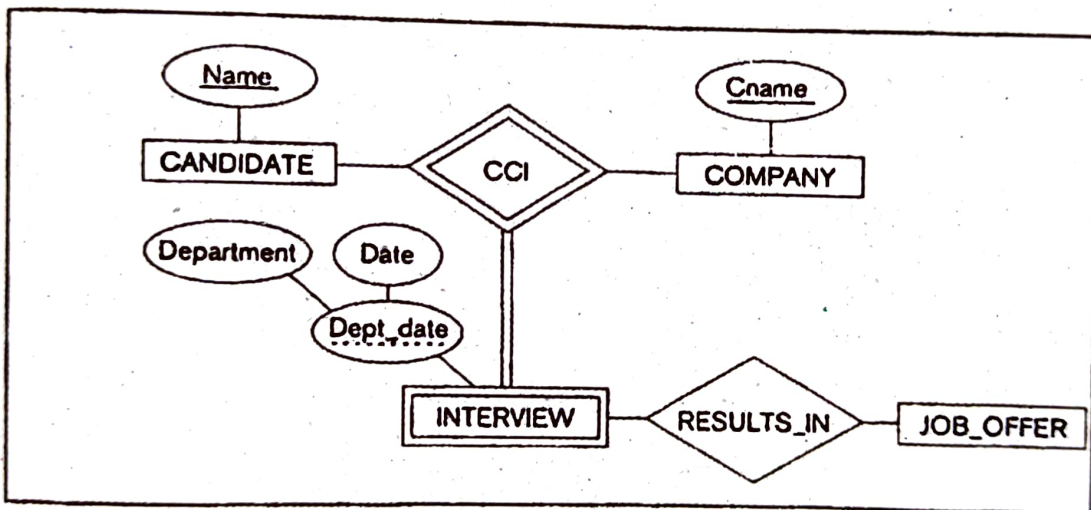
(b) Differentiate between a Specialization Hierarchy and a Specialization Lattice using appropriate examples. (4)

5. Given the following relations for an EMP_PROJ database :

(a) Employee (Emp#, Name, Age, Salary, City, Mobile)

Allotted (Project#, Emp#)

Project (Project#, Project_Name, Project_Manager)

Solve the following Queries on the above-mentioned database using SQL :

    (i) Get Emp# of employees working on both Project# 353 and Project# 354.

    (ii) Get details of employees working on all "database" project.

    (iii) Get Emp# of employees who work on all the projects that Emp # 107 works on.

    (iv) Insert a tuple <555 , "Operation Research", "Jim"> in the Project table.

    (v) Change the city of an employee from "Delhi" to "Chennai" whose name is "James".   (1+1+2+1+1)

(b) List all the FDs satisfied by the following table

A	B	C	D
a1	b1	c1	d1
a1	b1	c2	d2
a2	b2	c2	d2
a2	b2	c4	d4

(4)

6. (a) Create a B-tree of order 4 inserting following values in the given order (in steps)

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 (6)

(b) Consider the following relations for the EMP-PROJ database with the following relations :

Employee (Emp#, Name, Age, Salary, City, Mobile)

Allotted (Project#, Emp#)

Project (Project#, Project_Name, Project_Manager)

Write the following queries in Relational Algebra for the relations given above :—

(i) Display the project details of projects managed by "James".

(ii) Count the number of employees working on the "Artificial Intelligence" Project.

(4)

7. (a) Compute the number of blocks of access required to get records from an ordered file with r = 20,000 records stored on a disk with Block size B = 1024 bytes with or without primary index. Also, calculate

blocking factor. Assume that file records are of fixed size with record length R = 100 bytes, ordering key field is 9 bytes long and block pointer is 6 bytes long. (6)

(b) What are the four desirable properties of a Transaction that should be enforced by the concurrency control? (4)