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Roll No. | | | | | | | | | | |

S. No. of Question Paper : **12585**

Unique Paper Code : **2344002001**

Name of the Paper : **Database Management Systems**

Name of the Course : **Computer Science Generic Elective**

(NEP-UGCF-2022 GE)

Semester : **III**

Duration : **3 Hours** Maximum Marks : **90**

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

The paper has *two* sections. Section A is compulsory.

Attempt any *four* (4) questions from Section B.

All parts of the question must be answered together.

Section A

1. (*a*) Identify primary key and foreign keys in the following relations : 3

(*i*) Employee (Emp_id, Emp_Name, Dept_Name, Salary)

(*ii*) Department (Dept_id, Dept_Name, Building, Budget, Manager_id)

(*iii*) Job (Job_Code, Job_Des, Dept_id)

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(*b*) Define the following terms, draw their standard ER diagram notations and provide suitable examples for each : 6

(*i*) Entity

(*ii*) Weak entity

(*iii*) Attribute

(*iv*) Key attribute

(*v*) Composite attribute

(*vi*) Multivalued attribute.

(*c*) Explain the type of relationship and the cardinality ratio for the following entity pairs : 3

(*i*) Customer and Bank

(*ii*) Student and Roll No

(*iii*) Student and Faculty.

(*d*) R1 and R2 are two given relations : 4

R1

A	B
A1	B1
A2	B2
A3	B3
A4	B4

R2

A	B
A1	B1
A7	B7
A2	B2
A4	B4

Find the union (U), intersection (∩), and set difference (-) for R1-R2.

(*e*) What is the data redundancy ? What steps are taken to remove the data redundancy in a database system ? 3

(*f*) What is concurrency control in DBMS ? Why is it needed ? 3

(*g*) Give SQL command for the following : 4

(*i*) To add a new attribute email with data type varchar (20) in the relational table Employee.

(*ii*) To change Email attribute from varchar (20) to char (50).

(*iii*) Alter table Employee and make 'empno' as the primary key.

(*iv*) To Convert the text in "CustomerName" to upper-case.

(*h*) Explain the following relational algebra symbols. Give suitable examples and usage of each in database queries : 4

(*i*) (σ)

(*ii*) (π)

(*iii*) (ρ)

(*iv*) ($\bowtie$)

Section B

(Attempt any *four* questions.)

2. (*a*) Explain the Three-Schema Architecture of a database system giving a suitable diagram. What are the advantages and disadvantages of three-schema architecture ? 7

(*b*) For given relation : 8

$$R = \{A, B, C, D, E\}$$

$$FDs = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}.$$

(*i*) Identify the key in above relation.

(*ii*) Is the relation in 1NF, 2NF or 3NF ? Justify your answer.

(*iii*) How would you successively normalize it in BCNF ?

3. (*a*) What are ACID properties in database transactions ? Explain each property with example. 5

(*b*) Consider the following schema for the **BANK** database : 10

BRANCH(BranchID, Bname, City, Phone)

ACCOUNT(AccountNo, Aname, Atype, BranchID, Balance)

TRANSACTION(TID, T_Date, T_Type, AccountNo, Amount)

On the basis of this relation schema, write the following queries in relational algebra :

(*i*) Retrieve the ID and name of all the branches located in Delhi city.

(*ii*) Retrieve the ID, type and amount of all the transactions of withdrawal type.

(*iii*) List the number and type of all accounts opened in the branch having ID **B101**.

(iv) List the number and name of account holders withdrawing an amount greater than 10000 on 31st March, 2025.

(v) Calculate the maximum and minimum balance of accounts in each city.

4. (a) List *five* main responsibilities of DBA in DBMS. 5

(b) Consider a Bank database that maintains data about Customer, Loan, Accounts, Employee and Branch Name. The data requirements are as follows : 10

(i) Each branch of bank allows customers to open accounts and borrow loans.

(ii) A customer can open more than one account, and one account may also belong to one or more customers.

(iii) A customer can take more than one loan and a loan may be issued to more than one customer.

(iv) The bank has a number of employees working in different branches of the bank :

(a) Design an E-R Diagram for the above database.

(b) Identify the key attribute of each entity.

(c) Identify the cardinality ratios and participation constraints.

State necessary assumptions, if any.

5. (a) Explain the role of the following : 5

(i) End user

(ii) Database designers

(iii) Application programmers

(iv) Sophisticated users

(v) Naïve users.

(b) Differentiate between the following giving suitable examples : 10

(i) HAVING and WHERE clause

(ii) Join and Cartesian Product

(iii) Drop and Delete commands

(iv) Inner Join and Outer Join

(v) Like % **(Percentage)** and like _ **(Underscore)**.

6. (a) Consider an ordered data file with r = 40,000 records stored on a disk with block size B = 1024 types. File records are of fixed length with the record size R = 100 bytes. Compute the blocking factor and number of blocks needed to store this data file. 5

(*b*) Consider the following Bank Database : 10

Employee		
PersonName	**Address**	**City**
Ashu	B-23 Raj Nagar	Mumbai
Deepshikha	D-2 Mohan Nagar	Delhi
Seema	D-2 Dwarka	Delhi
Chakshu	D-1 Chand Nagar	Ghaziabad
Raj	B-2 Taj Nagar	Mumbai

Company	
CompanyName	**City**
Axis Bank	Delhi
Kotak Bank	Mumbai
PNB Bank	Ghaziabad
SBI	Mumbai
CBI	Delhi

Works		
PersonName	**CompanyName**	**Salary**
Deepshikha	Axis Bank	20,000
Ashu	Kotak Bank	50,000
Seema	Kotak Bank	40,000
Raj	Axis Bank	10,000
Chakshu	PNB Bank	60,000

Manages	
PersonName	**SupervisorName**
Deepshikha	Ashu
Seema	Ashu
Ashu	Raj
Raj	Chakshu
Ashu	Chakshu

Write the SQL queries for the following :

(*i*) Find the name, address and city of residence for all employees who work for 'Kotak Bank' and earn more than Rs. 10,000.

(*ii*) Find the highest salary, lowest salary and average salary paid by each company.

(*iii*) Find the names, address and salary of all employees who live Mumbai.

(*iv*) Increase the salary of all employees by Rs. 10,000.

(*v*) Modify the table 'Works' by changing the datatype of 'salary' attribute to float.

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7. (*a*) Consider the following operations performed on the database instance shown in the relations given below. Discuss the integrity constraints violated by each operation : 5

Book

ISBN	**Book Title**	**Year**	**PID**
001-354-921-1	Ramayan	2005	P001
001-987-650-5	Differential Calculus	2003	P001
001-987-760-9	C++	2005	P001
002-678-980-4	DBMS	2006	P002
004-765-409-5	UNIX	2007	P003

Publisher

PubID	**PName**	**State**
P001	McGraw Hill	Delhi
P002	PHI	Delhi
P003	Pearsons	Noida
P004	BPB	Delhi
P005	Wiley	USA

(*i*) Insert <'P003', 'Express Publications', 'Delhi'> into Publisher relation.

(*ii*) Insert <'NULL', 'Computer Network', '2005', 'P004'> into Book relation.

(*iii*) Insert <'004-765-200-1', 'VC++', '2010', 'P010'> into Book relation.

(*iv*) Delete <'004-765-409-5', 'UNIX', '2007', 'P003'> from Book relation.

(*v*) Modify <'P002', 'CRC Press', 'Delhi'> into Publisher relation.

(*b*) Given a relation R (A, B, C, D, E) with the following functional dependencies : 6

$$F = \{A \rightarrow B, B \rightarrow C, C \rightarrow D, D \rightarrow E\}$$

(*i*) Define functional dependency

(*ii*) Compute $(\mathbf{AD})^+$

(*iii*) Identify primary key for R.

(*c*) For the binary relationship given below, give the cardinality ratio based on Entity 1 and Entity 2. State any assumptions made to justify your answer : 4

Entity 1	Cardinality Ratio	Entity 2
Bank		Branch
Director		Movie
Customer		Account
Student		Aadhar Number