This question paper contains 6 printed pages.

Your Roll No. .....

Sl. No. of Ques. Paper : **2798** **GC-4**

Unique Paper Code : **32341403**

Name of Paper : **Database Management Systems**

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

Semester : **IV**

Duration : **3 hours**

Maximum Marks : **75**

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

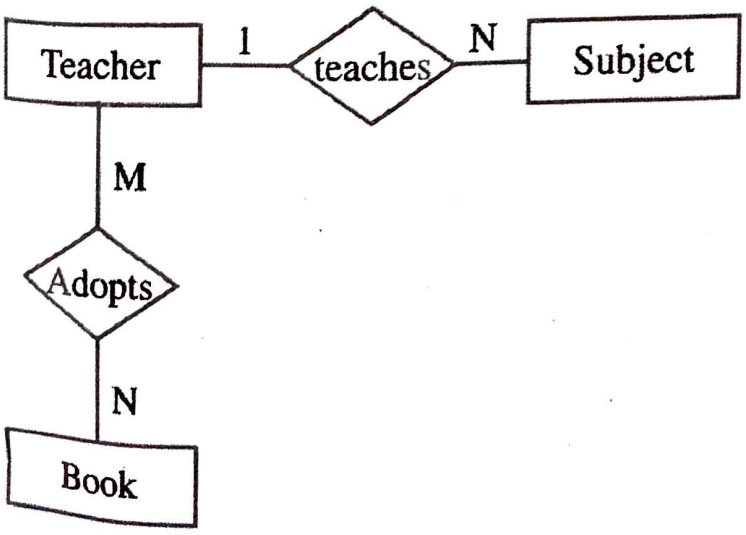
Question 1 is compulsory.

Attempt any four questions out of the remaining questions.

Parts of a question must be answered together.

1. (a) Consider a data file STUDENT (Sid, Sname, CourseNo, Dob, Address). Create the primary index (on Sid) and the secondary index (on CourseNo) on the above file diagrammatically. Which index will take more space and why? 5

   (b) Choose suitable attributes for various entities and convert the following ER diagram to relational tables. 5



(c) Give SQL command to create a relational table using the following information:

A table T with the attributes T1, T2, T3, T4 where:

* T1 is a number (maximum 10 digits in length) and cannot contain null values
* T2 is a character string (50 maximum characters in length)
* (T1, T2) form the primary key
* T3 and T4 are integer values
* Default value of T3 is 6
* T4 is a foreign key referring to T5 from another table S of the database. 5

(d) Consider the following tables A and B:

R

X	Y	Z
10	a	7
25	b	8
30	a	9

S

A	B	C
25	c	9
30	d	8
25	c	7

The attributes X, Y, Z are domain compatible with the attributes A, B, C respectively. Show the results of the following operations:

(i) R U S

(ii) R $\bowtie_{A.Z=B.C}$ S

(iii) R $\rightthreetimes_{R.X=S.A}$ S 1+2+2

(e) Differentiate between the logical and physical data independence with the help of an example. What is the system log used for? 2+2+1

(f) Two sets of FDs for a relation R(A, B, C) are given as follows:

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

$G = (A \rightarrow B, B \rightarrow C, A \rightarrow C, C \rightarrow A\}$

Are F and G equivalent? Justify your answer. 5

(g) Differentiate between Alter table and Update table command in SQL with the help of suitable example. 5

2. Suppose you are given the following requirements for a database for the National Hockey League (NHL). The NHL has many teams.

* each team has a name, a city, a coach, a captain, and a set of players,
* each player belongs to only one team,
* each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records,
* every team has a team captain, a team captain is also a player.
* injury record of each player is kept with its description (injury_date, injury_type).
* a game is played between two teams (referred to as host_team and guest_team) and has a date (such as April 11th, 2017) and a score (such as 2 to 1).

Identify:

(i) Entities of interest

(ii) Attributes of interest for each entity

(iii) Draw the ER diagram for the above mentioned scenario. Also specify clearly, all constraints on the relationships in the diagram. State any assumptions that you make. 2+2+6

3. (a) Consider the following database giving information of various branches of a library:

Book (BookId, title, PublisherName)

Library_Branch (BranchId, BranchName, address)

Book_Copies(BookId, BranchId, NoOfCopies)

Book–Loans (BookId, BranchId, CardNo, DateOut, DueDate)

Answer the following queries in SQL:

(i) For each library branch, list the number of copies of each title.

(ii) How many copies of the book titled, 'Fundamentals of Database Systems' are owned by each library branch?

(iii) For each book that is loaned out from 'CP' branch, for which the due data is today, retrieve the bok title and publisher name. 2+2+2

(b) What is cardinality ratio? For the binary relationships below, suggest cardinality ratios based on the meaning of the entity types. State any assumptions you make.

ENTITY 1	Cardinality Ratio	ENTITY 2
STUDENT	_____	TEACHER
COUNTRY	_____	CURRENT_PRESIDENT
LIBRARY	_____	BOOK
ITEM (that can be found in an order)	_____	ORDER

4

4. (a) Consider a file with the following key values: 8, 5, 2, 6, 4, 25. Insert these search key values in the given order in a B^+ tree of order $p = 3$ and $p_{leaf} = 2$. Show the tree at each step. 6

(b) Consider an ordered file with number of records $r = 30000$ stored on a disk with block size $B = 1024$ bytes. A primary index is created on this file where the key is 9 bytes long and the block pointer is 6 bytes long. Find the blocking factor and the number of blocks needed for the primary index. 2+2

5. (a) Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies $F = \{\{A, B\} \rightarrow \{C\}, \{B, D\} \rightarrow \{E, F\}, \{A, D\} \rightarrow \{G, H\}, \{A\} \rightarrow \{I\}, \{H\} \rightarrow \{J\}\}$. Find the key of R. Decompose R into 2NF and then 3NF relations. 2+2+2

(b) You are given the following state of the relational scheme R (A, B, C):

A	B	C
a1	b1	c1
a2	b1	c2
a3	b2	c3
a4	b3	c2

Indicate which of the following functional dependencies are satisfied by the current state? Justify your answer.

(i) $B \rightarrow C$

(ii) $A \rightarrow B$ 2+2

6. (a) Consider the tables given below and answer the following queries in relational algebra:

item (<u>ItemCode</u>, ItemName, ItemPrice, ItemQty)

customer (<u>CustCode</u>, CustName, CustAddress, CustPhone, CustCity)

order (<u>OrderCode, ItemCode</u>, OrderDate, QtyOrdered, CustCode)

(i) For each order display the total quantity of all items placed in that order.

(ii) Give the details of all those customers who live in Delhi and who bought item with item code '2020'.

(iii) Give the details of the cheapest item. 2+2+2

(b) Consider the following relations:

Employee

Eno	Ename	Dno
1	Anu	7
2	Ram	8
3	Rakesh	7

Department

Dnum	Dname	Dloc
7	XX	Delhi
8	YY	Mumbai
9	ZZ	Kolkata

Here, Eno is a Primary Key and Dno is a Foreign Key in EMPLOYEE relation.

For each of the following operations, indicate whether it results in constraint violation and if so, why?

(i) Insert <5, 'Pooja', 10> in Employee

(ii) Insert <5, 'Reeta', 7> in Employee

(iii) Delete <7, 'XX', 'Delhi' > from Department

(iv) Insert <10, 'AA', 'Delhi' > in Department 4

7. (a) Illustrate each of the following concepts with the help of an example:

(i) Total and disjoint specializations/generalizations

(ii) Recursive Relationship

(iii) Weak Entity 4+2

(b) Let F = {A → B, A → C, C → A} for a given relational schema R. Find $(BC)^+$ and $(C)^+$. 4

1200