7. (a) Illustrate the use of each of the following constraints that can be applied to specializations/generalizations with the help of an example :

    (i) Disjoint Total

    (ii) Disjoint Partial

    (iii) Overlapping Partial.   2+2+2

(b) Consider the following relations :

Student

SId	Sname	CNum
1	Anu	6
2	Shyam	8
3	Rakesh	6

Course

CNo	Cname	Dept
6	XX	Maths
7	YY	CompSc
8	ZZ	English

Here, SId is a Primary Key and CNum is a Foreign Key in Student relation. CNo is primary in Course relation.

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

    (i) Insert < 4, 'Preeti', 10 > in Student

    (ii) Insert < 5, 'Reena', 7 > in Student

    (iii) Delete < 6, 'XX', 'Maths' > from Dept

    (iv) Insert < 10, 'AA', 'Electronics' > in Course   4

Roll No. ☐☐☐☐ · ☐☐☐☐ · ☐☐

S. No. of Question Paper : **6514**

Unique Paper Code : **32341403**   HC

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

Name of the 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 No. **1** is compulsory.

Attempt any *four* questions out of the remaining Q. No. 2–Q. No. 7.

Parts of a question must be answered together.

1. (a) Two sets of FDs for a relation R (A,B,C,D,E) are given as follows :

$$F = \{A \rightarrow B$$
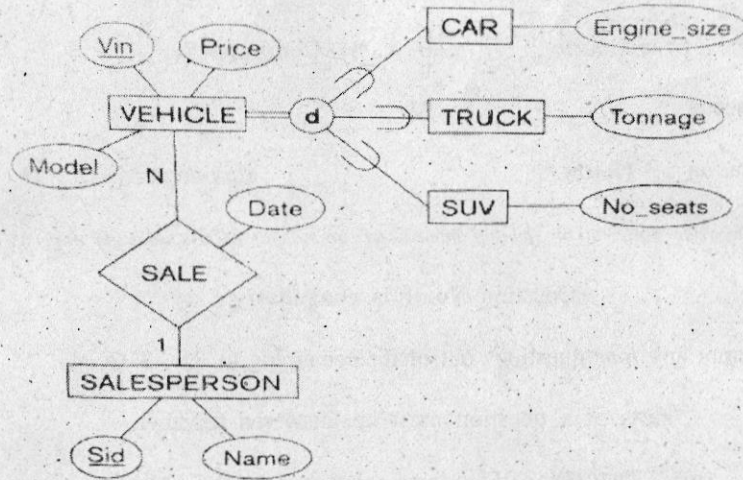$$AB \rightarrow C$$
$$D \rightarrow AC$$
$$D \rightarrow E\}$$
$$G = \{A \rightarrow BC$$
$$D \rightarrow AE\}$$

Are F and G equivalent ? Justify your answer.   5

P.T.O.

(b) Consider the following EER diagram for a vehicle dealer database. Vin (Vehicle Identification) is primary key for the entity VEHICLE and Sid (Salesperson Id) is the primary key for the entity SALESPERSON :

Convert the following components of the above EER diagram to relational tables :

(i) 1 : N relationship

(ii) Specialization. 2+3

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

• A table T with the attributes T1(int), T2(char(20)), T3(int), T4(char(6)), T5(int)

• (T1, T2) form the primary key

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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} → {C}, {A} → {D, E}, {B} → {F}, {F → {G, H}, {D} → {I, J}}. Find the key of R? Decompose R into 2NF and then 3NF relations. 2+2+2

(b) Differentiate between functional dependency and full functional dependency. Give an example of a relation that is in 3NF but not in BCNF giving reasons. 2+2

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

item(ItemCode, ItemName, ItemPrice, ItemQty)

customer(CustCode, CustName, CustAddress, CustPhone)

issue(IssueCode, ItemCode, IssueDate, IssueQty, CustCode)

(i) Find the names of distinct customers who have got issued any item with price above 1000/-.

(ii) Give the details of the costliest item.

(iii) Give the details of all those customers who bought an item with item code 'I005'. 2+2+2

(b) Give four advantages of the DBMS approach over the conventional file system approach. 4

(b) Answer the following queries in SQL :   1½+1½+1½+1½

   (i) List the address of all branch offices in London or Bristol.

   (ii) Find the minimum, maximum and average staff salary.

   (iii) For each branch office with more than one staff member, find the number of staff working and the sum of their salaries.

   (iv) Find all staff whose salary is larger than the salary of every staff member at the branch with branchNo 'B003'.

4. (a) Consider a file with the following key values : 9, 5, 2, 7, 4, 15. 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. Find the blocking factor for the file, the number of blocks needed for the file and number of block accesses needed by a binary search on this data file.   1+1+2

- Default value of T3 is 6
- Value of T4 should be taken from the values: (Male, Female)
- T5 is a foreign key coming from another table S of the database   5

(d) Consider the following tables A and B :

A		
X	Y	Z
15	a	7
25	b	8
35	d	6

B		
U	V	W
25	a	9
35	d	6
25	c	7

The attributes X, Y, Z are domain compatible with the attributes U, V, W respectively. Show the results of the following operations :

(i) A U B

(ii) $A \bowtie_{A.X=B.U} B$

(iii) $\Pi_{A.Z, B.W} (\sigma_{A.Y=B.V} (A \times B))$.   1+2+2

(e) What is *data independence* ? Illustrate the concepts of *logical data independence* and *physical data independence* with examples.   1+2+2

(f) Consider a data file EMPLOYEE (EmpId, Ename Salary, DeptNo, Dob, Designation). Create the primary index (on EmpId) and the secondary index (on DeptNo) on the above file diagrammatically. Which index will take more space and why ?　　　　3+2

(g) State the ACID properties of transactions. What is the use of system log ?　　　　4+1

2. Consider a movie database in which data is recorded about the movie industry.

The data requirements are summarized as follows :

- Each movie is identified by title and year of release. Each movie has a length in minutes. Each movie has a production company and is classified into one or more genres (such as horror, action, drama, and so forth). Each movie has one or more directors and one or more actors that appear in it. Each movie also has a plot outline. Finally, each movie has zero or more quotable quotes, each of which is spoken by a particular actor appearing in the movie.

- Actors are identified by name and date of birth and appear in one or more movies. Each actor in the movie has a role in it.

- Directors are identified by name and date of birth and direct one or more movies. It is possible for a director to act in a movie that he directed.

- Production companies are identified by name and each has an address. A production company produces one or more movies.

Identify :

(i) Entities of interest.

(ii) Attributes of interest for each entity.

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

3. Consider the following database giving information of various branches of a company and staff at each branch :

Branch (branchNo, street, city, postcode)

Staff (staffNo, fname, lname, position, sex, DOB, salary, branchNo)

(a) Give SQL Create Table commands to create the above tables.　　　　2+2