COMP 5 – 5 (RC)

T.E. (Comp.) (Semester – V) (RC) Examination, May/June 2015
DATA BASE MANAGEMENT SYSTEMS

Duration : 3 Hours   Total Marks : 100

Instructions : *Attempt* **any five** *questions by selecting at least* **one** *question from* **each** *module.*

MODULE 1

1. a) Construct an E-R diagram for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. It is not necessary that a person involved in a accident is the owner of the car. Clearly specify cardinality and the participation constraints. Construct tables for the resulting ER diagram. Specify constraints.   **6**

   b) What is an identifying relationship ? Explain with the help of an example. Can the cardinality ratio of an identifying relationship be many to one ?   **4**

   c) Existence dependency need not always result in a weak entity set. Is this true ? Provide example to justify your answer.   **3**

   d) Explain the concept of physical data independence and its importance in database systems.   **3**

   e) List the various users of the database system.   **4**

2. a) What do you mean by recursive relationship ? Why is it required ? Provide example.   **3**

   b) Provide examples for the following :   **4**
      i) Total and disjoint specialization
      ii) Partial and overlapping specialization.

   c) Define the concept of aggregation. Give two examples of where this concept is useful.   **5**

   d) Explain the distinction between condition defined and user defined constraints. Which of these constraints can the system check automatically ? Explain your answer.   **5**

   e) What is a composite attribute ? How is it stored in a relation for a given entity ? Provide example.   **3**

MODULE 2

3. a) Consider the following DreamHome rental database

   Branch (BranchNo, Street, City, PostCode)

   Staff (StaffNo, Name, Position, Gender, DOB, Salary, BranchNo)

   Property_for_rent (PropertyNo, Street, City, PostCode, Type, Rooms, Rent,
   　　　　　　　　　　　OwnerNo, StaffNo, BranchNo)

   Client (ClientNo, Name, TelNo, Preftype, MaxRent)

   PrivateOwner (OwnerNo, Name, Address, Telno)

   Viewing (ClientNo, PropertyNo, ViewDate, Comment)

   Registration (ClientNo, BranchNo, StaffNo, DateJoined)

   I) Answer the given queries in relational algebra :　　　　　　10

   　　i) List all cities where there is a branch office but no properties for rent.

   　　ii) Identify the clients who have viewed all properties with 3 rooms.

   　　iii) Identify the staff members that have registered maximum clients.

   　　iv) List the property with the maximum rent and display its owner information.

   　　v) List all cities where there is either a branch office or a property for rent.

   II) Retrieve the names and comments of all clients who have viewed a property
   using Tuple Relational Calculus.　　　　　　2

   III) Identify all the staff members earning salary greater than Fifty Thousand
   using Domain relational calculus.　　　　　　2

   IV) Write the following query in QBE : Retrieve the name and telephone numbers
   of all the owners from Delhi.　　　　　　2

   b) What do you mean by entity integrity ? Why is it required ?　　　　　　2

   c) What is the difference between schema and instance of a relation ?

4. a) Consider the following database

   Employee (empno,name,skill,salary)

   Position (posting_no,skill)

   Duty_allocation (posting_no,emp_no,day,shift)

   Find SQL queries for the following :　　　　　　10

   　　i) Retrieve the name of the employee earning second highest salary.

   　　ii) Find the names of all employees who are assigned to all positions that
   require a chef's skill.

   　　iii) Get a list of all employees who are not assigned a duty.

   　　iv) Get the employee numbers of all employees working on at least 2 days.

   　　v) Retrieve the names of employees whose salary is greater than the salary
   of employee 'XYZ'.

b) Giver a relation R = (A, B, C, D) and the corresponding set of functional dependencies. F = {A → BC, CD → E, B → D, E → A}. Find the canonical cover for F. What is the key of R ? **6**

c) What do you mean by a functional dependency ? Consider the following relation student guide(Name, Department, Guide). Identify all the functional dependencies in this relation. **4**

Name	Department	Guide
Seema	CSE	Prof. X
Jina	Chemical	Prof. Y
Purva	Physics	Prof. Z
Nita	CSE	Prof. X
Anjali	Maths	Prof. T
Meena	Chemical	Prof. N

MODULE 3

5. a) Consider relation R = {A,B,C,D,E,F,G,H,I} and a set of functional dependencies F={AB→C, A→DE, B→F, F→GH, D→IJ}. Consider the following decomposition D={R1,R2,R3,R4,R5}, R1={A,B,C}, R2={A,D,E}, R3 ={B,F}, R4={F,G,H} and R5={D,I,J}.

Determine whether each decomposition has the following properties :
   i) Dependency preservation and
   ii) Lossless Join. **6**

b) For a given relation R = {A,B,C,D,E,F,G,H} with the following set of functional dependencies
   F = {A→BCD, AE→F, E→G, D→H}. **8**
   i) Find the key
   ii) Relation R is in which normal form ?
   iii) Apply Normalization on R until it cannot be decomposed further. Also give reasons for decomposition.

c) What are multivalued dependencies ? Why are they required ? How are they different from functional dependencies ? Provide examples to support your answer. **4**

d) What is domain key normal form ? **2**

6. a) Suppose you need to sort a relation of 40 gigabytes, with 4 kilobyte blocks, using a memory size of 40 megabytes. Suppose the cost of a seek is 5 milliseconds, while the disk transfer rate is 40 megabytes per second.   **8**

    i) Find the cost of sorting the relation, in seconds, with

        A) number of buffer blocks allocated to each run bb=1 and

        B) number of buffer blocks allocated to each run bb=100.

    ii) In each case how many merge passes are required ?

  b) Consider the following relations   **8**

    employee(id,name,dept,salary)

    works_on(eid,pno,hours)

    project (pno,name,plocation)

    Consider the query :

    "Retrieve the name of the employees belonging to admin department and working on 'Project1' project for more than 5 hours per week."

    i) Draw the query graph and the initial canonical query tree for the above query.

    ii) Optimize the query using heuristic rules and show the resultant optimized query.

  c) What is the different between pipelining and materialization ?   **2**

  d) What do you mean by semantic query optimization ?   **2**

MODULE 4

7. a) Consider a transaction T that transfers Rs. 500/- from account A to account B as defined below :

    Read(a)

    a=a-500

    Write(a)

    Read(b)

    b=b+500

    Write(b)

    Assume that prior to the execution of transaction T, the amount in account A is Rs. 2,000/- and in B is Rs. 3,000/-, Furthermore, assume that a power failure occurs. What will happen ? Will our database be in a consistent state ? Apply ACID test to check whether the four properties hold or not ?

  b) During its execution, a transaction passes through several states. With the help of a state diagram, explain the various states.   **6**

c) Consider the following schedules :

s1 : r1(x);r2(z);r1(z);r3(x);r3(y);w1(x);c1;w3(y);c3;r2(y);w2(z);w2(y);c2;

s2 : r1(x);r2(z);r1(z);r3(x);r3(y);w1(x);w3(y);r2(y);w2(z);w2(y);c1;c2;c3;

Determine whether each schedule is strict, cascadeless, recoverable, or nonrecoverable. Are the schedules conflict serializable ? For each serializable schedule, determine the equivalent serial schedule.　8

8. a) Differentiate between wait-die and wound-wait schemes ?　4

   b) Produce a wait-for graph for the following transaction scenario and determine whether deadlock exists :

Transaction	Data item Locked by transaction	Data Item Transaction is waiting for
T1	X2	X1, X3
T2	X3, X10	X7, X8
T3	X8	X4, X5
T4	X7	X1
T5	X1, X5	X3
T6	X4, X9	X6
T7	X6	X5

Discuss two general techniques for handling deadlock

   1) time out
   2) deadlock detection and recovery.　6

   c) What benefit does rigorous – 2PL provide ? How does it compare with other forms of 2PL ?　4

   d) Discuss how serializability is used to enforce concurrency control in a database system. Why serializability is sometimes considered too restrictive as a measure of correctness for schedules ?　4

   e) What is meant by catastrophic failure ?　2