B.Tech. Degree IV Semester Special Supplementary Examination February 2020

CS/IT 15-1406 DATABASE MANAGEMENT SYSTEMS
(2015 Scheme)

Time: 3 Hours

Maximum Marks: 60

PART A
(Answer *ALL* questions)

(10 × 2 = 20)

I. (a) What is the difference between logical data independence and physical data independence?

   (b) Explain the distinction between disjoint and overlapping constraints.

   (c) Write the relational algebra to find the names of all depositors who have an account at the "Updown" branch.

   Use the Relations: **Account** (accountNumber,branchName,balance)

   Depositor (customerName,accountNumber)

   (d) Consider the following functional dependencies in a database:

   Date_of_Birth→Age, **Age**→Eligibility, **Name**→Roll_number,

   Roll_number→Name, **Course_number**→Course_name,

   Course_number→Instructor, **(Roll_number,Course_number)**→Grade.

   The relation (Roll_number,Name,Date_of_Birth,Age) is in Which Normal Form? Justify.

   (e) How does the concept of an object in the object-oriented model differ from the concept of an entity in the entity-relationship model?

   (f) When is it preferable to use a dense index rather than a sparse index? Explain your answer.

   (g) Suppose that we are using extendable hashing on a file that contains records with the following search-key values: 2, 3, 5, 7, 11, 17, 19, 23, 29, 31. Show the extendable hash structure for this file if the hash function is $h(x) = x$ **mod 8** and buckets can hold three records.

   (h) Write an SQL query to find all employee names who work in departments located at 'Calcutta' and whose salary is greater than ₹50000, in the following tables.

   EMP (Employee_no,Dept_no,Employee_name,salary)

   DEPT (Dept_no,Dept_name,Location)

   (i) Compare attribute and value set with examples.

   (j) Define Blocking Factor. Calculate the number of blocks required to store 120,000 records when the record size is 200 bytes and block size is 2400 bytes. Also find the unused space in each block.

(P.T.O.)

PART B

$(4 \times 10 = 40)$

II. (a) A university registrar's office maintains data about the following entities: (6)

      (i) courses, including number, title, credits, syllabus, and prerequisites

      (ii) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom

      (iii) students, including student-id, name, and program

      (iv) instructors, including identification number, name, department, and title

Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints.

  (b) Explain the three-tier client/server architecture. Where is it used? (4)

OR

III. (a) Differentiate between Weak entity type and Strong entity type with, examples. (5)

  (b) Design a generalization–specialization hierarchy for a motor-vehicle sales company. The company sells motorcycles, passenger cars, vans, and buses. Justify your placement of attributes at each level of the hierarchy. Explain why they should not be placed at a higher or lower level. (5)

IV. (a) What are the differences among primary, secondary and clustering Indexes? Which of the indexes are dense and which are not? (4)

  (b) An EMPLOYEE file has the following fields: SSN, 9 bytes; LASTNAME, 20 bytes; FIRSTNAME, 20 bytes; MIDDLE INIT, 1 byte; BIRTHDATE, 10 bytes; ADDRESS, 35 bytes; PHONE, 12 bytes; SUPERVISORSSN, 9 bytes; DEPARTMENT, 4 bytes; JOBCODE, 4 bytes; deletion marker, 1 byte. The EMPLOYEE file has r=30000 STUDENT records, fixed-length format, and unspanned blocking. The block size is B=2400 bytes. Write down appropriate formulas and calculate the following values for the above EMPLOYEE file: (6)

      (i) The record size R (including the deletion marker), the blocking factor bfr, and the number of disk blocks b.

      (ii) Calculate the wasted space in each disk block because of the unspanned organization.

      (iii) Calculate the average number of block accesses needed to search for an arbitrary record in the file, using linear search.

OR

V. (a) Write a brief note on Hashing. Explain the distinction between Internal hashing and external hashing. (5)

  (b) Consider a hash table of size 7 with hash function h(k)=k mod 7. Draw the hash table that results after inserting, in the given order, in the Following values: 19, 26, 13, 48, 17 for each of the three scenarios below: (5)

      (i) When collision are handled by separate chaining.

      (ii) When collisions are handled by linear probing.

      (iii) When collisions are handled by double hashing using a second Hash function h'(k) =5-(k mod 5).

VI. (a) Suppose you are given a relation R = (A, B, C, D, E) with the following functional dependencies: {CE →D, D→B, C →A} (4)

    (i) Find all candidate keys.

    (ii) Identify the best normal form that R satisfies (1NF, 2NF, 3NF or BCNF).

    (iii) If the relation is not in BCNF, decompose it until it becomes BCNF. At each step, identify a new relation, decompose and re-compute the keys and the normal forms they satisfy.

(b) Consider the following relations: (6)

    BOOKS (DocId, Title, Publisher, Year),

    STUDENTS (StId,StName,Major,Age)

    AUTHORS (AName, Address),

    borrows (DocId, StId, Date)

    has-written (DocId, AName),

    describes (DocId, Keyword)

Give an expression in the relational algebra for each of the following queries:

    (i) List all books published by McGraw-Hill before 1990.

    (ii) List the names of all students who have borrowed a book and who are CS majors.

    (iii) List the title of books written by the author 'Silberschatz'.

    (iv) List the name of those authors who are living in Davis.

OR

VII. (a) Write short note on Superkey, Candidate key, Primary key, and Foreign key with examples. (4)

(b) Consider the relational database of Figure below, where the primary keys are underlined. Give an expression in SQL for each of the following queries. (6)

    employee (person-name, street, city)

    works (person-name, company-name, salary)

    company (company-name, city)

    manages (person-name, manager-name)

    (i) Find the names of all employees who work for First Bank Corporation.

    (ii) Find the names and cities of residence of all employees who work for First Bank Corporation.

    (iii) Find the names, street address, and cities of residence of all employees who work for First Bank Corporation and earn more than $10,000 per annum.

    (iv) Find the names of all employees in this database who live in the same city as the company for which they work.

VIII. (a) List the ACID properties. Explain the usefulness of each. (5)

(b) For each of the following schedules, draw the precedence graph and determine whether the schedule is conflict serializable or not. If the schedule is conflict serializable, write the conflict equivalent serial schedule of transactions (e.g., T5; T7; T2). (5)

    (i) R1(A) W2(B) R2(A) W1(B) W3(B) W1(C) R3(B) W1(A)

    (ii) W2(C) R1(A) W3(B) R1(C) R3(B) R3(A) W1(B)

OR

IX. Why concurrency control is needed in database system? Explain any of the concurrency control techniques. (10)

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