MCA (Revised)

Term-End Examination

June, 2007

MCS-023 Ⓢ : DATABASE MANAGEMENT SYSTEMS

Time : 3 hours   *Maximum Marks : 100*
                                                                   (Weightage 75%)

Note :   *Question number 1 is* **compulsory**. *Attempt any* **three** *questions from the rest.*

1. (a)   Consider the data base :   10

STUDENT (Name, StudentNumber, Class, Major)

COURSE (CourseName, CourseNumber,
              CreditHours, Department)

SECTION (SectionIdentifier, CourseNumber,
              Semester, Year, Instructor)

GRADE_REPORT (StudentNumber,
                       SectionIdentifier, Grade)

PREREQUISITE (CourseNumber,
                       PrerequisiteNumber)

Specify the following queries in SQL :

(i) Retrieve the names of all senior students majoring in 'CS'.

(ii) Retrieve the names of all courses taught by Professor King in 1998 and 1999.

(iii) Retrieve the name and transcript (CourseName, CourseNumber, CreditHours, Semester, Year and Grade) of each student (CS = 5) majoring in CS.

(iv) Retrieve the names and major departments of all straight A students.

(v) For each section taught by Professor King, retrieve the CourseNumber, Semester, Year and number of students who took the section.

(b) Write short notes on :   *10*

(i) UNDO type and REDO type log entries

(ii) Transaction rollback and Cascading rollback

(iii) Two phase commit protocol for multi database transactions

(iv) Recovery from catastrophic failures

(v) Actions taken by read-item and write-item operations on a database

(c) A PARTS file with Part# as key field includes records with the following Part# values :   *10*

23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78, 15, 16, 20, 24, 28, 39, 43, 47, 50, 69, 75, 8, 49, 33, 38.

Suppose that the search field values are inserted in the given order in a B+ tree of order P = 4 and P_{leaf} = 3. Show how the tree will expand and what the final tree will look like.

(d) Consider the following relation for published books : *10*

Book (Book_title, Authorname, Book_type, Listprice, Author_affil, Publisher)

Author_Affil refers to the affiliation of author. Suppose the following dependencies exist :

Book_title → Publisher, Book_type

Book_type → Listprice

Authorname → Author_affil

(i) What normal form is the relation in ? Explain your answer.

(ii) Apply normalization until you cannot decompose the relation further. State the reasons behind each decomposition.

2. (a) What are the responsibilities of DBA and the database designers ? *5*

(b) What is the difference between controlled and uncontrolled redundancy ? Illustrate with examples. *5*

(c) Differentiate between the following : *10*

    (i) Database schema and Database state

    (ii) Procedural and Non procedural DMLs

    (iii) Generalization and Specialization

    (iv) Relationship instance, Relationship type and a Relationship set

    (v) Weak entity and Strong entity

3. (a) What is the difference between a key and a superkey ? Define primary key, candidate key and foreign key. *5*

(b) Consider the Library relational schema shown below : *10*

BOOK (Bookid, Title, PublisherName)

BOOK_AUTHORS (Bookid, AuthorName)

PUBLISHER (Name, Address, Phone)

BOOK_COPIES (Bookid, Branchid, No_of_copies)

BOOK_LOANS (Bookid, Branchid, CardNo, Dateout, Duedate)

LIBRARY_BRANCH (Branchid, BranchName, Address)

BORROWER (CardNo, Name, Address, Phone)

Write down the relational expressions for the following queries :

(i) How many copies of the book titled 'The Lost Tribe' are owned by the Library branch whose name is 'Sharpstown'.

(ii) How many copies of the same book are owned by each branch ?

(iii) Retrieve the names of all borrowers who do not have any books checked out.

(iv) For each book that is loaned out from the 'Sharpstown' branch and whose due date is today, retrieve the book title, the borrower's name and the borrower's address.

(v) For each library branch, retrieve the branch name and the total number of books loaned out from that branch.

(c) Consider the tables T_1 and T_2: 5

T_1

P	Q	R
10	a	5
15	b	8
25	a	6

T_2

A	B	C
10	b	6
25	c	3
10	b	5

Show the results of the following operations :

(i) $T_1 \underset{(join)}{\bowtie} T_1 . P = T_2 . A \quad T_2$

(ii) $T_1 \underset{(join)}{\bowtie} T_1 . Q = T_2 . B \quad T_2$

(iii) $T_1 \bowtie T_1 . P = T_2 . A \quad T_2$
        (left outer join)

(iv) $T_1 \bowtie T_1 . Q = T_2 . B \quad T_2$
        (right outer join)

(v) $T_1 \cup T_2$

4. (a) Define first, second and third normal forms when only primary keys are considered. How do general definitions of 2NF and 3NF, which consider all keys of a relation, differ from those that consider only primary key ?   *5*

(b) Define Boyce – Codd normal form. How does it differ from 3NF ? Why is it considered a stronger form of 3NF ?   *5*

(c) A file has r = 20,000 STUDENT records of fixed length. Each record has the following fields :   *10*

NAME (30 bytes), SSN (9 bytes),
ADDRESS (40 bytes), PHONE (9 bytes),
BIRTHDATE (8 bytes), SEX (1 Byte),
MAJORDEPTCODE (4 bytes),
MINORDEPTCODE (4 bytes),
CLASSCODE (4 bytes, integer) and
DEGREEPROGRAM (3 bytes). An additional byte is used as deletion marker.

The file is stored on a disk with the following characteristics :

Block size = 512 bytes, Inter Block gap = 128 bytes, number of blocks per track = 20, number of tracks per surface = 400. A disk pack consists of 15 double sided disks.

(i) Calculate the record size R in bytes.

(ii) Calculate the blocking factor (bfr) and the number of file blocks b, assuming an unspanned organization.

(iii) Calculate the average time it takes to find a record doing a linear search on the file if

    (a) File blocks are stored contiguously and double buffering is used.

    (b) The file blocks are not stored contiguously.

(iv) Assume that the file is ordered by SSN; calculate the time it takes to search for a record given its SSN value, by using a binary search.

5. Write short notes on :   5×4=20

(i) Wait die and wound-wait protocols that avoid deadlock and starvation.

(ii) UNDO/REDO recovery based on Immediate update in single user environment and with concurrent execution.

(iii) Data fragmentation techniques for distributed database design.

(iv) 3-tier Client Server Architecture.

(v) Advantages and disadvantages of DDBMS.