This question paper contains 8 printed pages.]

1798 *Your Roll No. .....*

B.Sc. (Hons.) Computer Science / V Sem. A

Paper 501 – FILE STRUCTURES AND DATABASE SYSTEMS

(Admissions of 2001 and onwards)

Time : 3 Hours *Maximum Marks : 75*

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

*Attempt **all** questions.*

Parts of a question must be answered together.

1. (a) Give three examples where use of null values would be appropriate. 2

   (b) Differentiate between the following:

   (i) procedural language and non-procedural language

   (ii) specialization lattice and specialization hierarchy

   (iii) entity type and entity set

   (iv) centralized and distributed DBMS 6

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(c) Single relations can be created by mapping which of the following types of specialization / generalization and why?

(i) total and disjoint

(ii) partial and disjoint

(iii) total and overlapping

(iv) partial and overlapping 3

(d) Define the following:

(i) metadata

(ii) complex attributes 2

2. (a) Consider a university database for scheduling of classrooms for final exams. This database could be modeled as consisting of following entities:

- exam with attributes course-number, section-number, room-number and date and time.
- course with attributes course-number, name and department
- section with attributes section-number and enrolment-number
- room with attributes room-number, capacity and building

Draw the ER diagram for the database. Also specify the participation and structural constraints. State your own assumptions wherever required. 6

(b) Map the ER Diagram given below into relations: 6

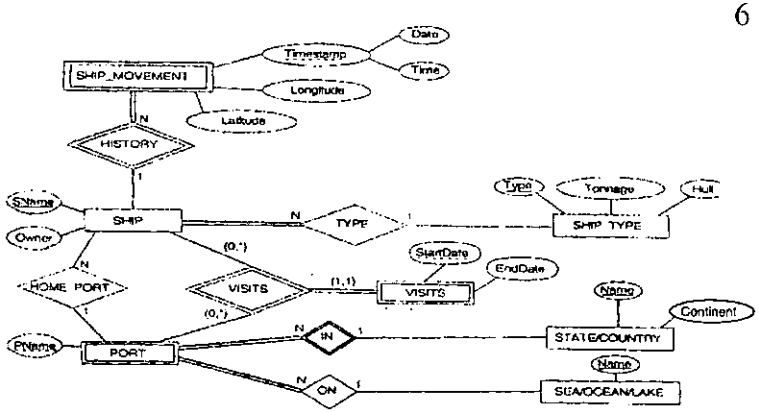

Fig. 1

3. Consider the following schema (underlined attributes are the primary keys) :

- student (student-id, student-name, sex, birth-date, GP A, joining-date)
- dept (dept-name, HOD)
- course (course-no, dept-name, course-name)
- enroll (student-id, dept-name, course-no, grade)

(a) Give SQL statements to create tables for the above schema. Add appropriate primary and foreign key constraints and also add the following constraints:

- Age should not be less than 21 years. (difference of at least 21 years between birth-date and joining-date)
- Course-no should be between 101 and 120.

- Student-name should be unique. 4+2

(b) Specify the following queries in SQL:

- Print the course names, course numbers of courses having less than eight students enrolled in these courses.
- Print the student-id, student-name and HOD of the department, the courses of which are taken by the students.
- Print the details of youngest student of Physics department.
- Print the student-id, name, and GPA of the students who are currently taking a course of the computer science department. 8

4. (a) Consider the following relation for published books:

BOOK (Book_title, Author_name, Book_type, Listprice, Author_affil, Publisher)

Author-affil refers to the affiliation of the author.

Suppose the following dependencies exist:

Book_title -> (Publisher, Book_type)

Book_type -> Listprice

Author_name -> Author-affil

- Determine the key(s) for this relation BOOK.

- Decompose relation BOOK into 3NF and BCNF relations. 5

(b) Find out the minimal set of functional dependencies for the following set of functional dependencies:

F = {SSN→(ename,bdate,add,dnum,),

dnum→(dname,dmgrssn),

SSN→dname

} 3

(c) Consider the following relation of the Fig.2 given below:

A	B	C
10	b1	c1
10	b2	c2
11	b4	c1
12	b3	c4
13	b1	c1
14	b3	c4

Fig. 2

Given the above extension, which of the following dependencies may hold in the above relation? If the dependency does not hold, explain why, by specifying the violating tuple of the given relation.

- $A \rightarrow B$
- $B \rightarrow C$
- $C \rightarrow B$
- $C \rightarrow A$ 4

5. (a) Consider the two union compatible relations Rl and R2 shown in Fig.3. Show the results of the following operations:

i) Rl *left outer join* R2 where Rl.X= R2.Q

ii) Rl Union R2

Rl

X	Y	Z
5	3	6
10	7	9
5	2	7

R2

P	Q	R
5	3	6
10	7	12
15	2	8

Fig. 3 3

(b) EMPLOYEE (employee-name, street, city)

WORKS (employee-name, company-name, salary)

COMPANY (company-name, city)

MANAGES (employee-name, manager-name)

Consider the above relational database. Give relational algebra expressions for the following queries:

(i) Find the names of all employees who do not work for First Bank Corporation.

(ii) Find the name, street and city of all employees who work for First Bank Corporation and earn more than Rs. 10,000.

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

(iv) Find the names of all employees who live in the same city and on the same city as do their manager. 6

6. (a) Explain linear hashing technique with an appropriate example. 3

(b) Consider a disk with block size B=512 bytes. A file has r =30000 STUDENT records of fixed-length. Each record has the following fields: 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 a deletion marker. The file is stored on the disk.

- Calculate the record size R in bytes.

- Calculate the blocking factor **bfr** and the number of file blocks **b**, assuming an unspanned organization. 3

(c) Consider a disk with block size B=512 bytes. A block pointer is P = 6 bytes long, and a record pointer is PR = 7 bytes long. Consider the file specifications given in Q6 (b) above and calculate

(i) the orders of the B + tree (internal nodes as well as leaf nodes);

(ii) the number of leaf-level blocks needed if blocks are approximately 75% full (rounded up for convenience);

(iii) the total number of blocks required by the B + –tree; 6

(d) Differentiate between the following:

(i) Primary and secondary index

(ii) static hashing and dynamic hashing 3