*This question paper contains **8+3** printed pages]

Your Roll No. .....

8861

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

Paper—CS 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.)

Part A is compulsory. Attempt any *four* questions from Part B.

Parts of a question should be answered together.

Part A

1. (*a*) Describe the following notions in approximately **30** words each :

(*i*) Metadata

(*ii*) Data model

(*iii*) Query compiler. 6

P.T.O.

(*b*) Consider a MOVIE database in which data is recorded about the movie industry. The data requirements are as follows :

- Each movie is identified by title and year of release and has a production company and genre (horror, action, drama etc.). Each movie has one or more directors and one or more actors appearing in it.
- Actors are identified by name and date of birth and appear in one or more movies. Each actor has a role in the movie.
- Directors are also identified by name and date of birth and direct one or more movies.
- Production companies are identified by name and each has an address and it can produce one or more movies.

Draw an ER diagram and specify appropriate min, max constraints. 6

(c) Consider the following Relational Database :

employee (person-name, street, city)

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

company (company-name, city)

manager (person-name, manager-name)

Write Relation algebra expression for the following queries :

(i) Find company name with least number of employees.

(ii) Find number of employees working and living in same city.

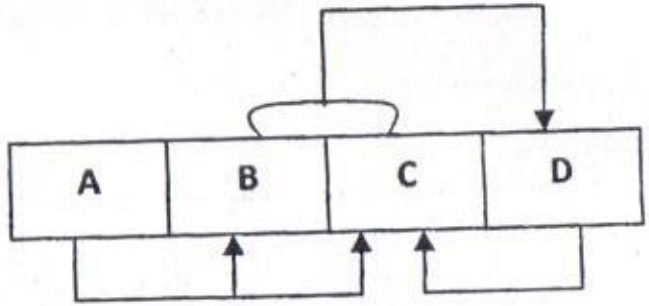
(iii) Count number of persons working under manager 'Mr. Smith'. 2×3=6

P.T.O.

(d) (i) State Armstrong's Inference rules. 3

(ii) "A single level index is more efficient than a multilevel index." Comment whether the statement is true or false. Why ? 3

(e) Given the following dependencies on R (A, B, C, D) :



(i) What normal form is the relation in ? Justify.

(ii) Apply normalization until you cannot decompose it further stating reasons for decomposition. 2+4

(*f*) What is a Dense index ? Illustrate with the help of an example, what is the use of creating such indexes ? 2+3

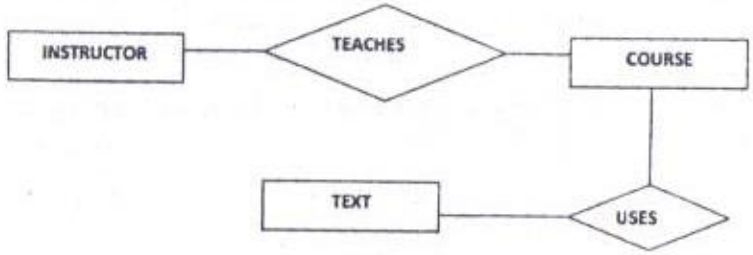
Part B

2. (*a*) Who are parametric end users ? What kind of interfaces need to be designed for them ? Contrast these interfaces with the interfaces used for a DBA. 4

(*b*) Differentiate between the following (any *two*) :

- Logical data independence and Physical data independence
- Database state and database schema
- Federated and homogeneous distributed DBMS. 6

3. (*a*) Consider the following ER-diagram. Assume that a course may or may not use a textbook, but that a text by definition is a book that is used in some course. A course may not use more than five books. Instructors teach from two to four courses.



Supply (min, max) constrains on this diagram. State clearly any additional assumptions you make. 4

(*b*) Illustrate the following with an example. Also specify notation used for each in ERD (any *four*) :

(*i*) Derived attribute

(*ii*) Composite attribute

(*iii*) Multivalued attribute

(*iv*) UNARY relationship

(*v*) Ternary relationship

(*vi*) Role names. 6

4. (*a*) Consider a disk with block size B = 512 bytes. A block pointer is P = 6 bytes long and a record pointer PR = 7 bytes long. A file has r = 30,000 employee records of fixed length. Each record has the following fields :

Name (30 bytes), SSN (9 bytes), Depttcode (9 bytes), Address (40 bytes), Phone (9 bytes), Birthdate (8 bytes), Sex (1 byte), 10bcode (4 bytes), Salary (4 bytes, real number).

An additional byte is used as deletion marker.

Suppose file is ordered by key field SSN and primary index on SSN is to be constructed. Calculate :

(*i*) the blocking factor bfr and the index blocking factor bFr_i 2

(*ii*) the number of first-level index entries and no. of first-level index blocks. 2

(*iii*) No. of levels needed if using multilevel index. 2

(*b*) What is hashing ? What are collisions ? How can they be avoided ? 4

5. (*a*) A part file with P# as key field includes records with the following P# value : 23, 65, 37, 60, 46, 92, 48, 71.

Suppose that search field values are inserted in the given order in a B+ tree with p = 4 and Pleaf = 3. Show how the tree will expand and what the final tree will look like. 6

(*b*) What are the three different types of anomalies that would arise in the following Relation :

EMP_PROJ (Emp#, Proj#, Ename, Pname, No_hours)

Illustrate your answer with the help of a sample database. 4

6. (*a*) Calculate the order p of a B and B^+ tree whose search key field V = 8 bytes, record pointer = 6 bytes, Block size = 512 bytes and block pointer = 6 bytes. 4

(*b*) A PARTS file with Part# as hash key includes records with the following Part# values : 2369, 3760, 4692, 4871, 5659, 1821, 1074, 7115, 1620, 2428, 3943, 4750, 6975, 4981, 9208. The file uses eight buckets numbered 0 to 7. Each bucket is one disk block and holds two records. Load these records into the file in the given order using the hash function h(k) = k mod 8. Calculate the average number of block accesses for a random retrieval on Parts. 6

7. (*a*) Student(Rollno, sname, deptno, bdate, address)

Dept(Dnumber, dname, d_incharge)

Course(courseno, cname, offeringdno)

Teacher(tid, tname, Ph#, Dno)

TaughtBy(tid, rollno, cno, t_session)

Consider the above relational schema and write the following SQl queries (any *three*) :

- Retrieve the department name, department incharge and the courses offered by the department.
- Retrieve the total no. of students taught by each teacher.
- Retrieve the students born in 1995.
- Set the phone number to 9999911111 for teacher with tid = 101. 6

(*b*) Given a Relational Scheme R = (A, B, C, D, E) with FDS :

$f = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$

(*i*) Find candidate keys of R.

(*ii*) Compute canonical/minimal cover Fc.

(*iii*) What normal form is **R** in ? Normalize it further till it cannot be decomposed. 1+1+2 5

ds

6

.O.