

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), April 2018
B. Tech in Computer Science and Engineering, Semester: IV

Roll No.....

CSESP401: Information Management Basics

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1 Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. Tree structures are used to store data in
 - (A) Network model.
 - (B) Relational model.
 - (C) Hierarchical model.
 - (D) File based system
- ii. What is a disjoint less constraint?
 - (A) It requires that an entity belongs to no more than one level entity set.
 - (B) The same entity may belong to more than one level.
 - (C) The database must contain an unmatched foreign key value.
 - (D) An entity can be joined with another entity in the same level entity set.
- iii. What is data integrity?
 - (A) It is the data contained in database that is non redundant.
 - (B) It is the data contained in database that is accurate and consistent.
 - (C) It is the data contained in database that is secured.
 - (D) It is the data contained in database that is shared.
- iv. If the closure of an attribute set is the entire relation then the attribute set is a
 - (A) superkey
 - (B) candidate key
 - (C) primary key
 - (D) not a key
- v. Which one is correct statement?

Logical data independence provides following without changing application programs:

 - (i) Changes in access methods.
 - (ii) Adding new entities in database
 - (iii) Splitting an existing record into two or more records
 - (iv) Changing storage medium
 - (A) (i) and (ii)
 - (B) (iv) only,
 - (C) (i) and (iv)
 - (D) (ii) and (iii).

- vi. Which one is true statement :
 - (A) With finer degree of granularity of locking a high degree of concurrency is possible.
 - (B) Locking prevents non - serializable schedules.
 - (C) Locking cannot take place at field level.
 - (D) An exclusive lock on data item X is granted even if a shared lock is already held on X.
- vii. Maximum height of a B+ tree of order m with n key values is
 - (A) $\log_m(n)$
 - (B) $(m+n)/2$
 - (C) $\log_{m/2}(m+n)$
 - (D) None of these
- viii. Which of the following is not a characteristic of a relational database model?
 - (A) Table
 - (B) Tree like structure
 - (C) Complex logical relationship
 - (D) Records
- ix. Which is the best file organization when data is frequently added or deleted from a file?
 - (A) Sequential
 - (B) Direct
 - (C) Index sequential
 - (D) None of the above
- x. Which of the following is not a recovery technique?
 - (A) Deferred update
 - (B) Immediate update
 - (C) Two-phase commit
 - (D) Shadow paging

Q.2 Short answer type questions (5 questions @ 2 marks)

10

- i. How a file-processing system and a DBMS are different from each other.
- ii. Explain what is meant by repetition of information and inability to represent information. Explain why each of these properties may indicate a bad relational database design.
- iii. When is it preferable to use a dense index rather than a sparse index? What is the difference between a clustering index and a secondary index?
- iv. Explain the ACID properties for the transaction with its importance.
- v. Under what conditions is it less expensive to avoid deadlock than to allow deadlocks to occur and then to detect them?

Consider the following relations containing airline flight information:

Flights(flno, from, to, distance, departs, arrives)

Aircraft(aid, aname, cruisingrange)

Certied(eid, aid)

Employees(eid, ename, salary)

- Q.3 Write the following queries in relational algebra based above airline flight schema: 10
- a) Find the eids of pilots certified for some Boeing aircraft.
 - b) Find the names of pilots certified for some Boeing aircraft.
 - c) Find the aids of all aircraft that can be used on non-stop flights from Bonn to Madras.
 - d) Identify the flights that can be piloted by every pilot whose salary is more than \$100,000.
 - e) Find the names of pilots who can operate some plane with a range greater than 3,000 miles but are not certified on any Boeing aircraft.

Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft (otherwise, he or she would not qualify as a pilot), and only pilots are certified to fly.

OR

- Q.3 Consider the following relational schema for a library: 10
- member(memb no, name, dob)
books(isbn, title, authors, publisher)
borrowed(memb no, isbn, date)

Write the following queries in relational algebra.

- a) Find the names of members who have borrowed any book published by "McGraw-Hill".
- b) Find the name of members who have borrowed all books published by "McGraw-Hill".
- c) Find the name and membership number of members who have borrowed more than five different books published by "McGraw-Hill".
- d) For each publisher, find the name and membership number of members who have borrowed more than five books of that publisher.
- e) e. Find the average number of books borrowed per member. Take into account that if a member does not borrow any books, then that member does not appear in the borrowed relation at all.

- Q.4A Give an example of a relation schema R' and set F' of functional dependencies such that there are at least three distinct lossless decompositions of R' into BCNF. 5

- Q.4B If deadlock is avoided by deadlock-avoidance schemes, is starvation still possible? Explain your answer. 5

OR

- Q.4B Most implementations of database systems use strict two-phase locking. Suggest three reasons for the popularity of this protocol. 5

- Q.5A Explain why the allocation of records to blocks affects database-system performance significantly. 5

Q.5B Suppose that a page can contain at most four data values and that all data values are integers. Using only B+ trees of order 2, give examples of each of the following: 5

- a) A B+ tree whose height changes from 2 to 3 when the value 25 is inserted. Show your structure before and after the insertion.
- b) A B+ tree in which the deletion of the value 25 leads to a redistribution. Show your structure before and after the deletion.

OR

Q.5B Suppose that we are using extendable hashing on a file that contains records with the following search-key values: 5

2, 3, 5, 7, 11, 17, 19, 23, 29, 31

Show the extendable hash structure for this file if the hash function is

$$h(x) = x \bmod 8$$

and buckets can hold three records.

Q.6A Consider the following two transactions: 5

```
T1: read(A);
    read(B);
    if A = 0 then B := B + 1;
    write(B).
T2: read(B);
    read(A);
    if B = 0 then A := A + 1;
    write(A).
```

Add lock and unlock instructions to transactions T1 and T2, so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock?

Q.6B During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain why each state transition may occur. 5

OR

Q.6B Explain why the read-committed isolation level ensures that schedules are cascade-free. 5

Q. 7, 8 and 9 are based on following case study:

Computer Sciences Department frequent fliers have been complaining to Dane County Airport officials about the poor organization at the airport. As a result, the officials have decided that all information related to the airport should be organized using a DBMS, and you've been hired to design the database. Your first task is to organize the information about all the airplanes that are stationed and maintained at the airport. The relevant information is as follows:

- Every airplane has a registration number, and each airplane is of a specific model.
- The airport accommodates a number of airplane models, and each model is identified by a model number (e.g., DC-10) and has a capacity and a weight.

- A number of technicians work at the airport. You need to store the name, SSN, address, phone number, and salary of each technician.
- Each technician is an expert on one or more plane model(s), and his or her expertise may overlap with that of other technicians. This information about technicians must also be recorded.
- Traffic controllers must have an annual medical examination. For each traffic controller, you must store the date of the most recent exam.
- All airport employees (including technicians) belong to a union. You must store the union membership number of each employee. You can assume that each employee is uniquely identified by the social security number.
- The airport has a number of tests that are used periodically to ensure that airplanes are still airworthy. Each test has a Federal Aviation Administration (FAA) test number, a name, and a maximum possible score.
- The FAA requires the airport to keep track of each time that a given airplane is tested by a given technician using a given test. For each testing event, the information needed is the date, the number of hours the technician spent doing the test, and the score that the airplane received on the test.

- Q.7 Design a conceptual schema and draw an ER diagram for Dane County Airport. Be sure to indicate all key and cardinality constraints and any assumptions that you make. Identify any constraints that you are unable to capture in the ER diagram 10
- Q.8 Map E-R designed in Relational Table. 10
- Q.9 (a) List Functional Dependencies in Each Table and Normalize the Relation. 20
(b) Prepare detailed Data Dictionary.