

Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech/ME (CSE/IT/SE)/SEM-2/PGCSE-203A/PGIT-201/PGSE-201/2010

**2010**

**ADVANCED DATABASE MANAGEMENT**

Time Allotted : 3 Hours

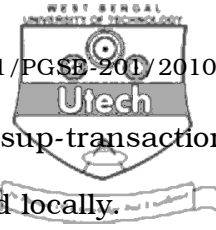
Full Marks : 70

*The figures in the margin indicate full marks.*

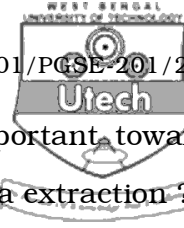
*Candidates are required to give their answers in their own words as far as practicable.*

Answer Question No. 1 and any *four* from the rest.

1. Comment on the correctness of any *ten* of the following statements : 10 × 2 = 20
- i) A distributed database system allows applications to access data from local and remote sites in an integrated manner.
  - ii) Data in a typical data warehouse is only accessed for reading and not modified.
  - iii) A horizontal fragmentation is produced by specifying a predicate that performs a restriction on the tuples in a relation.
  - iv) Normalization is a formal process of designing databases in a manner that completely eliminates redundancy.



- v) In a distributed environment, a local sub-transaction may be aborted even after it is committed locally.
- vi) Join operation should be done after selection, projection and union operations for distributed database systems.
- vii) Relational model is ideally suitable for handling loosely structured data items.
- viii) In case of statistical database, imposing limit only on the size of sets about which statistics can be taken is not enough, but also the size of intersection of two sets that are queried need to be limited to make the compromise of the database arbitrarily difficult.
- ix) Since the same fragment may reside in multiple sites, redundancy control is not at all an objective for designing distributed database systems.
- x) Horizontal fragments are necessarily disjoint.
- xi) Isolation facilitates concurrent execution of transactions.
- xii) A distributed database has a lesser security threat than a centralized database.



2. a) What is data cleaning ? Why is it important towards building a data warehouse ? What is data extraction ?

b) M/s DKB Ltd. is a retail-outlet chain that sales products of 8 different types across the country. The company decides to build a data cube to store the total monthly sales volume for each of the 12 shops in 3 different cities for last 10 years. Draw a data-cube as specified.

c) Design an equivalent Star Schema representation for the retail business of M/s DKB Ltd. as stated above.

State your assumptions, if any.

6 + 6  $\frac{1}{2}$

3. a) Describe the objectives of data distribution.

b) What are the effects of replication of fragmentation ? How many types of fragmentations are possible ? Explain in brief.

c) What is the importance of the three different layers of the reference architecture for the distributed DBMS ?

d) Given relation R and S, comment on the correctness of the following two transformations :

$$i) \quad PJ_{A1}SL_{F2}R \Rightarrow SL_{F2}PJ_{A1}R$$

$$ii) \quad SL_F(R \cup S) \Rightarrow SL_{FR}(R) \cup SL_{FS}(S).$$

2 + 5 + 3 + 2  $\frac{1}{2}$



4. a) Consider the following global, fragmentation and allocation schema :

Global schema :

Student (Roll, Name, coursename, admission\_yr, DOB)

Fragmentation schema :

Student<sub>1</sub> = SL<sub>coursename</sub> = "MCA" (PJ<sub>roll, name, coursename</sub> (Student))

Student<sub>2</sub> = SL<sub>coursename</sub> = "M.Tech" (PJ<sub>roll, name, coursename</sub> (Student))

Student<sub>3</sub> = SL<sub>coursename</sub> = "B.Tech" (PJ<sub>roll, name, coursename</sub> (Student))

Allocation schema :

Student<sub>1</sub> at sites 1, 2

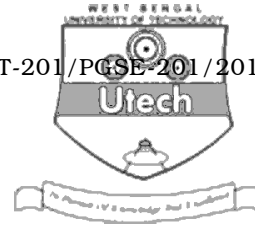
Student<sub>2</sub> at sites 3, 4

Student<sub>3</sub> at sites 5, 7

Assume that MCA, B.Tech, M.Tech are the only possible values for the course name.

- i) Write a query that accepts the roll number of student and outputs the name, coursename, DOB and year of admission of the student, at levels fragment, location, and local mapping transparency.
  - ii) Write an application for moving a student from M.Tech to MCA where the student roll is 11, at different levels of data distribution transparency.
- b) Consider an additional relation library (Roll, bookname, borowdate, returndate) that stores library records of a student. Define a derived fragmentation schema to split this table in a manner such that records for students belonging to the three courses are kept separately in two different fragments.

$$(5 + 5) + 2\frac{1}{2}$$



5. a) Consider the following transactions :

T1 : { Read (X), Write (X), Commit }

T2 : { Write (X), Write (Y), Read (Z), Commit }

T3 : { Read (X), Read (Y), Read (Z), Commit }

Write a serial schedule involving T1, T2, and T3.

- b) Determine whether the following schedules are serializable or not :

S1 : Ri (X), Wi (X), Rj (X), Wj (X)

S2 : Rj (X), Wj (X), Ri (X), Wi (X).

- c) How are the disadvantages of 2PL overcome in strict 2PL ?  $5 + 5 + 2\frac{1}{2}$

6. a) Briefly describe the methodology for identification of primary horizontal fragments towards the design of a distributed database system.

- b) Explain the significance of derived fragmentation towards efficient design of a distributed database system, using a suitable example.

- c) In the context of distributed database design, why is it important to identify which part of application data are read-only items ?  $6 + 6 + 2\frac{1}{2}$



7. Consider the reservation system for a travel agency operating conducted tours from different cities. The information to be stored is given below :

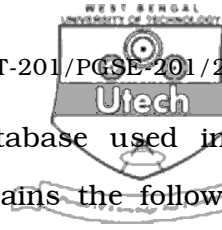
- Tour information : Tour id, duration, journey date, city of departure, total number of seats, number of seats reserved and cost for the tour
- Customer information : Customer id, name, address, phone number, email address
- Reservation description : Customer id, tour id, advance amount.

Design a distributed database solution for booking counters across the country considering the following frequent queries/operations :

- Availability of seats : Booking information on a particular tour from a specific departure city is displayed on the screen.
- Request for reservation : Checking for and inserting data for new customers; checking for availability of seats, inserting reservation description.

Your design should include the definition of global schema, fragmentation schema and allocation schema. State your assumptions clearly.

12  $\frac{1}{2}$



8. Design the relational schema for a database used in a hospital management system which contains the following information :

For each doctor : doctor id, specialization, address, phone

For each patient : patient\_id, doctor\_id, last\_visit\_dat, address, disease, phone, DOB

For each medicine : stock\_no, date\_of\_expiry, supplier\_name, quantity\_in\_stock

Show the most important functional dependencies. State any assumption you make regarding dependencies. Explain Multivalued dependency using this example. How would you remove the MVD to arrive at a normalized relation ?

$$6 + 4 + 2\frac{1}{2}$$

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