



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech (IT)/SEM-6/IT-604/2010  
2010**

## **DATABASE MANAGEMENT SYSTEM**

*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.*

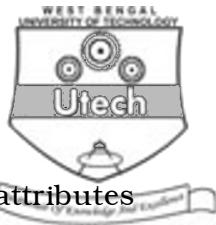
### **GROUP – A**

#### **( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following :

$10 \times 1 = 10$

- i) A table can have only one
  - a) Primary key
  - b) Candidate key
  - c) Super key
  - d) all of these.
- ii) What is a RDBMS terminology for a set of legal values that an attribute can have ?
  - a) Tuple
  - b) Relation
  - c) Attribute
  - d) Domain.
- iii) What is the smallest unit of data in a relational model ?
  - a) Data type
  - b) Field
  - c) Data value
  - d) None of these.



- iv) The word 'loss' in lossless refers to  
a) loss of information      b) loss of attributes  
c) loss of relations      d) none of these.
- v) SELECT operation in SQL is a  
a) data query language  
b) data definition language  
c) data manipulation language  
d) data control language.
- vi) 2NF is always in  
a) 1NF                          b) BCNF  
c) MVD                          d) none of these.
- vii) When all the attributes in a relation describe and depend upon the primary key, the relation is said to be in  
a) 1NF                          b) 2NF  
c) 3NF                          d) 4NF.
- viii) The concurrency control has the problem of  
a) lost updates              b) dirty read  
c) unrepeatable read        d) all of these.
- ix) What separates the physical aspects of data storage from the logical aspects of data representation ?  
a) Data b) Schema  
c) Constraints              d) Relationship.
- x) What schema defines how and where the data are organized in a physical data storage ?  
a) External                    b) Internal  
c) Conceptual                d) None of these.



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**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

$3 \times 5 = 15$

2. a) Define 'meta data'.  
b) What is the difference between 'Strong Entity Set' & Weak Entity Set' ?  $2 + 3$
3. Discuss the entity integrity and referential integrity constraints. Why is each considered important ? Explain with suitable example.
4. Write the concepts of dense index and sparse index with example. When is it preferable to use a dense index rather than a sparse index ? Explain.
5. Define BCNF. How does it differ from 3NF ? Why is it considered stronger from 3NF ?
6. With suitable examples, show how recovery in a database system can be done using LOG files with —
  - a) immediate updation
  - b) deferred updation.  $2 \times 2 \frac{1}{2}$

**GROUP – C**

**( Long Answer Type Questions )**

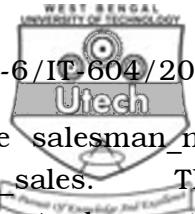
Answer any *three* of the following.

$3 \times 15 = 45$

7. a) Consider the relational database as given below and write down expressions in relational algebra for the following queries.  
Material\_Master ( item\_id, item\_name, reorder\_level )  
Material\_Dts ( item\_id, Supplier\_id, Purchase\_date, Qty, Utcost )
  - i) Select the quantities of each purchased material alphabetically.
  - ii) Select the names of materials which have the highest total quantity.
  - iii) Replace the material name 'power supply' with 'UPS'.
  - iv) Increase the quantities of material purchased by 'ABC' for all purchases done after February, 2003.



- b) Give an example of derived attribute.
- c) Design a Generalization-Specialization hierarchy for a motor-vehicle sales company. The company sells motorcycles, passenger cars, vans, buses. Justify your placement of attributes at each level of the hierarchy.
- d) List two reasons why 'null' values might be introduced into the database ? 6 + 2 + 5 + 2
8. a) Consider the following relations and write queries in SQL :
- Flights (flno, from, to, distance, departs, arrives, price)
- Aircraft (aid, aname, cruising\_range)
- Certified (eid, aid)
- Employees (eid, ename, salary)
- i) Identify the flights that can be piloted by every pilot whose salary is more than \$1,00,000.
- ii) Find the eids of employees who make the second highest salary.
- iii) Print the names and salary of every non-pilot whose salary is more than the average salary for pilots.
- iv) For all aircraft with cruising\_range over 1000 miles, find the name of the aircraft and the average salary of all pilots certified for this aircraft.
- v) Find the names of pilots who can operate planes with a range greater than 3000 miles but are not certified on any Boeing aircraft.
- b) Specify the query in SQL to declare a 'Cursor' to find names & cities of residence of customers who have both an account and a loan at a particular bank branch in the same city as that customer.



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- c) The salesman\_master table records the salesman\_no, name, rate\_of\_commission, qtd\_sales. The commission\_amount and date\_of\_payment along with the salesman\_no is calculated and recorded in commission\_payable table.

Write a PL/SQL block of code such that depending upon the user entered salesman\_no, the commission\_amount is calculated and inserted into the commission\_payable table. If the user enters a salesman\_no that is not in the salesman\_master table, then the PL/SQL block must display appropriate error message back to the user.

- d) What is a trigger ?

Consider the following relational schema :

An employee can work in more than one department ; the pct\_time field of the works relation shows the percentage of time that a given employee works in a given department :

Emp (eid, ename, age, salary)

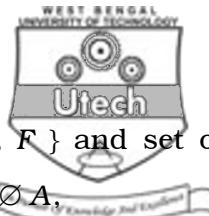
Works (eid, did, pct\_time)

Dept (did, budget, managerid)

Write a Trigger to ensure each of the following requirements, considered independently.

- i) Employees must make a minimum salary of \$1000.
- ii) Every manager must also be an employee.
- iii) The total percentage of all appointments for an employee must be under 100%
- iv) A manager must always have a higher salary than any employee that he or she manages.

5 + 3 + 3 + 4



9. a) For a given Relvar  $R = \{ A, B, C, D, E, F \}$  and set of functional dependencies  $F = \{ AB \not\rightarrow C, C \not\rightarrow A, BC \not\rightarrow D, ACD \not\rightarrow B, BE \not\rightarrow C, CE \not\rightarrow FA, CF \not\rightarrow BD, D \not\rightarrow EF \}$ , find the irreducible set & candidate keys.
- b) Use the definition of functional dependency to argue that each of Armstrong's axioms (reflexivity, augmentation, pseudo-transitivity, union & decomposition) are sound.
- c) Explain the following terms 'partial functional dependency' and 'non-transitive dependency' with examples.
- d) Consider the following proposed rule for functional dependencies :

If  $A \not\rightarrow B$  and  $C \not\rightarrow B$ , then  $A \not\rightarrow C$ . Prove that this rule is not sound by showing a relation  $r$  that satisfies  $A \not\rightarrow B$  and  $C \not\rightarrow B$ , but does not satisfy  $A \not\rightarrow C$ .

4 + 5 + 3 + 3

10. a) Consider the relation  $R ( A, B, C, D, E )$  with the set of  $F = \{ A \not\rightarrow C, B \not\rightarrow C, C \not\rightarrow D, DC \not\rightarrow C, CE \not\rightarrow A \}$ . Suppose the relation has been decomposed by the relations  $R1 ( A, D )$ ,  $R2 ( A, B )$ ,  $R3 ( B, E )$ ,  $R4 ( C, D, E )$  and  $R5 ( A, E )$ . Is this decomposition lossy or lossless ? Justify your answer.



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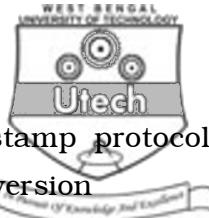
- b) Given a database schema named PLANE\_INFO (flight\_no, date, plane, airline, from, to, miles), the functional dependency diagram is given below :

Dia.

Decompose it up to Boyce-Codd Normal Form ( BCNF ).

- c) If  $D$  be the set of all functional and multivalued dependencies then write down the rules to compute the  $D^+$  ( Closure of  $D$  ).
- d) Suppose you are given a relation  $R$  with four attributes,  $ABCD$ . For each of the following sets of FD's, assuming those are the only dependencies that hold for  $R$ , do the following :
- Identify the candidate key(s) for  $R$ .
  - Identify the best normal form that  $R$  satisfies ( 1NF, 2NF, 3NF, BCNF ).
  - If  $R$  is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies :
    - $C \not\rightarrow D, C \not\rightarrow A, B \not\rightarrow C$
    - $B \not\rightarrow C, D \not\rightarrow A$
    - $ABC \not\rightarrow D, D \not\rightarrow A$
    - $A \not\rightarrow B, BC \not\rightarrow D, A \not\rightarrow C$
    - $AB \not\rightarrow C, AB \not\rightarrow D, C \not\rightarrow A, D \not\rightarrow B$ .

3 + 3 + 4 + 5



11. a) Distinguish between locking and timestamp protocols for concurrency controls. Explain multi-version two-phase locking.
- b) Describe the wait-die and wound-wait protocols for deadlock prevention.
- c) Define three concurrency problems, dirty read, non-repeatable read, phantoms.
- d) Consider the following *two* transactions :

```
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  $T_1$  and  $T_2$ , so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock ?

- e) What are the roles of the Analysis, Redo and Undo phases in the recovery algorithm 'ARIES' ?

$$2 + 2 + 3 + 4 + 4$$

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