

**BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR**  
**M. E. (ICE) 1<sup>st</sup> Semester Examination, 2012**

**Design of Database Systems (ICE-903)**

**Time : 3Hours**

**Full Marks: 70**

**Answer any FIVE questions**

1. What is DBMS? In which situation use of DBMS is not suitable and why? What is the importance of data independence in database environment? Compare relational, hierarchical and network data model.

**2+3+3+6**

2. When is subclass needed in ER data modeling? Discuss the difference between specialization and generalization in ER diagram. What are the characteristics of relation in RDBMS? In a tuple relational calculus query with n tuple variables, what would be the minimum number of join condition? Consider the relations R(A,B,C) and S(D,E,F). Write the tuple relational calculus expression equivalent to  $\pi_{A,B}(\sigma_{C=D}(R \times S))$ .

**3+3+4+2+2**

3. Why Armstrong's axioms are said sound? Does every set of dependencies have a minimal equivalent set? Is it always unique? Prove that any relation with two attributes is in BCNF. Consider a relation emp\_proj(eno,pno,hours,pname,plocation) with the functional dependency pno  $\rightarrow$  (pname,plocation). What is the update anomalies associated with the relation emp\_proj and how we solve them? Discuss dangling tuple problem.

**2+3+2+5+2**

4. Explain the ACID properties of transaction. Describe the lost update problem. Why result equivalent is not used for the equivalence of two schedules. How conflict equivalence improve the problem of result equivalence in this context. Give an example of a serializable schedule that is not strict and state the reason.

**4+3+5+2**

5. In which situation deadlock detection and deadlock prevention techniques are used? Prove that cautious waiting avoids deadlock. Consider the following sequence of actions: r1(X), w2(X), w2(Y), w3(Y),w1(Y),c1,c2,c3. Describe how optimistic concurrency control mechanism handles the sequence. How does granularity of data items affect the performance of concurrency control?

**4+2+5+3**

6. What are the advantages and disadvantages of deferred update technique? Explain how delete operation in a file with sparse index is done. What is clustering index? Consider a disk with block size 512 bytes. A block pointer is 6 bytes long and record pointer is 7 bytes long. A file has 20000 EMPLOYEE records of fixed size and length of each record is 100 bytes. The file is not ordered by the key field Eno(9 bytes) and we want to construct a B tree index on Eno. Calculate the order p of the B tree and number of level needed if nodes are 69% full.

4+3+2+5

7. Describe the discretionary access control for database security. Consider the join operation:  $EMP \bowtie_{\text{dno=dnum}} DEPT$ . EMP file has 10000 records stored in 2000 blocks. There is secondary index on non key attribute dno with level  $x_{\text{dno}} = 2$ . DEPT file consists of 125 records stored in 13 blocks. Primary key of DEPT is dnum. If blocking factor of resulting file is 4 records per block, then find out the cost of the join in nested-loop join technique. If there are 7 main memory blocks, then how it will affect the result? Consider the following relations.

Employee (eno, ename, dnum, sex, city, salary)

Dept (dnum, dname, mgrno)

Project(pno, pname, dnum, ploc)

Works\_on(eno, pno, hour)

Write the relational algebraic form of the following query:

For every project located in 'Kolkata', list the project number, controlling department number and department manager's name. Draw the initial query tree of the query and optimize the query using heuristic optimization technique.

4+5+5

8. Consider two relations Emp(eno,name, title) and Pay (title,salary). Perform horizontal fragmentation of Pay with respect to salary. Using these fragments, perform derived fragmentation for Emp and prove the correctness for fragmentation of Emp relation. Consider the following global, fragmentation and allocation schema.

Global schema: guest (no,blockno,roomno,roomtype,name,city,phno)

Fragmentation schema:  $guest_1 = \pi_{\text{no,blockno,roomno,roomtype}}(\sigma_{\text{blockno}='north'}(\text{guest}))$

$guest_2 = \pi_{\text{no,blockno,roomno,roomtype}}(\sigma_{\text{blockno}='south'}(\text{guest}))$

$guest_3 = \pi_{\text{no,name,city,phno}}(\sigma_{\text{blockno}='north'}(\text{guest}))$

$guest_4 = \pi_{\text{no,name,city,phno}}(\sigma_{\text{blockno}='south'}(\text{guest}))$

allocation schema:  $guest_1$  at sites 1,2  
 $guest_1$  at sites 3,4  
 $guest_1$  at sites 5,6  
 $guest_1$  at sites 7,8

Write an application that moves a guest having no=40 from 'north' block to 'south' block at local mapping transparency.

Explain when a schedule in DDBMS is serializable. Describe distributed 2PL protocol for concurrency control in distributed database.

5+3+2+4

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