B.TECH/IT/4TH SEM/INFO 2204/2022

DATABASE MANAGEMENT SYSTEMS
(INFO 2204)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) A relation R(X,Y,Z,P), holds the following fd set, F=(XY→Z, XY→P, Z→P} . The set is irreducible when
(a) Z->P is discarded
(b) When X is discarded from XY→Z
(c) When Y is discarded from XY→Z
(d) It is already in reducible form

(ii) If a schedule S can be transformed into a schedule S' by a series of swaps of non-conflicting instructions, we say that S and S' are
(a) Conflict Serializable
(b) View equivalent
(c) Conflict Equivalent
(d) View Serializable

(iii) Consider the following DDL statement.
Create table Course (courseid number(5) primary key, course-name number(10) , studid varchar2(10) references student(studentid));
Which of the following integrity constraints have been imposed on the tableEmployee using the above DDL statement:
(a) Entity Integrity constraint and Domain Integrity Constraint
(b) Entity Integrity constraint and Referential Integrity Constraint
(c) Entity Integrity constraint
(d) Entity Integrity constraint and Self-referential Integrity Constraint.

(iv) **Statement 1:** It is always possible to normalize a relation to BCNF, preserving all functional dependencies and maintaining lossless join property.
Statement 2: It is always possible to normalize a relation to 3NF decomposition preserving all functional dependencies and lossless join property.
Considering the above two statements choose the right option from the followings:
(a) Only Statement 1 is correct
(b) Only Statement 2 is correct
(c) Both Statement 1 and Statement 2 are correct
(d) Both Statement 1 and Statement 2 are incorrect

(v) In a relation R (A, B, C, D), If A is the candidate key, and set of functional dependencies are F={ A→BC and A →D} .
Then in which normal form the relation is in
(a) 3NF (b) BCNF (c) 2NF (d) 1NF

(vi) If two relations hold a referential integrity constraint then which of the following is true
(a) No row can be inserted in child table if it is not present in parenttable
(b) No row can be inserted in parent table if it is not present in childtable
(c) No rows can be deleted from child table
(d) No rows can be deleted from parent table

(vii) Consider a schedule S with three concurrent transactions. In order to find out whether execution will lead to deadlock, a particular graph can be used.
The graph is
(a) Precedence Graph (b) Wait for graph
(c) Precided Graph (d) Non primitive graph

(viii) What type of index structure is maintained on a key attribute of an ordered database file?
(a) Secondary (b) Clustering (c) Primary (d) Btree

(ix) A relation R(P,Q,R,X) is decomposed into R1(P,Q) and R2(P,R,Z), where P is the candidate key of R1. So, the decomposition is
(a) Lossy (b) Is lossless (c) Both (a) and (b) (d) None of these

(x) A secondary index is created on the nonordering key field of a disk file. The number of records in the disk file is 30000. The record length of file is 30 bytes and for index it is 15 bytes. Block size of index and file = 1024 bytes. So number of blocks in index is
(a) 30000/(bfr of index) (b) 3000/(bfr of disk file)
(c) 30/(bfr of index) (d) 30000/15.

Group- B

2. (a) Explain the architecture of Oracle Server. In which database file the actual data is stored. [(CO1)(Remember/LOCQ)]

(b) Consider a relation A(deptid, deptname, location-id) defining all departments of the organization and every department name should start with D. Consider another relation B(location-id, location-city) which stores the locations of the departments. Identify the constraints that exists between the two relations. Next, write SQL statements to define the constraints and add each of the constraints on the already existing tables in the database. (Note: The sequence in which the constraints are to be added should be considered).
[(CO2,CO3)(Analyze/IOCQ)]

(c) Site an example of Weak Entity Set and its relationship with a strong entity set by using ER-notation. Convert the ER schema of your example to its corresponding tabular representation. [(CO2)(Understand/LOCQ)]

2 + 6 + 4 = 12

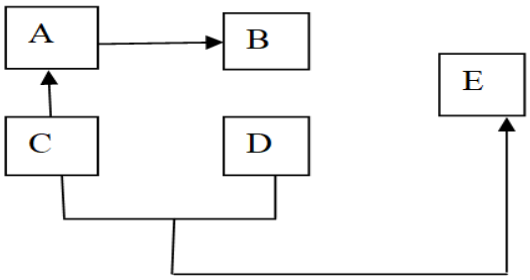
3. (a) Given the relational schema: **CLASSMATES** (RollNo, Name, RegistrationNo, Address, PhoneNo) , **COURSES** (RollNo, CourseCode, CourseName), **TEACHERS** (CourseCode, TeacherCode, TeacherName). Write the algebra and SQL for the following queries.
   (i) What are the names of the classmates enrolled in the course INGO202?
   (ii) Which course classmate Vikash is taking.
   (iii) What are the names of the classmates enrolled in both INGO202 and INGO201? [(CO3)(Apply/IOCQ)]

   (b) Consider the following relational schema and set of functional dependen-cies. Which of these superkeys form a key (i.e., a minimal superkey) for this relation? R(A,B,C,D,E) with functional dependencies AB -> E and D -> C.
   [(CO2)(Analyze/IOCQ)]

9 + 3 = 12

Group - C

4. (a) Given a set of functional dependency (FD diagram) that exists in the relation R (A, B, C, D, E)

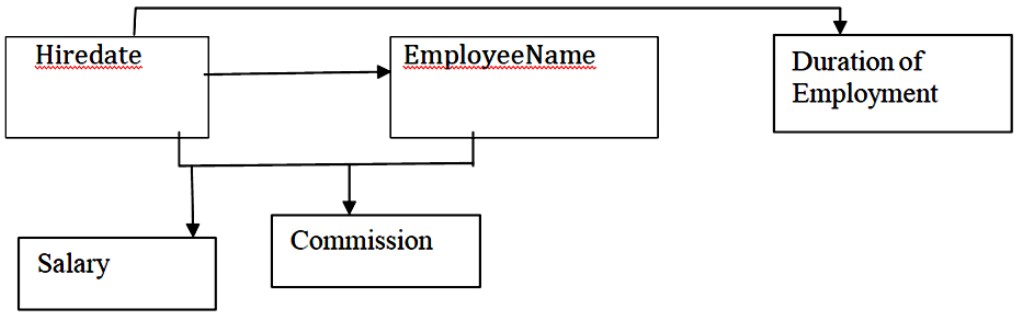


   (i) Determine out the functional dependencies
   (ii) Find out the Candidate key/s of the relation
   (iii) Convert the relation to BCNF. [(CO2,CO6)(Create/HOCQ)]

   (b) Convert the following FD's to irreducible set.
   (i) A → BC, AB→ D, AC→D
   (ii) A→B, A→B, B→C, AB→C. [(CO2)(Analyze/IOCQ)]

6 + 6 = 12

5. (a) Consider the following FD diagrams, representing the company's Employee details. Find out the minimal super key/keys and normalize the relation to BCNF.



[(CO2,CO3,CO6)(Create/HOCQ)]

   (b) Consider the following example, where the subject INGO-3104 has two books and is taught by two faculties. Is the relation in 4NF?

Subject_id	Faculty	Books
INGO-3104	JJI	B1
INGO-3104	PPI	B2

[(CO3)(Apply/IOCQ)]

7 + 5 = 12

Group - D

6. (a) A bank has set rules for dealing with negative account balance, by setting the account balance as zero and creating a loan in the amount of overdraft. An overdraft is an event where a customer's withdrawal amount exceeds the available account balance. Write a trigger such that once the event happens, a row in the loan table gets inserted, with values loan_no and loan-amount, (which is equal to the overdrawn amount). [(CO3)(Apply/IOCQ)]

   (b) A concurrent schedule S has two transactions T1 and T2. The read and write operations are given below.

   T_1: $r_1(A)$; $w_1(A)$; $r_1(B)$; $w_1(B)$

   T_2: $r_2(A)$; $w_2(A)$; $r_2(Z)$; $w_2(Z)$

   S = $r_1(A);w_1(A);r_2(A);w_2(A);r_1(B);w_1(B);r_2(Z);w_2(Z)$

   Find out (without using graph) whether the schedule **S** is conflict serializable.

   [(CO4)(Analyze/IOCQ)]

   6 + 6 = 12

7. (a) Site an example where a concurrent schedule is 2 phase locked, however deadlock scenario has occurred. How can we detect a deadlock in a concurrent schedule? What are the two deadlock prevention schemes based on timestamp. [(CO4)(Understand/LOCQ)]

   (b) Consider the concurrent schedule S. Evaluate the problems that takes place in the following cases. How can we overcome the problem of second case?

   Case1: If T2 performs commit before T1 commits, and next T1 fails.

   Case2: If all transactions are executing and no one commits, and suddenly T1 fails.

T1	T2	T3
Read(X)		
X=X+45		
Write(X)		
	Read(X)	
	X=X-45	
	Write(X)	
		Read(X)

[(CO4)(Analyze/IOCQ)]

6 + 6 = 12

Group - E

8. (a) Explain the concept of multilevel indexing with diagram.

   [(CO5)(Understand/LOCQ)]

(b) Suppose that an unordered file with r=20000 records stored on a disk with block size B=1024 bytes. File records are of fixed size with record length R = 110 bytes.

(i) Find out the blocking factor of the file
(ii) Find the number of blocks needed for the file to maintain the records
(iii) If a record is accessed from this file, find out the number of block accesses required. Suppose a secondary index is created on the above file, with ordering key field V = 5 bytes and block pointer P = 8 bytes.
(iv) Find the blocking factor for the index.
(v) Find the total number of blocks in the index.
(vi) If a record is accessed from this indexed file, find out the number of block accesses required. [(CO5,CO6)(Create/HOCQ)]

3 + 9 = 12

9. (a) A student file with Rollno as the key field includes records with the following Rollno values: 80, 85, 10, 45, 28, 88, 43, 12, 14, 18, 19, 25, 27
Create a BTree with the following keys showing each and every step.
[(CO5,CO6)(Create/HOCQ)]

(b) What is the difference between B Tree and B^+ tree? Create a B^+ tree with the above keys having order of internal node as 3 and order of leaf node as 2.
[(CO5, CO6)(Create/HOCQ)]

5 + (2 + 5) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	15.62	48.96	35.42

Course Outcome (CO):

After the completion of the course students will be able to

1. Understand the need of DBMS over traditional file system and acquire the knowledge on overall database description, at three levels, namely, internal, conceptual, and external levels.
2. Deduce the constraints , i.e., the candidate keys, super-keys, that exists in a given real world problem and design the entity relationship diagram to graphically represent entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems.
3. Formulate a mathematical tool using relational algebra that operates on one or more relational tables and outputs a relational table as result, and design a normalized Database based on real-world situations, maintaining all constraints and manipulate database relations using SQL and PL/SQL.
4. Prove whether the ordering of concurrent transactions result in inconsistency of the database system or not.

5. Compare the number of block access required for searching a particular record, in an un indexed data file, with respect to a data file having (primary , secondary , clustering or multilevel) index structure.
6. Create a complete Normalized Database system, maintaining all the requirement specifications for a real life problem, and creating indexed relations for efficient accessing.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question