B.TECH/ECE/EE /6TH SEM/CSEN 3221/2022

FUNDAMENTALS OF RDBMS (CSEN 3221)

Time Allotted: 3 hrs Full Marks: 70

Figures out of the right margin indicate full marks.

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

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

| Group – A (Multiple Choice Type Questions) | | | | | | | |
|---|--|--|--|--|--|--|--|
| Choo | se the correct alternative for the follo | owing: $10 \times 1 = 10$ | | | | | |
| (i) | The overall design of a database is called (a) schema of the database (c) the screen of the database | (b) structure of the database (d) view of the database. | | | | | |
| (ii) | According to the levels of abstraction, the (a) conceptual schema (c) subschema | schema at the intermediate level is called (b) physical schema (d) view. | | | | | |
| (iii) | It is an abstraction through which relation (a) Generalization (c) Aggregation | ships are treated as higher level entities (b) Specialization (d) Inheritance. | | | | | |
| (iv) | During transaction before commit which of the following statement is do automatically in case of shutdown? (a) Rollback (b) Commit (c) View (d) Flashback. | | | | | | |
| (v) | Relation R=(<u>A,B</u> ,C,D) with AB as primary be in 1NF but not in 2NF. (a) AB -> C (b) AB -> D (c) A | | | | | | |
| (vi) | The part of a database management system which ensures that the data remain a consistent state is (a) authorization and integrity manager (b) buffer manager (c) transaction manager (d) file manager. | | | | | | |
| (vii) | What is the name of the query that is pla of another query (a) Multi Query (c) Super Query | aced within a WHERE or HAVING clause (b) Sub Query (d) Aggregate Query. | | | | | |

1

1.

B.TECH/ECE/EE /6TH SEM/CSEN 3221/2022

- (viii) A superkey set consists of {AB, A, BC, ABC}. Out of these the minimal super keys are (a) {A, BC, AB} (b) {ABC} (c) {A, AB} (d) {A, BC}
- (ix) Consider R1 and R2 are two different relations, which operation will produce a relation that has all attributes which are common to R1 and R2
 - (a) Union

(b) Intersection

(c) Cartesian Product

(d) Join.

- (x) Assume transaction X holds a shared lock R. If transaction B also requests for a shared lock on R
 - (a) it will result in a deadlock situation
 - (b) it will immediately be granted
 - (c) it will immediately be rejected
 - (d) it will be granted as soon as it is released by X.

Group - B

- 2. (a) What are the roles played by Transaction manager and Buffer manager? [(CO1)(Remember/LOCQ)]
 - (b) When you buy merchandise from a website, what type of DBMS architecture is used? Explain with the help of a diagram. [(CO1) (Apply/IOCQ)]
 - (c) Your friend is buying train ticket from Howrah Station computerised railway reservation counter. What type of DBMS architecture is used? Explain with the help of a diagram. [(CO1) (Apply/IOCQ)]
 - (d) What do you understand by physical data independence?

[(CO1)(Understand/LOCQ]

(2+2)+3+3+2=12

- 3. (a) State two important functions of the Database Administrator[DBA]. [(CO2) (Remember/LOCQ)]
 - (b) Distinguish between total and partial participation in an E-R diagram. [(CO3) (Understand/LOCQ)]
 - (c) Draw an E-R diagram for the following:

"A publishing company produces books on various subjects. The books are written by Authors who specialize in one particular subject. The company employs editors who not necessarily being specialists in a particular area, each take sole responsibility for editing one or more book publications. Every book require some items for publication. These items supplied by suppliers. One Supplier can supply many items. Shop owner buys books from the publisher. Shop owner can buy many books, but one book can be bought by one shop owner only. Books are uniquely identified by book-id." [(CO4) (Analyse/IOCQ)]

2 + 3 + 7 = 12

Group - C

4. (a) Distinguish between *Specialization* and *Genaralization* in an E-R model. [(CO4) (Remember/LOCQ)]

B.TECH/ECE/EE /6TH SEM/CSEN 3221/2022

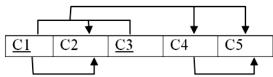
- (b) Describe the *cartesian product* and *natural join* operations of Relational Algebra with suitable examples. [(CO2) (Analyze/LOCQ)]
- (c) Keeping in mind your design from question 3.c, write Relational Algebra Operations for the following:
 - (i) Find name of all customers who have bought the book *Sonar Kella* and *Passage To India* published by *Ananda*.
 - (ii) Find the total royalties received by the author for the books *Sonar Kella* and *Passage To India*.

Find the name of the highest priced book published in 2021.

[(CO3) (Analyze/IOCQ)]

2 + 4 + 6 = 12

5. (a) Given the dependency diagram shown in the following figure, (the primary key attributes are underlined)



(i) Identify and discuss each of the indicated dependencies.

[(CO4)(Analyze/IOCQ]

- (ii) Create a database whose tables are at least in 3NF, showing dependency diagram for each table. [(CO4)(Create/HOCQ]
- (b) What problems occur if there is transitive dependency? Explain with proper examples. [(CO4)(Understand/LOCQ]

(4 + 5) + 3 = 12

Group - D

- 6. Consider the following relations:
 - (i) **Employee** (Emp_Code, Emp_Name, Desig, Manager, Date_of_Joining, Salary, Dept_Code)

With Constraints: *Primary Key* is Emp_Code, *Foreign Key*: Manager references Employee(Emp_Code), Dept_Code references Department(Dept_Code)

(ii) **Department** (Dept_Code, Dept_Name, Location) With Constraints: *Primary Key* is Dept_Code

Write the following queries in SQL:

- (i) List the average salary and number of employees working in each department.
- (ii) List the names of those departments where the total salary is greater than 15000.
- (iii) List the names of the employees and the names of their managers under whom they are working.
- (iv) List the details of those employees who are getting salary greater than the average salary of their department. [(CO3)(Create/HOCQ]

(2+2+4+4)=12

7. (a) Distinguish between primary key and unique key constraints.

[(CO1) (Remember/LOCQ)]

B.TECH/ECE/EE /6TH SEM/CSEN 3221/2022

- (b) How can we implement foreign key constraints in SQL? Explain with examples. [(CO3) (Understand/LOCQ)]
- (c) Construct the table EMPLOYEE with the following attributes: EMPLOYEE(EName, E_Id, Date_of_Birth, Salary, City, Pincode) Write the following SQL queries:
 - (i) Display the Name and Id of all employees whose salary is greater than 80,000 And lesser than 90,000.
 - (ii) Display the Name and Id of all employees who reside in any of the following Cities MUMBAI, KOLKATA, PUNE, HYDERABAD and whose salary is greater than 100000. [(CO1) (Analyze/IOCQ)]

2 + 4 + 6 = 12

Group - E

- 8. (a) Distinguish between Locking and Time_Stamping? [(CO4) (Remember/LOCQ)]
 - (b) Draw and explain the State-Transition diagram of a transaction, also explain the Properties of *Atomicity* and *Durability* with regard to transactions.

[(CO3) (Understand/LOCQ)]

(c) Consider the following two transactions T1 and T2.

```
read_lock(Y);
                        T2:
                             read_lock(X);
read_item(Y);
                             read_item(X);
unlock(Y);
                             unlock(X);
write_lock(X);
                             write_lock(Y);
read_item(X);
                              read_item(Y);
X=X+Y;
                              Y=X+Y;
write_item(X);
                             write_Item(Y);
unlock(X);
                             unlock(Y);
```

Considering initial values X=20 and Y=30 what will be the result of serial schedule T1 followed by T2. [(CO4)(Analyse/IOCQ)]

3 + 4 + 5 = 12

- 9. (a) Justify the following statement: Concurrent execution of transactions is more important when data must be fetched from (slow) disk or when transactions are long, and is less important when data are in memory and transactions are very short.

 [(CO5)(Understand/LOCQ)]
 - (b) Consider the following two transactions:-

```
T1: read (A);
read (B);
B = A + B;
write (B);
```

T2: write (A); read (B);

Add lock and unlock instructions so that the transaction T1 and T2 observe two-phase locking protocol. Is it deadlock free? [(CO5)(Apply/IOCQ]

4 + 8 = 12

CSEN 3221 4

| Cognition Level | LOCQ | IOCQ | HOCQ |
|-------------------------|-------|-------|-------|
| Percentage distribution | 38.54 | 43.75 | 17.70 |

Course Outcome (CO):

After the completion of the course students will be able to

- Identify the basic concepts and various data model used in database design.
- Formulate relational algebra expression for queries and evaluate it using the concept of query processing and Optimization.
- Create RDBMS schema and formulate queries based on that schema using SQL.
- Apply Normalization and various types of dependencies for evaluating a relational database design.
- Apply and relate to concept of transaction, concurrency control and recovery in database.
- Understand basic database storage structures and access techniques: file and page organizations, indexing methods including BTree and hashing.

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

5

CSEN 3221