BASICS OF RDBMS
(CSEN 3206)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Which of the following best defines a candidate key in a relational model?
(a) Any super key that can uniquely identify a tuple of strong entity.
(b) A minimal super key that can uniquely identify a tuple of strong entity.
(c) A discriminator key of a weak entity.
(d) A foreign key attribute of strong entity.

(ii) Which type of constraint ensures that a value exists in parent/ base table before it can be referenced from another dependent table?
(a) Entity Integrity constraint (b) Participation constraint
(c) Referential Integrity constraint (d) Mapping cardinality constraint

(iii) If a relation has the functional dependencies A -> B, B -> C, and A -> C, what can be said about the closure of attribute A?
(a) {A} (b) {A, B}
(c) {A, C} (d) {A, B, C}

(iv) Which of the following is not a partial functional dependency (FD)?
(a) FD A -> B in a relation where {A, B, C} is a composite primary key.
(b) FD B -> C where B is part of a composite key {A, B} and C is a candidate Key
(c) FD A -> C where A is a non-prime attribute and C is part of the key.
(d) FD A -> D in a relation where A is part of a composite key {A,B} and D is a non-prime attribute.

(v) Which of the following is true about non trivial functional dependencies X ->Y, where X and Yare subset of attributes of relation R respectively?
(a) Y∩ X = Φ (b) Y is a subset of X
(c) Y∩ R is a subset of X (d) X∩ R=R

(vi) Which of the following is NOT a Data Definition Language (DDL) command?
(a) ALTER (b) CREATE
(c) INSERT (d) DROP

(vii) Let R2 has a foreign key that refers to Primary key of relation R1. Which of the following operations may cause violation of referential integrity constraints?

I: insert into R1 II: Insert into R2
III: deletion from R1 IV: delete from R2

(a) II and III (b) I and IV (c) I, II and III (d) III and IV

(viii) In 2-phase locking protocol, which of the following locks are compatible?
(a) Read-lock(A) by T1 transaction and write-lock(A) by T2 transaction
(b) Write-lock(A) by T1 transaction and write-lock(A) by T2 transaction
(c) Write-lock(A) by T1 transaction and read-lock(A) by T2 transaction
(d) Read-lock(A) by T1 transaction and read-lock(A) by T2 transaction

(ix) Which of the following statement is false?
(a) Consistency property cannot be ensured for all possible concurrent schedules of a set of transactions.
(b) Atomicity always ensures that a transaction must always commit and never rollback.
(c) Isolation property can be ensured if a concurrent schedule is serializable.
(d) Durability property of a transaction can be achieved by using appropriate log-based recovery scheme along with regular database backup in stable storage.

(x) Checkpoints are a part of
(a) Recovery measures (b) Security measures
(c) Concurrency measures (d) Authorization measures

Fill in the blanks with the correct word

(xi) The _____ property of database architecture allows for changes in the database schema without affecting the application using the database.

(xii) A relation R is not in 3NF if there exist a mutual functional dependency between two _____ attributes of R.

(xiii) The SQL sub query structure is known as a _____ sub query when an inner nested sub query may be evaluated once for each row evaluated by the outer query and the final query output will be a result of repetitive execution of the inner query in dependence with the outer query.

(xiv) Serializability ensures _____ property of database transactions in concurrent execution environment.

(xv) A _____ entity in an ER diagram is an entity that cannot exist without being associated with another entity.

Group - B

2. (a) Describe the 3-schema architecture for database development along with an illustrative diagram. Clearly mention the functionalities of each level.

[(CO1)(Analyse/HOCQ)]

(b) State what is meant by DDL, DML, DCL. Give an example for each.

[(CO1)(Remember/LOCQ)]

(c) List at least 3 advantages of DBMS over File processing system.

[(CO1)(Remember/LOCQ)]

6 + 3 + 3 = 12

3. (a) The tourism department wishes to computerize its data. The information consists of monuments of tourist interest, their location and history. Monuments are classified according to historical, religious and architectural importance. The list of facilities available at each spot are (i) living accommodation in terms of hotels, their names, category and the number of rooms available and (ii) local transport facilities in terms of service provider name, tours with their tariff and timing. Draw an ER diagram by identifying entities, relationships, attributes, primary keys. *[(CO1)(Analyse/IOCQ)]*

(b) What is data dictionary? List three important functions of DBA [Database Administrator]. *[(CO1)(Remember/LOCQ)]*

(c) Distinguish between total and partial participation in an E-R diagram. *[(CO1)(Understand/IOCQ)]*

6 + (1 + 3) + 2 = 12

Group - C

4. (a) Consider the relational database given below:
Sailors (Sid, SName, Rating, Age)
Boats (Bid, BName, Colour)
Reserves (Sid, Bid, Day)
The underlined attributes are the primary keys. Day denotes the day of the week.
Write the Relational algebraic expressions for each of the following:
(i) Find the Id and name of the sailors whose age is less than 30.
(ii) Find the name of the sailors who have reserved a blue coloured boat.
(iii) Find the name of the sailors who have reserved a red coloured boat on Wednesday.
(iv) Find the Id and name of the boats which were reserved on Friday.
[(CO2)(Analyse/IOCQ)]

(b) Define the term functional dependency and Multivalued dependency. *[(CO4)(Understand/LOCQ)]*

(4 × 2) + (2 + 2) = 12

5. (a) Consider the relation R(A,B,C,D,E,F,G,H,I,J) having the following set of functional dependencies:
AB → C, A → DE, B→F, F →GH, D→ IJ
Determine the highest normal form of the relation R. Explain your answer.
[(CO4)(Understand/LOCQ)]

(b) If R is not in 2NF, decompose R into 2NF, and then decompose into 3NF. If R is in 2NF, decompose R into 3NF. Show the steps. *[(CO4)(Apply/IOCQ)]*

(c) Is there a BCNF decomposition of R? Justify your answer. *[(CO4)(Evaluate/HOCQ)]*

4 + 6 + 2 = 12

Group - D

6. Consider the following relations:
(i) Employee (Emp_Code, Emp_Name, Desig, Manager, Date_of_Joining, Salary,Dept_Code)
(ii) Department (Dept_Code, Dept_Name, Location)

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) 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 than80,000 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. *[(CO3)(Analyse/IOCQ)]*

2 + 4 + (3 + 3) = 12

Group - E

8. (a) What are the differences between sequential and indexed file organization? *[(CO6) (Remember/LOCQ)]*

(b) Write the difference between commit and rollback. *[(CO6)(Remember/HOCQ)]*

(c) Construct a B+ tree for the key values 1, 3, 5, 7, 9, 2, 4, 6. Order of each node is. 4. Show each step. *[(CO6)(Apply/IOCQ)]*

3 + 3 + 6 = 12

9. (a) Let T1 and T2 be transactions that operate on same data items P, Q & R. Let r1(P) mean that T1 reads P, w1(P) mean that T1 writes P, same for T2. Given are two schedules S1 & S2. Using precedence graphs, determine if they are conflict serializable or not? If S2 schedule is serializable, write down the equivalent serial schedule(s).
S1: r1(P); w1(P); r2(P); w2(P); r1(P); w1(P)
S2: r1(P); w1(P); r2(P); w2(P); r1(Q); w1(Q); r2(R); w2(R) *[(CO5) (Analyse/IOCQ)]*

(b) Describe the Two-phase locking protocol. Why is it required? Discuss its limitations. *[(CO5) (Understand/LOCQ)]*

(6 + 2) + (2 + 1 + 1) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	32.29	43.75	23.96