KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.Sc.
Year : II

Course : BICP 206
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 20 FEB 2025

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Select the Mark [X] in the most appropriate answer.

1. In bioinformatics, which type of database is most suitable for storing and querying unstructured genomic data?
   [ ] Relational databases
   [ ] NoSQL databases
   [ ] Hierarchical databases
   [ ] File-based systems

2. Given the functional dependencies A → B and B → C, which of the following is true?
   [ ] A → C is a transitive dependency
   [ ] A → C violates 2NF
   [ ] B → C violates 3NF
   [ ] A → C is not a valid dependency

3. What is the primary purpose of a database system?
   [ ] To enhance data redundancy
   [ ] To enable efficient storage and retrieval of data
   [ ] To create backup copies of data
   [ ] To generate random data sets

4. Which of the following scenarios indicates a violation of the First Normal Form (1NF)?
   [ ] A table with duplicate rows
   [ ] A table with columns containing multi-valued attributes
   [ ] A table without primary keys
   [ ] A table with transitive dependencies

5. Which SQL query will return the second-highest salary from a "Employees" table?
   [ ] SELECT MAX(Salary) FROM Employees;
   [ ] SELECT Salary FROM Employees ORDER BY Salary DESC LIMIT 2;
   [ ] SELECT MAX(Salary) FROM Employees WHERE Salary < (SELECT MAX(Salary) FROM Employees);
   [ ] SELECT TOP 2 Salary FROM Employees;

6. Which of the following SQL clauses is used to filter rows after an aggregation function is applied?
   [ ] WHERE
   [ ] GROUP BY
   [ ] HAVING
   [ ] ORDER BY

7. In SQL, what will happen if you attempt to insert a NULL value into a column defined with the NOT NULL constraint?
   [ ] The row is inserted, and the column is set to a default value.
   [ ] The database throws an error, and the insertion fails.
   [ ] The NULL value is automatically converted to 0
   [ ] The insertion is successful, but the column remains empty.

8. What is a key feature of MongoDB's data model?
[ ] Data is stored in tables with fixed schemas.
[ ] Data is stored in a flat file structure.
[ ] Data is organized into key-value pairs only.
[ ] Data is stored as JSON-like documents with flexible schemas.

9. Which of the following is NOT a valid aggregate function in SQL?
[ ] SUM [ ] AVG [ ] TOTAL [ ] COUNT

10. What is an attribute in the context of relational databases?
[ ] A type of database key
[ ] A column in a table representing a specific property
[ ] A relationship between two tables
[ ] A row in a table

11. Which of the following commands in MongoDB is used to insert a new document into a collection?
[ ] db.collection.add()
[ ] db.collection.insertOne()
[ ] db.collection.push()
[ ] db.collection.save()

12. Which transaction property ensures that changes made by a transaction are permanently saved, even if a system crash occurs?
[ ] Atomicity [ ] Consistency [ ] Isolation [ ] Durability

13. What is the significance of the "commit" command in transaction management?
[ ] It locks the transaction to prevent changes.
[ ] It rolls back the transaction to its initial state.
[ ] It saves all changes made by the transaction to the database.
[ ] It checks the consistency of the transaction.

14. Which concurrency control technique uses locks to prevent conflicts between transactions?
[ ] Timestamp-based protocol
[ ] Deadlock handling
[ ] Lock-based protocol
[ ] Validation-based protocol

15. In a timestamp-based concurrency control system, what happens if a transaction requests a data item with an older timestamp than the last write operation on that item?
[ ] The transaction is granted immediate access.
[ ] The transaction is aborted.
[ ] The transaction is placed in a wait queue.
[ ] The system generates a warning but grants access.

16. Which of the following database recovery techniques ensures that all updates are recorded in the log before being written to the database?
[ ] Deferred update
[ ] Immediate update
[ ] Shadow paging
[ ] Checkpointing

20 FEB 2025

17. What is the primary function of concurrency control in a database?
[ ] To prevent conflicts in multi-user environments
[ ] To enhance data retrieval speeds
[ ] To create backup copies of data
[ ] To ensure data redundancy

18. What happens during the rollback process in database recovery?
[ ] Completed transactions are saved permanently.
[ ] Uncommitted changes made by a failed transaction are undone.
[ ] The database state is reset to its original state before failure.
[ ] All transactions are restarted.

19. Which key uniquely identifies each record in a relational database table?
[ ] Foreign key [ ] Composite key [ ] Primary key [ ] Candidate key

20. In database normalization, what is the goal of the Third Normal Form (3NF)?
[ ] Remove transitive dependencies [ ] Avoid the use of keys
[ ] Ensure data integrity [ ] Eliminate duplicate columns

KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Level : B.Sc.
Year : II
Time : 2 hrs. 30 mins.

20 FEB 2025

Course : BICP 206
Semester : II
F.M. : 40

SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Discuss the concept of constraints in relational databases. How do constraints improve database integrity? [2+2]

2. Define the term "functional dependency" in relational databases. Why is it important for database normalization? Explain with example. [1+3]

3. Explain the role of primary keys and foreign keys in relational databases with suitable examples. [4]

4. Explain the difference between INNER JOIN and OUTER JOIN in SQL, with examples. [4]

5. What is serializability in database transactions? Explain with an example how it ensures correctness in concurrent transactions. [1+3]

6. What are the reasons to switch to NoSQL from traditional relational DBMS? Explain types of NoSQL databases with example. [2+2]

7. Discuss the timestamp-based protocol for concurrency control. How does it prevent conflicts between transactions? [2+2]

SECTION "C"
[2 Q × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. What is an Entity-Relationship model? Design an Entity-Relationship (E-R) diagram for a bioinformatics database that stores information about genes, their associated proteins, and related diseases. Identify the entities, attributes, relationships, and specify the primary keys. [2+6]

9. Consider following schema and write SQL for given statements. [2 × 4=8]
Gene (GeneID, GeneName, Chromosome, Function)
Patient (PatientID, Name, Age, Gender, Diagnosis)
Gene_Patient (MutationID, PatientID, GeneID, MutationType, Severity)
   - Find the name of the patients who is diagnosed with "Lung Cancer".
   - Find the names of genes associated with "high-severity" mutations.
   - Retrieve the details of all mutations for patients diagnosed with "Breast Cancer."
   - Find the count of mutations and order the result by the number of mutations in descending order.

P.T.O.

10. Write about CRUD operation in NoSQL with example of each. Determine whether the following schedule with three transactions T1, T2, and T3 is conflict serializable or not? If yes write down the conflict equivalent serial schedule. [4+4]

T1	T2	T3
R(X)		
	R(X)	
W(X)		
		R(Y)
	W(X)	
		W(Y)