KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.E./B.Sc.
Year : II

Course : COMP 232
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]

Choose and encircle in the most appropriate option from each set of choices

1. The view level of database represents:
   a. Highest level of abstraction of data
   b. Lowest level of abstraction of data
   c. Intermediate level of abstraction of data
   d. none of the above.

2. A data model is a collection of conceptual tools for describing:
   a. Data
   b. Data relationships and data semantics
   c. Consistency constraints.
   d. All of the above

3. In E-R diagrams, a weak entity set is depicted with a :
   a. Double diamond b. Double rectangle c. Double line d. Dotted lines

4. Specialization is the process of:
   a. Bottom up design
   b. Combining a number of entity sets that share the same features into a higher-level entity set.
   c. Top down design
   d. Aggregation

5. Two relations are said to be union compatible if they have same number of:
   a. Attributes b. Tuples c. Key attributes d. Foreign keys

6. The result of _____ operation is a relation that includes all tuples that are in both R and S relations.
   a. Join b. Minus c. Union d. Intersection

7. If a relation is in 2NF then:
   a. Every candidate key is a primary key
   b. Every non-prime attribute is fully functionally dependent on each relation key
   c. Every attribute is functionally independent
   d. Every relational key is a primary key.

8. Which of the following is true?
   a. A relation in 3NF is always in BCNF
   b. A relation in BCNF is always in 3NF
   c. BCNF and 3NF are totally different
   d. A relation in BCNF is in 2NF but not in 3NF

9. A consistent database is :
   a. One in which all tables have foreign keys
   b. One in which all data integrity constraints are satisfied
   c. One in which all tables are normalized
   d. One in which all SQL statements only update one table at a time

10. Which of the following means that data used during the execution of a transaction cannot be used by a second transaction until the first one is completed?
a. Serializability b. Atomicity c. Isolation d. Time stamping

11. As long as two transactions, T1 and T2, access ____ data, there is no conflict, and the order of execution is irrelevant to the final outcome.
a. Shared b. Common c. Unrelated d. Locked

12. Which phase in a two-phase lock is when a transaction releases all locks and cannot obtain any new lock?
a. Growing b. Shrinking c. Locking d. Unlocking

13. Which type of lock prevents all types of access to the locked resource?
a. Exclusive lock b. Shared lock c. Two-phased lock d. Explicit lock

14. In which phase, changes are permanently applied to the database?
a. Read b. Validation c. Write d. Shared

15. In log based recovery, when a failure occurs:
a. All transactions should be undone
b. All transactions should be redone
c. A log is to be consulted to determine which transactions are undone and which transactions are redone.
d. None of the above

16. In DBMS, deferred update means :
a. All the updates are done first but the entries are made in the log file later.
b. All the log files entries are made first but the actual updates are done later.
c. Every update is done first followed by a writing on the log file.
d. Changes in the views are deferred till a query asks for a view.

17. The write ahead logging (WAL) protocol simply means that :
a. The writing of data item should be done ahead of any logging operation
b. The log record for an operation should be written before the actual data is written
c. All log records should be written before a new transaction begin
d. The log never needs to be written

18. A check pointing system is needed :
a. To ensure system security b. To recover from transient faults
c. To ensure system privacy d. To ensure system integrity

19. A ____ is a key-value pair used to define Graph Nodes and Relationships?
a. Relationships b. Nodes c. Property d. Labels

20. Neo4j is developed using which of the following language?
a. Java b. Python c. C d. C++

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SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt ANY SIX questions. Write the answers in your own words as far as practicable.

1. Define File System and Database Management System, list out the advantages and disadvantages of DBMS over File Systems? Explain the concept of physical data independence, and its importance in database systems. [4]

2. What do you understand by the term ER diagram? Sketch the ER diagram of an Airline reservation system. The ER diagram is intended to keep track of customers and their reservations, flights and their status, seat assignments on individual flights, and the schedule and routing of future flights. [4]

3. Consider a database consisting of the four relation schemas:

```
passenger ( p_id, p_name, p_gender, p_city)
agency ( a_id, a_name, a_city)
flight (f_id, f_date, f_time, f_origin, f_dest)
booking (p_id, a_id, f_id, f_date)
```

Answer the following questions using relational algebra queries: [4]

a. Get the complete details of all flights to Biratnagar.
b. Get the details about all flights from Kathmandu to Biratnagar.
c. Find the passenger names for passengers who have bookings on at least one flight.
d. Get the details of flights that are scheduled on both dates 01/12/2024 and 02/12/2024 at 16:00 hours.

4. Explain the distinctions among the primary key, candidate key, superkey and foreign key with suitable examples. [4]

5. List the ACID properties, Explain the significance of each. During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain why each state transition may occur. [4]

6. Classify the types of failures of Database Systems. What are the methods to recover a database from failures? [4]

7. Define NoSQL Databases. What are the different types of NoSQL databases, explain. Mention the situations when you would choose RDBMS or NoSQL. [4]

P.T.O.

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt ANY TWO questions. Write the answers in your own words as far as practicable

8.

a. Normalization is based on the analysis of functional dependencies. Explain different types of functional dependencies with suitable examples. Demonstrate how you can achieve different Normal forms (1NF, 2NF, 3NF and BCNF). [4]

b. Consider a relation $R(A,B,C,D,E)$ having a set of FD's $F=\{A\rightarrow BC,\ CD\rightarrow E,\ B\rightarrow D,\ E\rightarrow A\}$. List all the candidate keys of relation R. Also find primary key, prime ttributes and non-prime attributes. [4]

9.

a. Consider the relations

```
Project (P-No, P-Name, Cheif-Architect)
Employee (E-No, E-Name),
Assignee-to (P-No, E-No)
```

Write SQL queries for the following operations: [4]

I. Get E-No of employees working on project whose P-No is P250.
II. Get details of employees (both number and name) working on project P525.
III. Obtain details of employees working on the project named DATABASE.
IV. Get details of employees working on both projects P150 and P200.

b. Explain with the help of suitable examples the following clauses as used in SQL: ***where, order by, group by, like.*** [4]

10.

a. What is a serializable schedule? Draw the precedence graph of the following schedule and determine whether the schedule is serializable. [4]

T_1	T_2	T_3	T_4
	read-lock(A)		
	write-lock(B)		
	unlock(A)		
		write-lock(A)	
	unlock(B)		
read-lock(B)			
		unlock(A)	
			read-lock(B)
read-lock(E)			
			unlock(B)
write-lock(C)			
unlock(E)			
unlock(B)			
		write-lock(B)	
		unlock(B)	
unlock(C)			
			read-lock(C)
			unlock(C)
	write-lock(C)		
	unlock(C)		

b. Discuss the locking techniques for concurrency control with examples. Describe the role of two-phased locking in the process of deadlock detection and avoidance. [4]