Panchkhal

KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Marks Scored:

Level : B.Tech.
Year : II

Course : AICS 201
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 25 MAR 2025

SECTION "A"
[20Q. × 0.5 = 10 marks]

Attempt *ALL* the questions. Encircle the most appropriate answers.

1. Which of the following is not a feature of DBMS?
   a. Minimum Duplication and Redundancy of Data
   b. High Level of Security
   c. Single-user Access only
   d. Support ACID Property

2. The ability to query data, as well as insert, delete, and alter tuples, is offered by
   a. TCL (Transaction Control Language)
   b. DDL (Data Definition Language)
   c. DCL (Data Control Language)
   d. DML (Data Manipulation Language)

3. _____ is a set of one or more attributes taken collectively to uniquely identify a record
   a. Primary key b. Foreign Key c. Super Key d. Candidate Key

4. Why the following statement is erroneous?
   SELECT dept_name, ID, avg (salary)
   FROM instructor
   GROUP BY dept_name;
   a. ID should not be used in group by clause
   b. Group by clause is not valid in this query
   c. avg (salary) should not be selected
   d. None

5. Which of the following is known as a set of entities of the same type that share properties, or attributes?
   a. Relation set b. Tuples c. Entity set d. Entity Relation Model

6. After groups have been established, SQL applies predicates in the ____ clause, allowing aggregate functions to be used.
   a. Where b. Having c. Group by d. With

7. The primary key of the representation of a weak entity set consists of the primary key of the strong entity set and the ___
   a. Discriminator of the weak entity set
   b. Foreign key
   c. Primary key of all the other entity sets
   d. All the attributes of the weak entity set

8. Which of the following is used to denote the selection operation in relational algebra?
   a. Pi (Greek) b. Sigma (Greek) c. Lamda (Greek) d. Omega (Greek)

9. For any pincode, there is only one city and state. Also, for given street, city and state, there is just one pincode. In normalization terms, empdt1 is a relation in
empdt1 (empcode, name, street, city, state, pincode)
a. 1 NF only
b. 2 NF and also in 1 NF
c. 3 NF and hence also in 2 NF and 1 NF
d. BCNF and hence also in 3 NF, 2NF and 1 NF

10. Neither multivalued nor composite attributes, nor their combinations, may be used in the ___ normal form.
a. First
b. Second
c. Third
d. Fourth

11. There needs to be which of the following conditions for each nontrivial dependency of function X on function Y for a relation to be in third normal form.
a. A super key is X
b. Every element of Y is a part of some candidate key, i.e. Y is a prime attribute
c. Either A or B
d. None of the above

12. NULL is
a. The same as 0 for integer
b. The same as blank for character
c. The same as 0 for integer and blank for character
d. Not a value

13. Which of the following has "all-or-none" property?
a. Atomicity
b. Durability
c. Isolation
d. Consistency

14. ____ states that only valid data will be written to the database.
a. Consistency
b. Atomicity
c. Durability
d. Isolation

15. When the transaction finishes the final statement, the transaction enters into
a. Active state
b. Committed state
c. Partially committed state
d. Abort state

16. In order to maintain transactional integrity and database consistency, what technology does a DBMS deploy?
a. Triggers
b. Pointers
c. Locks
d. Cursors

17. Which of the following protocols ensures conflict serializability and safety from deadlocks?
a. Two-phase locking protocol
b. Time-stamp ordering protocol
c. Graph based protocol
d. None of the mentioned

18. Which of the following are introduced to reduce the overheads caused by the log-based recovery?
a. Checkpoints
b. Indices
c. Deadlocks
d. Locks

19. The transaction can no longer continue with its normal execution because of some internal condition, such as bad input, data not found, overflow, or resource limit exceeded. That is
a. Read error
b. Boot error
c. Logical error
d. System error

20. Which NoSQL database type is best suited for storing and retrieving JSON documents?
a. Key value
b. Document
c. Graph
d. Object-Oriented

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F. M. : 40

SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions. **(Q.N. 4 is compulsory)**

1. Define data independence. Explain three schema architecture.

2. Design a database (ER diagram) for an automobile company to provide to its dealers to assist them in maintaining customer records and dealer inventory and to assist sales staff in ordering cars.

3. Consider the employee database of figure below
employee (person_name, street, city)
works (person_name, company_name, salary)
campany (company_name, city)
Give an expression in the relational algebra to express each of the following queries:
   a. Find the name of each employee who lives in city "Panchkhal".
   b. Find the name of each employee whose salary is greater than Rs 100000.
   c. Find the names of each employee who lives in "Panchkhal" and whose salary is greater than Rs 100000.
   d. Find the tuples of the employee relation working in the Hyundai Motor Company.

4. Consider the bank database of figure below, where the primary keys are underlined.
branch (branch_name, branch_city, assets)
customer (ID, customer_name, customer_street, customer_street)
loan (loan_number, branch_name, amount)
borrower (ID, loan_number)
account (account_number, branch_name, balance)
depositer (ID, account_number)
Construct the following SQL queries for this relational database
   a. Find the ID of each customer of the bank who has an account but not a loan.
   b. Find the ID of each customer who lives on the same street and in the same city as customer '12345'
   c. Find the name of each branch that has at least one customer who has an account in the bank and who lives in "Harrison".

5. Why do we need concurrency control? Discuss two phase locking protocol.

6. Why database recovery is essential? Explain log-based recovery technique.

7. What is NOSQL database system. Discuss its characteristics.

P.T.O.

SECTION "C"

[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions. **(Q.N. 9 is compulsory)**

8. Define normalization. Why normalization is important in database design? Explain 1NF, 2NF and 3NF with suitable example.

9. What are the categories of NOSQL system. Explain briefly. Discuss about the CAP theorem.

10. Write short note on: [4Q × 2=8]
    a. Aggregate Queries
    b. Integrity Constraints
    c. Natural Join
    d. Weak Entity