ROLL NO. _____

Code: AC61/AT61/AC112/AT112
Subject: DATABASE MANAGEMENT SYSTEMS

AMIETE – CS/IT (Current & New Scheme)

Time: 3 Hours **June 2018** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Q2 TO Q7 CAN BE ATTEMPTED BY BOTH CURRENT AND NEW SCHEME STUDENTS.**
- **Q8 AND Q9 HAVE BEEN GIVEN INTERNAL OPTIONS FOR CURRENT SCHEME (CODE AC61/AT61) AND NEW SCHEME (CODE AC112/AT112) STUDENTS.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: **(2×10)**

a. Which of the following is the problem of file management system?
(A) Atomicity Problem **(B)** Data redundancy
(C) Concurrent access anomalies **(D)** All of these

b. The maximum number of superkeys for the relation schema R(E,F,G,H) with E as the key is
(A) 5 **(B)** 6
(C) 7 **(D)** 8

c. Given the relations
employee (name, salary, deptno) and
department (deptno, deptname, address)

Which of the following queries cannot be expressed using the basic relational algebra operations (U, -, x, π, σ, p)
(A) Department address of every employee
(B) Employees whose name is the same as their department name
(C) The sum of all employees' salaries
(D) All employees of a given department

d. Which of the following is **TRUE**?
(A) Every relation in 3NF is also in BCNF
(B) A relation R is in 3NF if every non-prime attribute of R is fully functionally dependent on every key of R
(C) Every relation in BCNF is also in 3NF
(D) No relation can be in both BCNF and 3NF

e. Which of the following is not an Armstrong's axiom ?
(A) Reflexivity rule **(B)** Transitivity rule
(C) Pseudotransitivity rule **(D)** Augmentation rule

f. Consider a schema R(A, B, C, D) and functional dependencies A -> B and C -> D. Then the decomposition of R into R1 (A, B) and R2(C, D) is
(A) dependency preserving and loss less join
(B) loss less join but not dependency preserving
(C) dependency preserving but not loss less join
(D) not dependency preserving and not loss less join

g. Consider the following transaction involving two bank accounts x and y.
read(x); x := x – 50; write(x); read(y); y := y + 50; write(y)
The constraint that the sum of the accounts x and y should remain constant is that of
(A) Atomicity **(B)** Consistency
(C) Isolation **(D)** Durability

h. 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) Both **(A)** and **(B)**

i. A file is organized so that the ordering of data records is the same as or close to the ordering of data entries in some index. Then that index is called
(A) Dense **(B)** Sparse
(C) Clustered **(D)** Unclustered

j. Materialised views make sure that
(A) View definition is kept stable
(B) View definition is kept up-to-date
(C) View definition is verified for error
(D) View is deleted after specified time

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

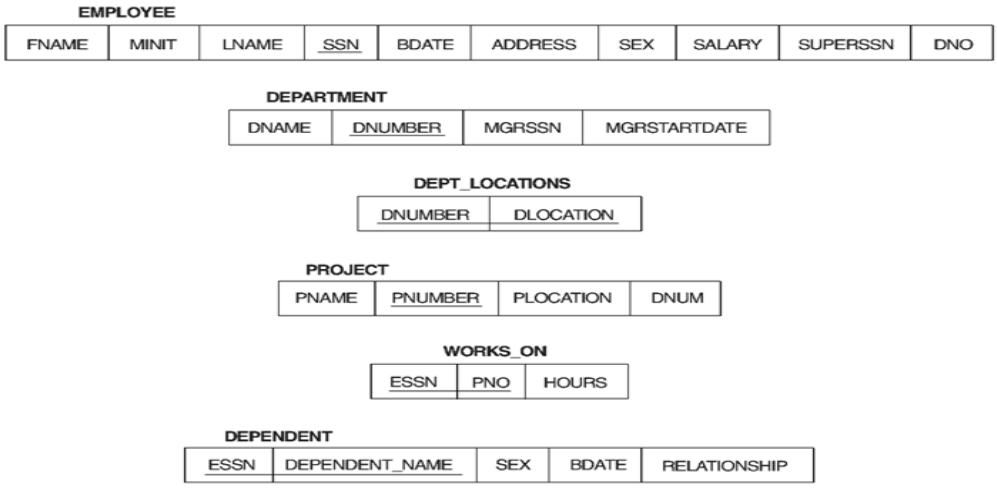
Q.2 a. Write & explain characteristics of Database approach. **(8)**

b. (i) Describe the three-schema architecture. Why do we need mappings between schema levels?
(ii) When is the concept of a weak entity used in data modeling? Define the terms owner entity type, weak entity type, identifying relationship type, and partial key. **(8)**

Q.3 a. Consider the following schema: **(8)**
Suppliers(sid: integer, sname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)
The key fields are underlined, and the domain of each field is listed after the field name. Therefore sid is the key for Suppliers, pid is the key for Parts, and sid and pid together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers. Write the following queries in relational algebra and tuple relational Calculus.
(i) Find the names of suppliers who supply some red part.
(ii) Find the sids of suppliers who supply every red part.

b. Explain join operation and variations of join with example. **(8)**

Q.4 a. Consider the following schema: **(8)**



Write each of the following queries in SQL.
(i) Retrieve the name of each employee who has a dependent with the same first name and is the same sex as the employee.
(ii) For each project, retrieve the project number, the project name, and the number of employees who work on that project.
(iii) Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary.

b. Explain the ER-to-Relational Mapping Algorithm for the following types with example. **(8)**
(i) Mapping of Binary 1:1 Relationship Types
(ii) Mapping of Binary 1:N Relationship Types
(iii) Mapping of Binary M:N Relationship Types.

Q.5 a. (i) Define the term functional dependency.
(ii) Explain the process of normalization. Explain 3NF and BCNF with suitable example**.** **(4+4)**

b. (i) Define dependency preserving and lossless join decomposition with example.
(ii)Suppose you are given a relation R with four attributes ABCD. For each of the following sets of FDs, assuming those are the only dependencies that hold for R, do the following:
(a) Identify the candidate key(s) for R.
(b) Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF).
(c) If R is not in BCNF, decompose it into a set of BCNF relations that preserve the dependencies.
i. $C \rightarrow D$, $C \rightarrow A$, $B \rightarrow C$
ii. $ABC \rightarrow D$, $D \rightarrow A$ **(8)**

Q.6 a. Discuss the atomicity, durability, isolation, and consistency preservation properties of a database transaction. **(4)**

b. (i) Define the violations caused by each of the following:
dirty read, nonrepeatable read, and phantoms.
(ii) Describe the four levels of isolation in SQL. **(6)**

c. How do optimistic concurrency control techniques differ from other concurrency control techniques? Why are they also called validation or certification techniques? Discuss the typical phases of an optimistic concurrency control method. **(6)**

Q.7 a. Discuss the deferred update technique of recovery. What are the advantages and disadvantages of this technique? Why is it called the NO-UNDO/REDO method? **(8)**

b. Describe the three phases of the ARIES recovery method. **(8)**

Q.8 (For Current Scheme student i.e. AC61/AT61)

a. Differentiate between the following giving advantages and disadvantages of each. **(8)**
(i) Open addressing and chaining for collision resolution.
(ii) Unordered and ordered file

b. (i) What are the reasons for having variable-length records? What types of separator characters are needed for each?
(ii) What do you understand by the term INDEX? What is the difference between a primary index and a secondary index? **(4+4)**

Q.8 (For New Scheme student i.e. AC112/AT112)

a. Discuss the two main types of constraints on specializations and generalizations. **(6)**

b. What is a fragment of a relation? What are the main types of fragments? Why is fragmentation a useful concept in distributed database design? **(6)**

c. Explain Distributed Query Processing Using Semijoin. **(4)**

Q.9 (For Current Scheme student i.e. AC61/AT61)

a. Describe the nested-loop join, sort- merge join and Partition-hash join. **(6)**

b. Discuss the cost components for query execution. **(4)**

c. What is meant by semantic query optimization? How does it differ from other query optimization techniques? **(6)**

Q.9 (For New Scheme student i.e. AC112/AT112)

a. What is a statistical database? Briefly discuss the problem of statistical database security. **(6)**

b. Explain Granting and Revoking of Privileges with example. **(4)**

c. What are digital signatures? How do they work? **(6)**