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

ROLL NO. _____

AMIETE – CS/IT (Current & New Scheme)

Time: 3 Hours **June 2019** **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. Count function in SQL returns the number of
(A) values **(B)** distinct values
(C) groups **(D)** columns

b. Let R(A, B, C, D) be a relational schema with the following functional dependencies A —> B, B --> C , it
(A) Gives a lossless join, and is dependency preserving.
(B) Gives a lossless join, but is not dependency preserving
(C) Does not give a loss less join, but is dependency preserving
(D) Does not give a lossless join and is not dependency preserving

c. The normalization of 1NF relations to 2NF involves:
(A) Removal of partial dependencies
(B) Removal of full dependencies
(C) Removal of transitive dependencies
(D) Removal of multi-valued dependencies

d. In the index allocation scheme of blocks to a file, the maximum possible size of the file depends on :
(A) the size of the blocks, and the size of the address of the blocks
(**B)** the number of blocks used for the index, and the size of the blocks
(C) the size of the blocks, the number of blocks used for the index, and the size of the address of the blocks
(D) None of these

e. Amongst the ACID properties of a transaction, the 'Durability' property requires that the changes made to the database by a successful transaction persist
(A) Except in case of an operating system crash
(B) Except in case of a disk crash
(C) Except in case of a power failure
(D) Always, even if there is a failure of any kind

f. Which one of the following statements about normal forms is FALSE?
(A) BCNF is stricter than 3NF
(B) Lossless, dependency-preserving decomposition into 3NF is always possible
(C) Lossless, dependency-preserving decomposition into BCNF is always possible
(D) Any relation with two attributes is in BCNF

g. Which of the following is not a recovery technique?
(A) Deferred update **(B)** Immediate update
(C) Two-phase commit **(D)** Shadow paging

h. Checkpoints are a part of
(A) Recovery measures **(B)** Security measures
(C) Concurrency measures **(D)** Authorization measures

i. Cartesian product in relational algebra is
(A) a Unary operator **(B)** a Binary operator
(C) a Ternary operator **(D)** not defined

j. The collection of information stored in a database at a particular moment is called as
(A) schema **(B)** instance of the database
(C) data domain **(D)** independence

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

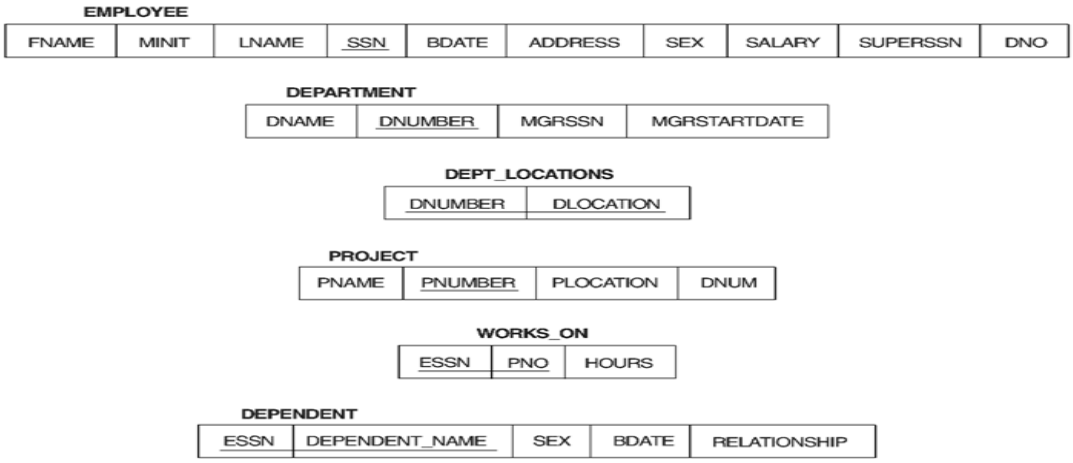
Q2. a. Define the following terms: data model, database schema, database state, internal schema, conceptual schema, external schema, data independence, DDL, DML, SDL and VDL. **(10)**

b. university registrar's office maintains data about the following entities: (a) courses, including number, title, credits, syllabus, and prerequisites; (b) course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom; (c) students, including student-id, name, and program; and (d) instructors, including identification number, name, department, and title.
Further, the enrolment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modelled. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints. **(6)**

Q3. a. Let the following relation schemas be given:
R = (A,B,C)
S = (D,E, F)
Let relations r(R) and s(S) be given. Give an expression in SQL that is equivalent to each of the following queries.
a. $\Pi_A(r)$
b. $\sigma_{B=17}(r)$
c. $r \times s$
d. $\Pi_{A,F}(\sigma_{C=D}(r \times s))$ **(8)**

b. How does tuple relational calculus differ from domain relational calculus? Discuss the meanings of the existential quantifier ($\exists$) and the universal quantifier ($\forall$) **(8)**

Q4. a.



Write each of the following queries in SQL.
(i) List the names of all employees who have a dependent with the same first name as themselves.
(ii) List the names of employees who work on all the projects controlled by department number 5.
(iii) For each employee, retrieve the employee's first and last name and the first and last name of his or her immediate supervisor. **(8)**

b. (i) Define foreign key. What is this concept used for?
(ii) Explain the ER-to-Relational Mapping Algorithm for Mapping of Binary M:N Relationship Types. **(8)**

Q5. a. What is Functional Dependency? Describe normalization and also differenciate BCNF and 3 NF with suitable example. **(8)**

b. (i) Write the algorithm for computation of attribute set closure.
(ii) Compute the attribute closure of the following set of functional dependencies for relation schema R = {A, B, C, D, E}.
A -> BC, CD -> E, B -> D, E -> A
List the candidate keys for R. **(8)**

Q6. a. What is a transaction? 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)**

b. Define these terms: blind write, serializable schedule, recoverable schedule. **(6)**

c. Consider the three transactions T1, T2, and T3, and the schedules S1 and S2 given below. Draw the serializibility (precedence) graphs for S1 and S2 and state whether each schedule is serializable or not. If schedule is (conflict) serializable, write down the equivalent serial schedule(s).
S1: r1(x); r2(z); r1(z); r3(x); r3(y); w1(x); w3(y); r2(y); w2(z); w2(y)
S2: r1(x); r2(z); r3(x); r1(z); r2(y); r3(y); w1(x); w2(z); w3(y); w2(y) **(6)**

Q7. a. What are deferred modification and immediate modification technique for recovery? How does recovery takes place in case of a failure in these techniques? **(8)**

b. What are log sequence numbers (LSNs) in ARIES? How are they used? What information do the Dirty Page Table and Transaction Table contain? **(8)**

Q8. (For Current Scheme, AC61/AT61)

a. What are the differences among primary, secondary, and clustering indexes? How do these differences affect the ways in which these indexes are implemented? **(8)**

b. How does a B-tree differ from a B+-tree? Why is a B+-tree usually preferred as an access structure to a data file? **(8)**

Q8. (**For New Scheme, AC112/AT112)**

a. Define the following terms: superclass of a subclass, superclass/subclass relationship, IS-A relationship, specialization, generalization, category, specific (local) attributes, and specific relationships. **(8)**

b. Discuss what is meant by the following terms: degree of homogeneity of a DDBMS, degree of local autonomy of a DDBMS, federated DBMS, distribution transparency, fragmentation transparency, replication transparency and multidatabase system. **(8)**

Q9 (For Current Scheme, AC61/AT61)

a. What is meant by the term heuristic optimization? Discuss the main heuristics that are applied during query optimization. **(6)**

b. **(**i) What is a query execution plan?
(ii) Describe the nested-loop join and Partition-hash join. **(10)**

Q9. **(For New Scheme, AC112/AT112)**

a What are the different types of SQL injection attacks? **(6)**

b. What type of information does a digital certificate include? **(4)**

c**.** What is flow control as a security measure? What types of flow control exist? **(6)**