A7-R3: INTRODUCTION TO DATABASE MANAGEMENT SYSTEM

NOTE:

1. There are **TWO PARTS** in this Module/Paper. **PART ONE** contains **FOUR** questions and **PART TWO** contains **FIVE** questions.

2. **PART ONE** is to be answered in the **TEAR-OFF ANSWER SHEET** only, attached to the question paper, as per the instructions contained therein. **PART ONE** is **NOT** to be answered in the answer book.

3. Maximum time allotted for **PART ONE** is **ONE HOUR**. Answer book for **PART TWO** will be supplied at the table when the answer sheet for **PART ONE** is returned. However, candidates, who complete **PART ONE** earlier than one hour, can collect the answer book for **PART TWO** immediately after handing over the answer sheet for **PART ONE**.

TOTAL TIME: 3 HOURS **TOTAL MARKS: 100**

(PART ONE – 40; PART TWO – 60)

PART ONE
(Answer all the questions)

1. Each question below gives a multiple choice of answers. Choose the most appropriate one and enter in the "tear-off" answer sheet attached to the question paper, following instructions therein. (1x10)

1.1 _____ produces all the combinations of tuples from relations R_1 and R_2 that satisfy a join condition with only equality comparisons.
A) Theta join
B) Equi-join
C) Natural join
D) None of the above

1.2 The ascending order of a data hierarchy is
A) Bit – byte – record – field – file – database
B) Byte – bit – field – record – file – database
C) Bit – byte – field – record – file – database
D) Bit – byte – file – record – field – database

1.3 The _____ is used to maintain a complete record of all activity that affected the contents of a database during a certain period of time
A) View
B) Transaction log
C) Query language
D) DML

1.4 In the DBMS approach, application programs perform
A) Storage functions
B) Processing functions
C) Access control
D) All of the above

1.5 If a piece of data is stored in two places in the database, then
A) Storage space is wasted.
B) Changing the data in one place, causes data inconsistency.
C) Can be more easily accessed.
D) Both A) and B)

1.6 Which of the following is not a logical database structure?
A) Chain
B) Network
C) Tree
D) Relational

1.7 When DML commands are embedded in a general purpose programming language, the language is termed
A) Host Language
B) Query Language
C) Data Sublanguage
D) None of the above

1.8 _____ produces relations that comprises of all tuples of R that appear in combination with every tuple of S.
A) R – S
B) R U S
C) R ÷ S
D) None of the above.

1.9 A database log, that is used for security purposes is called
A) Database Audit
B) Audit Trail
C) Transaction Log
D) None of the above

1.10 An alias is
A) An alternate name given to a relation
B) An alternate name given to an inner query
C) An alternate name given to a user
D) None of the above

2. Each statement below is either TRUE or FALSE. Choose the most appropriate one and ENTER in the "tear-off" sheet attached to the question paper, following instructions therein. (1x10)

2.1 Redundancy is minimized with a computer based database approach.
2.2 A row in a database can be called a domain.
2.3 All relations are in 1NF.
2.4 A dense index has an index entry for every search key value (record) in the data file.
2.5 Static 2PL does not require transactions to lock all items by pre-declaring the read set and the write set.
2.6 The isolation property ensures that either all the database operations in a transaction are executed or none.
2.7 The recovery manager is responsible for implementing a particular strategy for concurring control.
2.8 Relational calculus and relational algebra are both procedural languages.
2.9 The lossless join property ensures that no spurious tuples are generated when a NATURAL JOIN operation is applied to the relations in a decomposition.
2.10 A population is a set of properties concerning a user, that are relevant for ensuring security of a database.

3. Match words and phrases in column X with the closest related meaning/ word(s)/phrase(s) in column Y. Enter your selection in the "tear-off" answer sheet attached to the question paper, following instructions therein. (1x10)

X		Y	
3.1	Tuple	**A.**	Variables
3.2	Function of a database	**B.**	High speed, large capacity disk
3.3	Most important hardware component required for the operation of a database	**C.**	Lossless join
3.4	Threats to the security of a database are	**D.**	Additive rule
3.5	The function in SQL that is used to check whether the result of a correlated nested query is empty or not.	**E.**	Column in a database
3.6	Natural join of a set of relations $R_1,\ldots,R_n$ on which join dependency holds, generates	**F.**	High definition monitor
3.7	$(X \rightarrow Y \ WY \rightarrow Z)$ derives $WX \rightarrow Z$	**G.**	Pseudo transitive rule
3.8	Default ORDER BY	**H.**	EXISTS
3.9	Keeping all tuples of relation R or relation S or both in the result, can be obtained by	**I.**	Ascending
3.10	A formula in relational calculus is made up of	**J.**	Collect and organize data
		K.	Spurious tuples
		L.	Direct
		M.	Row/record in a database
		N.	OUTER JOIN
		O.	UNIQUE
		P.	NATURAL JOIN
		Q.	Descending
		R.	Atoms
		S.	Output data

4. Each statement below has a blank space to fit one of the word(s) or phrase(s) in the list below. Enter your choice in the "tear-off" answer sheet attached to the question paper, following instructions therein. (1x10)

A.	Shadow page	**B.**	Fully Functional Dependency	**C.**	Multi-valued
D.	Timestamp	**E.**	Immediate	**F.**	Conflict equivalent
G.	Two	**H.**	Virtual	**I.**	Recoverable
J.	Views	**K.**	Partial Functional Dependency	**L.**	Single-valued
M.	Deferred	**N.**	Physical	**O.**	Discretionary
P.	View equivalent	**Q.**	Mandatory	**R.**	Strict

4.1 If base tables are updated, changes are reflected in the _____.

4.2 Shadow paging enforces the maintenance of _____ page tables during the life of a transaction.

4.3 A _____ is a unique identifier created by the DBMS to identify a transaction.

4.4 _____ attributes in an ER diagram, do not map directly into columns for the appropriate tables; new tables need to be created.

4.5 Views are _____ tables.

4.6 A functional dependency X→Y is a _____, if removal of any attribute A from X, means that the dependency does not hold any more.

4.7 The _____ update techniques do not physically update the database on the disk, until after a transaction reaches its commit point.

4.8 Two schedules are said to be _____ if the order of any two conflicting operations is the same in both schedules.

4.9 _____ security mechanisms are used to grant privileges to users.

4.10 A _____ schedule is one in which transactions can neither read nor write an item X until the last transaction that wrote X has committed or aborted.

PART TWO

(Answer any **FOUR** questions)

5.

a) What is meant by data independence? Mention different types of data independence.

b) Given the following assertions, for a relational database, that represents the current term enrollment at a large university, draw an ER diagram, for his schema, that takes into account all the assertions given. There are 2000 instructors, 4000 courses and 30000 students. Use as many ER constructs as you can to represent the true semantics of the problem.

Assertions:

a. An instructor may teach none, one, or more courses in a given term (average is 2.0 courses).
b. An instructor must direct the research of at least one student (average = 2.5 students).
c. A course may have none, one, or two prerequisites (average = 1.5 prerequisites).
d. A course may exist even if no students are currently enrolled.
e. All courses are taught by only one instructor.
f. The average enrollment in a course is 30 students.
g. A student must select at least one course per term (average = 4.0 course selections).

(7+8)

6.

a) Define super keys, candidate keys, primary keys. How are they related to strong and weak entity sets?

b) Using the following database, which is a COMPANY relational database schema, answer the followings (primary keys in all the tables are underlined)

EMPLOYEE

FNAME	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS

DNUMBER	DLOCATION

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM

WORKS_ON

ESSN	PNO	HOURS

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP

i) Retrieve the names and address of all employees who work for the “Research” department. (Relational algebra)

ii) Find the names of all employees who work on all the projects controlled by department 5. (Relational algebra)

iii) Retrieve the names of all employee, who either work in department 4 and make over $25000 per year, or work in department 5 and make over $30000 (Relational algebra).

iv) Retrieve the social security nos. (SSN) of all the employees who either work in department 5 or directly supervise an employee who works in department 5 (Relational algebra).

(7+[4x2])

7.

a) Differentiate between DDL and DML.

b) What information does SQL-DDL provide on each relation?

c) Write SQLs for the following (please refer to the COMPANY relational schema in Q.6(b)):

i) Retrieve a list of employees and the projects, they are working on, ordered by department, and within each department, ordered alphabetically by last name, first name.

ii) Retrieve the name of each employee who has a dependent with the same first name as the employee (use nested queries).

iii) Count the number of distinct salary values in the database.

iv) For each project, retrieve the project number, project name and the number of employees who work on the project.

(3+4+[4x2])

8.

a) What are the different techniques used on the failure of a transaction?

b) Answer each of the following questions using "yes" or "no". Justify each answer. (The candidate key may be either a single attribute or a composite attribute key, shown underlined.) Other candidate keys may be possible.

Given: R(A,B,C) and the functional dependency BC → A:

i) Is R in 3NF?

ii) Is R in BCNF?

iii) Is BC a candidate key?

c) Write and state the rules applied to find out the closure of a set of functional dependencies.

(4+6+5)

9.

a) What are the different types of database security mechanisms? How does the DBA impose security on the database by using "privileged account"?

b) Explain Multi-Valued Data Dependency. How is it related to 4NF? Explain with an example.

(8+7)