B2.2-R4: 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 A view is a
A) Base table
B) Derived table
C) Named derived table
D) None of the above

1.2 System failures are also known as
A) Soft crashes
B) Media crashes
C) Hard crashes
D) System failures are non-existent

1.3 Considering the following statements
i) A given user has different access rights on different objects.
ii) Each data object has a certain classification level, while the user has a clearance level.
iii) Is flexible.
iv) Is rigid.
Which of the following combinations of the above given statements, best describes discretionary control?
A) Only i)
B) Only ii)
C) i) and iii)
D) ii) and iv)

1.4 The property of transaction that states "The changes applied to the database by a committed transaction must persist in the database. These changes must not be lost because of any failure." is
A) Atomicity
B) Consistency
C) Isolation
D) Durability

1.5 **[TS => Timestamp; T_i => i^{th} transaction]** The following operation sequence :

If TS(T_i) < TS(T_j) [T_i is older than T_j]
T_i is allowed to wait
Else abort T_i and restart later with the same timestamp;

corresponds to

A) Wait – Die
B) Wound – Wait
C) Continuous – Wait
D) Strict Timestamp Ordering

1.6 The Deferred – Update technique is synonymous to

A) NO UNDO/ REDO algorithm
B) UNDO/ REDO algorithm
C) UNDO/ NO REDO algorithm
D) None of the above

1.7 Given the query:
{t.DOB, t.ADDRESS | EMPLOYEE(t) ^ t.FNAME = 'MAHESH' ^ t.LNAME = 'KUMAR'}
Consider the following query formats

i) Select DOB, ADDRESS
From EMPLOYEE
Where FNAME = 'MAHESH' AND LNAME = 'KUMAR'

ii) {uv | (∃q)(∃r)(∃s)(∃t)(∃w) EMPLOYEE(qrstuvw) ^ q = 'MAHESH' ^ s = 'KUMAR'}

Which of the following combinations best describes the given relational calculus query?

A) Only i)
B) Only ii)
C) i) and ii)
D) All the three queries retrieve different data

1.8 A relation schema R is in _____ if, whenever a non-trivial functional dependency X→A holds in R, then X is a superkey of R

A) 3NF
B) BCNF
C) 2NF
D) 4NF

1.9 Considering the following functional dependencies
DM→NP and D→M; after applying the elimination rule of extraneous attributes, the resultant dependency becomes

A) D→M
B) D→NP
C) M→NP
D) M→N

1.10 The capacity to change the conceptual schema without having to change the external schema or application programs

A) Data independence
B) Physical data independence
C) Logical Data independence
D) Such change mechanisms are non-existent

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 The data communications manager is a part of the DBMS.
2.2 A view is a virtual named derived relation, while a snapshot is real.
2.3 The SQL is strongly typed?
2.4 The physical design is DBMS specific while the logical design is DBMS independent.
2.5 The commit point corresponds to the end of a logical unit of work.
2.6 An attribute is prime if it is not a member of some candidate key.
2.7 The Cartesian product of two relations R_1 and R_2, includes as tuples all possible permutations of tuples from R_1 and R_2.
2.8 A cohert channel specifies the channels along which information is allowed to move.
2.9 The Relational Algebra query: $\pi_{NAME,ADDRESS}(\sigma_{DNAME='RESEARCH'}(EMPLOYEE))$ is equivalent to the SQL query:
```
Select NAME, ADDRESS
From EMPLOYEE
Where DNAME = 'RESEARCH'.
```
2.10 Generalization is the process of defining a set of subclasses of an entity.

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	The immunity of applications to changes in the way data is stored and accessed.	**A.**	DDL
3.2	Supports the processing of database objects	**B.**	Dirty Read Problem
3.3	The number of tuples	**C.**	Data Integrity
3.4	The smallest semantic unit of data	**D.**	Lossless Join
3.5	The problem that occurs when one transaction updates a database item and then the transaction fails for some reason	**E.**	Data independence
3.6	Set of tuples of a relation that satisfy some selection condition	**F.**	Theta-Join
3.7	The property which ensures that each functional dependency is represented in some individual relation resulting after decomposition	**G.**	Cardinality
3.8	Extracts DML commands from an application program written in a host language	**H.**	Precompiler
3.9	The operation that produces all combinations of tuples from relations R_1 and R_2 that satisfy a join condition	**I.**	View Definition Language
3.10	Often used to specify user views and their mapping	**J.**	Dependency preservation
		K.	Data Definition Language
		L.	Scalars
		M.	Population

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.	Schema	**B.**	Non-procedural	**C.**	Domain
D.	Relation	**E.**	Many-to-One	**F.**	One-to-One
G.	Successful	**H.**	Catalog	**I.**	Conceptual View
J.	View mechanism	**K.**	Procedural	**L.**	Divide
M.	Range				

4.1 The _____ is a representation of the entire information content of the database.

4.2 The _____ is a pool of values from where specific attributes of specific relations draw their actual values.

4.3 The _____ operation returns a relation consisting of all tuples appearing in the first, but not in the second of the two specified relations.

4.4 Relational calculus is _____.

4.5 The tuple variable ranges over a _____.

4.6 A _____ in SQL consists of the descriptors for an individual database.

4.7 A _____ consists of the descriptors for that portion of that database that belongs to some individual

4.8 A functional dependency is a _____ relationship between two sets of attributes in a given relation.

4.9 The COMMIT TRANSACTION operations signal _____ end of transaction.

4.10 The _____ subsystem can be used to hide sensitive data from unauthorized users.

PART TWO

(Answer any **FOUR** questions)

5.

a) Show the block diagram of 3 level database architecture. Explain the significance of each level. What do you mean by physical and logical data independence?

b) Given the following assertions for the relational database that represents the current term at a university, draw an ER diagram for this schema that takes into account all the assertion given below.

Assertions:

i) An instructor may teach none, one, or more courses in a given term.

ii) An instructor must direct the research of at least one student.

iii) A course may have none, one or two pre requisite.

iv) A course may exist even if no students are currently enrolled.

v) All courses are taught by only one instructor.

vi) The average enrollment in a course is 30 students.

vii) A student must select at least one course at a time.

(8+7)

6.

a) Define 3NF and BCNF. Give an example of a relation that is in 3NF but not in BCNF.

b) Given the following set of Functional Dependencies, find the minimum set of 3NF relations. Designate the candidate key attribute of these relations. Is the set of relations you derived, also BCNF?

A → BCDEF, AB → CDEF, ABC →DEF, ABCD → EF, ABCDE→F, B → DG, BC → DEF, BD → DEF, E → BF

c) What do you mean by integrity constraint? Give example.

(5+5+5)

7.

a) How are the operations of EQUI-JOIN and NATURAL-JOIN different? Explain with an example based on relational algebra.

b) Write SQL commands for the following schema:

EMP(**ENO**, NAME, ADDRESS, SALARY, DNO)

DEPT(**DNO**, DNAME)

DEPT_LOC(**DNUM**, DLOC)

PROJECT(**PNO**, NAME, LOCATION, DNUM).

i) Retrive the name and address of all the employees who work for the 'R&D' department.

ii) For every project located in Kolkata, display the project number and the controlling department name.

iii) Retrieve the names of the projects, whose locations do not match the location of their respective controlling departments.

c) What is a safe expression? Give an example.

(5+7+3)

8.

a) What is data encryption? Name the different categories of encryption algorithm with one example per category.

b) Write a short note on shadow paging. State some of its disadvantages.

c) What is Trigger in SQL? Give an example to define a trigger.

(5+6+4)

9.

a) How does Oracle support very large databases using different horizontal partitioning of tables? What are the advantages of this partitioning scheme?

b) A transaction reads a data item balance which has a value of Rs. 1000/-, modifies it to Rs.1500/- and writes back on to database. Show the log entries and the database value of balance when

   i) The value is read.

   ii) The value is updated.

   iii) The transaction partially commits.

c) What is the purpose of division operator in relational algebra? Give an example.

(6+6+3)