Bachelor Of Engineering In Information Technology
2nd Year 1st Semester, Semester Examination, 2022-2023
Subject Name –(IT/PC/B/T/213) Database Management Systems

Time: 3 Hrs. **Full Marks=100**

CO1 [10]

Q1.

(a) Discuss the main characteristics of the **database approach** and how it differs from traditional file systems.

(b) Define **instances** and **schemas** of database?

(c) Write down two functions of **DBA**.

[4+4+2=10]

CO2 [20]

Q2.

(a) Consider the following instance of the relational schema **R(X, Y, Z):**

X	Y	Z
1	1	a
1	1	a
2	1	b
3	2	b

Justify that the following **functional dependencies** hold or not.(Mentions all steps)

i) X→Y

ii)Y→Z

(b) Consider the following relational schema:

Student (Reg_No, Name, Address, Phone, Class_ID)

The following functional dependencies hold:

FD1: Reg_No → {Name, Address}

FD2: Address, Phone → Class_ID

FD3: Name → Phone

FD4: Class_ID → Reg_No

Identify all **candidate key(s)** for the above relation.

What is the **highest normal form** of R?

(c) Explain **Update Anomaly** and **Insertion Anomaly** in details with a proper example.

[(3+3)+(4+4)+(3+3)=20]

CO3 [20]

Q3.

(a) Consider the following instance of the two relations given below:

PRODUCT (NAME, COUNT, SHOPID) and QUANTITY (COUNT, SHOPID)

PRODUCT		
NAME	COUNT	SHOPID
MOBILE	5	3
LAPTOP	5	1
MOBILE	6	2
LAPTOP	8	2
LAPTOP	20	6
SPEAKER	8	1
SPEAKER	25	2

QUANTITY	
COUNT	SHOPID
5	1
8	2

What **product name(s)** will be displayed by the operation **PRODUCT ÷ QUANTITY?**

(b) Consider two relation schemas given below:

HOSPITAL (HOSPITALID, NAME, LOCATION) and DOCTORS (DOCTORNAME, HOSPITALID)

Write down the Relational Algebra expression equivalent to the following statement given below.

i) "Names of all doctors available in NRS hospital"

ii) "Name and location of all hospital in which Dr. T Sarkar is attached".

(c) Discuss about **RENAME and PROJECT** operation in Relational Algebra?

[6+(4+4)+(3+3)=20]

CO4 [20]

Q4.

(a) Why is **indexing** required for a **database**?

(b) Justify this statement **"In a secondary index file, all the search key values must be presented".**

(c) Let us consider the following statistics for searching for a condition in a given relation.

Number of blocks containing record of the relation (b) = 500

Time to transfer one block (tb) = 0.3 milliseconds

Time for one seek (ts) = 4 milliseconds

Find out the **cost of selection query** on a **key attribute** using linear search file scan.

OR

Suppose a file is organized using a **B+ tree of order 4**. The search-keys are inserted in the following order: 1, 5, 10, 24, 30, 3, 8, 13, 27, 35, 15, 17, 19.

Draw the **B+ tree** and justify this statement **"The Key 24 will be in root node".**

[5+7+8=20]

CO5 [20]

Q5.

(a) Consider the following schedule S involving three transactions T_1, T_2, T_3.

T_1	T_2	T_3
R(X)		
		R(Z)
		W(Z)
W(Y)		
W(X)		
		W(X)
	W(Z)	

R(X) denotes read operation on data item X by transaction T_i.
W(Y) denotes write operation on data item Y by transaction T_i.
Identify the possible **number of conflict serializable schedule(s)** and **their correct order of execution** of the above schedule S.

OR

Explain in details **"How to avoid Cascading roll-back in Two phase locking mechanism?".**

(b) Let us consider the following statistics for two relations **Customers and Orders**:

- Number of records of Customers: $\mathbf{n_{Customers} = 300.}$
- Number of blocks of : $\mathbf{b_{Customers} = 30.}$
- Number of records of Orders: $\mathbf{n_{Orders} = 100.}$
- Number of blocks of Orders: $\mathbf{b_{Orders} = 10.}$

Let us consider a **natural join** of **Orders ⋈ Customers**.

Find out the **required number of block transfers** in the **worst case** (enough memory only to hold one block of each relation) and assume **Orders as the outer relation.**

(c) Explain the **ACID** properties of a transaction in details. **[8+8+4=20]**

CO6 [10]

Q6.

(a) Define **Distributed Database, Decentralized Database and Data Warehouse.**
(b) Compare the **Homogeneous** and **Heterogeneous** Distributed Database. **[(2+2+2)+4=10]**

(IT/PC/B/T/213) Database Management Systems:

After completing this course, the students should be able to:

CO1: Explain the basic Database concepts and different data models. (K2)

CO2: Find the available functional dependencies to apply normalization concepts in typical scenarios. (K3)

CO3: Design queries using relational algebra operations and SQL. (K3)

CO4: Explain principles of Physical Data Storage and Query Optimization. (K3)

CO5: Comprehend transaction processing and concurrency control techniques and apply them in various problems (K3)

CO6: Discuss different types of advanced databases. (K2)