

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Fourth Semester B.Tech Degree (S, FE) Examination January 2024 (2019 Scheme)

**Course Code: CST 204****Course Name: Database Management Systems**

Max. Marks: 100

Duration: 3 Hours

**PART A***(Answer all questions; each question carries 3 marks)*

Marks

- |    |  |   |
|----|--|---|
| 1  | Differentiate between Structured, Semi-structured, and Unstructured data. Give an example each.  | 3 |
| 2  | Explain the three categories of Data Models.   | 3 |
| 3  | Explain the "Cross-Reference approach" to mapping a Binary 1:1 Relationship Type that you employ when you map an ER Model into a Relational Schema, with the help of an example. | 3 |
| 4  | With the help of an example database, explain the usage of the set operations Union, Intersection, and set difference in Relational Algebra.                                     | 3 |
| 5  | "Views simplify the specification of certain queries". Justify this statement  | 3 |
| 6  | Differentiate between Assertions and Triggers.   | 3 |
| 7  | Define the term "Functional Dependency". Give an example.  | 3 |
| 8  | Give an algorithm to find the Minimal Cover for a set of Functional Dependencies.  | 3 |
| 9  | Give six types of failures in a transaction processing system that necessitate Recovery procedures.  | 3 |
| 10 | Explain the importance of transaction logging and checkpointing for efficient transaction processing.  | 3 |

**PART B***(Answer one full question from each module, each question carries 14 marks)***Module -1**

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|----|---|---|
| 11 | a) Explain the main four characteristics of the Database Approach that distinguish it from the traditional file-processing approach | 7 |
|    | b) Categorize the different types of people who work in a database system environment.  | 7 |

- 12 Design an ER diagram for a typical college library database and then map it into a relational database schema. List your assumptions and indicate the cardinality mappings. 14

### Module -2

- 13 a) Consider the following schema and frame Relational Algebra queries for the following problems: 11
- 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 given after the field name.
- (i) Find the names of suppliers who supply **red** parts
- (ii) Find the SIDs of suppliers who supply some **red** part **or** are at the address '221 Packer Ave'
- (iii) Find the SIDs of suppliers who supply some **red** part **and** some **green** part
- (iv) Find the SIDs of suppliers who supply **every red** part
- b) Differentiate between DELETE and DROP commands in SQL. Illustrate their usage. 3
- 14 a) Consider a company database having the following schema and frame Relational Algebra queries for the following problems. Primary keys are underlined. 10
- EMPLOYEE (SSN, Name, SupervisorSSN, Dnum)
- DEPARTMENT (Dnumber, Dname, MgrSSN)
- PROJECT (Pnumber, Plocation, ControlDeptNum)
- EMPLOYEE (Dnum) References DEPARTMENT (Dnumber) and
- PROJECT (ControlDeptNum) References DEPARTMENT (Dnumber)
- (i) Find the names of all employees who are supervised by the supervisor of the employee named 'Smith'
- (ii) List the numbers of the projects (Pnumbers) controlled by Smith's department
- b) Illustrate the usage of the SQL commands – ALTER, INSERT, DELETE and UPDATE 4

### Module -3

- 15 Consider the following Database with two tables: 14

**Table: Employees**

EmployeeID INT PRIMARY KEY

FirstName VARCHAR(50)

LastName VARCHAR(50)

JobTitle VARCHAR(100)

Salary DECIMAL(10,2)

HireDate DATE

DepartmentID INT

**Table: Departments**

DepartmentID INT PRIMARY KEY

DepartmentName VARCHAR(100)

ManagerID INT

**Foreign Key:** Employees.DepartmentID references Departments.DepartmentID

Frame SQL queries for the following problems:

- (i) Calculate the average salary per department.
- (ii) List the employees with the highest salary in each department:
- (iii) Find departments with more than 25 employees.
- (iv) Get the employee names starting with 'S' in alphabetical order

- 16 a) With the help of an example explain Single-level indexing and multi-level indexing. Also, compare and contrast single-level indexing with multi-level indexing 8
- b) Explain a situation where a multi-level index would be significantly less effective than a single-level index, and vice versa 6

**Module -4**

- 17 a) Given the following FDs for the relation Employees (EmployeeID, DepartmentID, ManagerID, Salary): 6
- EmployeeID → DepartmentID
- DepartmentID → ManagerID

ManagerID  $\rightarrow$  Salary

Identify any redundant FDs in the set and explain why they are redundant.

- b) Consider the following FDs for the relation Books (BookID, Title, Author, Publisher): 8

BookID  $\rightarrow$  Title, Author

Author  $\rightarrow$  Publisher

{Title, Publisher}  $\rightarrow$  BookID

Find a minimal cover for this set of FDs. Explain how you arrived at your answer.

- 18 a) Give an algorithm each for checking Lossless Join and Dependency Preserving Properties 6

- b) Suppose that we decompose the schema  $R = (A, B, C, D, E)$  into (A, B, C) (A, D, E). 8

Show that this decomposition is a lossless decomposition if the following set F of functional dependencies holds:

$F = \{A \rightarrow BC, \quad CD \rightarrow E, \quad B \rightarrow D, \quad E \rightarrow A\}$

### Module -5

- 19 a) What is a serial schedule? Why are serial schedules unacceptable in practice? 4
- b) What is a conflict serializable schedule? Give an algorithm to check whether a schedule is conflict serializable or not. Check whether the following schedules are conflict serializable or not and find an equivalent serial schedule if possible. 10
- (i)  $r2(X); w2(X); r1(X); w1(X); r1(Y); w1(Y)$
- (ii)  $r1(X); r2(X); w1(X); r1(Y); w2(X); w1(Y)$
- 20 a) Explain the working of Binary Locks and Shared/Exclusive Locks 5
- b) Explain Two-Phase locking protocol and any three variants of it 9

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