

DATABASE MANAGEMENT SYSTEMS

(Common to CSE and IT)

Time: 3 hours

Max. Marks: 70

PART – A

(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- How many distinct tuples are in a relation instance with cardinality 22?
 - Define candidate key.
 - Let $R = (A, B, C)$, and let r_1 and r_2 both be relations on schema R . Give an expression in SQL that is equivalent to $r_1 - r_2$.
 - Explain the statement that relational algebra operators can be composed. Why is the ability to compose operators important?
 - Decompose the functional dependency $X \rightarrow YZ$.
 - Consider a relation $R(A, B, C, G, H, I)$ and functional dependences $\{A \rightarrow B, A \rightarrow C, CG \rightarrow H, CG \rightarrow I, B \rightarrow H\}$. Compute $(AG)^+$.
 - Suppose that there is a database system that never fails. Is a recovery manager required for this system?
 - What benefit does strict two-phase locking provide?
 - List the two kind of indices.
 - $B+$ tree of order d has m entries in every node. What is the mathematical relation between d and m ?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

- 2 (a) Why would you choose a database system instead of simply storing data in operating system files? When would it make sense not to use a database system?
- (b) What are the responsibilities of a DBA? If we assume that the DBA is never interested in running his or her own queries, does the DBA still need to understand query optimization? Why?

OR

- 3 Consider the following information about a university database:
Professors have an SSN, a name, an age, a rank and a research specialty. Projects have a project number, a sponsor name, a starting date, an ending date and a budget. Graduate students have an SSN, a name, an age and a degree program. Each project is managed by one professor. Each project is worked on by one or more professors. Professors can manage and/or work on multiple projects. Each project is worked on by one or more graduate students. When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a supervisor for each one. Departments have a department number, a department name and a main office. Departments have a professor who runs the department. Professor's work in one or more departments.
Design and draw an ER diagram that captures the information about the university.

UNIT – II

- 4 Consider the following schema:
Suppliers(sid: integer, sname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)
Write the queries in relational algebra, tuple relational calculus, domain relational calculus and SQL to find the *sids* of suppliers who supply some red part and some green part.

OR

- 5 Consider the following relational schema and briefly answer the questions that follow:
Emp(eid: integer, ename: string, age: integer, salary: real)
Dept(did: integer, budget: real, managerid: integer)
- Define a table constraint on **Emp** that will ensure that every employee makes at least \$10,000.
 - Define a table constraint on **Dept** that will ensure that all managers have age > 30.

UNIT - III

6 Explain about following normal forms

- (a) Second Normal Form.
- (b) Third Normal Form.
- (c) Boyce-Codd Normal Form.

OR

- 7 (a) Write a short note about lossless join decomposition.
(b) Give a note on Dependency preservation.

UNIT - IV

8 Show that there are schedules that are possible under the two-phase locking protocol, but are not possible under the timestamp protocol, and vice versa.

OR

- 9 (a) List the ACID properties. Explain the usefulness of each
(b) Explain the difference between the three storage types-volatile, nonvolatile and stable in terms of I/O cost.

UNIT - V

10 Explain the difference between Hash index and B^+ tree index. In particular, discuss how equality and range searches work, using an example?

OR

- 11 (a) What is the minimum space utilization for a B^+ tree and ISAM index?
(b) Explain why local depth and global depth are needed in Extendible Hashing.
