

S.A. ENGINEERING COLLEGE
(An Autonomous Institution, Affiliated to Anna University)

QUESTION BANK
EVEN SEMESTER, 2023-2024

SUBJECT CODE: IT1401A

SUBJECT TITLE: DATABASE MANAGEMENT SYSTEMS

SEM/YEAR: IV SEM/II YEAR

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| UNIT I - RELATIONAL DATABASES |
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| Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL |
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QUESTIONS

| S.NO | PART-A |
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| 1. | List the disadvantages of file system over database. |
| 2. | Mention the major responsibilities of a database administrator. |
| 3. | State the levels of abstraction in a DBMS. |
| 4. | What is a data model? List the types of data model used. |
| 5. | Define foreign key. Give an example. |
| 6. | Write a relational algebra expression for selecting all tuples from the relation <i>Loan</i> with the condition <i>Loan amount greater than 5000 rupees</i> |
| 7. | Differentiate primary key from candidate key. |
| 8. | What are aggregate functions? List some aggregate functions Supported by SQL. |
| 9. | Why does SQL allow duplicate tuples in a table or in a query result? |
| 10. | Differentiate between dynamic SQL and static SQL. |
| PART-B | |
| 1. | Compare and contrast various data model groups, providing relevant examples for each. |

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| 2. | Utilize the knowledge of two-tier architecture and three-tier architecture to construct a well labeled diagram, illustrating the distinctive features and components of each. |
| 3. | Compose a detailed explanation, accompanied by a clear diagram, outlining all the components of a DBMS |
| 4. | Apply the understanding of basic relational algebra operations by providing examples that illustrate the practical application of each operation. |
| 5. | Consider a relation Employee (Employee_name, Company_name, Salary) Analyze and Write SQL for the following (i) the total salary of each company (ii) Find the employee name who is getting highest salary (iii) Find the company name which has lowest average salary (iv) Find the employee name whose salary is higher than average salary of TCS. |

UNIT II - DATABASE DESIGN

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd's Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

| S.NO | PART-A |
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| 1. | List the different symbols used in ER diagram with examples. |
| 2. | What is a weak entity? Give an example. |
| 3. | What are the desirable properties of decomposition? |
| 4. | What is meant by non-loss decomposition? |
| 5. | Define the two types of functional dependency with an example. |
| 6. | Define full functional dependency. |
| 7. | Consider the following relation: R(A,B,C,D,E) The primary key of the relation is AB. The following functional dependencies hold: $A \rightarrow C$, $B \rightarrow D$, $AB \rightarrow E$. Is the above relation in second normal form? |
| 8. | Define BCNF. |
| 9. | Compare 3NF with BCNF with an example. |

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| 10. | Define Fourth Normal Form. | | | | | | | | | | | | | | | | | | | | | | | | |
| PART-B | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. | (i) Construct an ER diagram for a car insurance company whose customers own one or more cars each. Each car has associated with zero to any number of recorded accidents. Each insurance policy covers one or more cars and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date and the date when the payment was received. | | | | | | | | | | | | | | | | | | | | | | | | |
| | (ii) Construct an ER diagram for a Banking System. | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. | What is data normalization? Apply the understanding of first normal form, second normal form, third normal form by providing examples that illustrate the key principles and transformations involved in achieving each level of normalization. | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | Normalize the following table into 1NF, 2NF and 3NF. EMPLOYEE [EMPNO, EMPNAME, WORKDEPT, DEPTNAME, SKILLID1, SKILLID2, SKILLID3] | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. | Normalize the following invoice into 1NF, 2NF, and 3NF. HILLTOP ANIMAL HOSPITAL DATE: JAN 13/2018 INVOICE # 987 MR. RICHARD COOK 123 THIS STREET MY CITY, ONTARIO Z5Z 6G6 <table><tr><td><u>PET</u></td><td><u>PROCEDURE</u></td><td><u>AMOUNT</u></td><td>ROVER RABIES</td></tr><tr><td></td><td>VACCINATION</td><td>30.00</td><td></td></tr><tr><td></td><td>MORRIS RABIES VACCINATION</td><td>24.00</td><td></td></tr><tr><td></td><td>TOTAL</td><td>54.00</td><td></td></tr><tr><td></td><td>TAX (8%)</td><td><u>4.32</u></td><td></td></tr><tr><td></td><td>AMOUNT OWING</td><td><u>58.32</u></td><td></td></tr></table> | <u>PET</u> | <u>PROCEDURE</u> | <u>AMOUNT</u> | ROVER RABIES | | VACCINATION | 30.00 | | | MORRIS RABIES VACCINATION | 24.00 | | | TOTAL | 54.00 | | | TAX (8%) | <u>4.32</u> | | | AMOUNT OWING | <u>58.32</u> | |
| <u>PET</u> | <u>PROCEDURE</u> | <u>AMOUNT</u> | ROVER RABIES | | | | | | | | | | | | | | | | | | | | | | |
| | VACCINATION | 30.00 | | | | | | | | | | | | | | | | | | | | | | | |
| | MORRIS RABIES VACCINATION | 24.00 | | | | | | | | | | | | | | | | | | | | | | | |
| | TOTAL | 54.00 | | | | | | | | | | | | | | | | | | | | | | | |
| | TAX (8%) | <u>4.32</u> | | | | | | | | | | | | | | | | | | | | | | | |
| | AMOUNT OWING | <u>58.32</u> | | | | | | | | | | | | | | | | | | | | | | | |
| 5. | (i) Compare BCNF and 3NF with appropriate example. | | | | | | | | | | | | | | | | | | | | | | | | |
| | (ii) Give an example of a relation that is in 3NF and not in BCNF. How will you convert that relation into BCNF? | | | | | | | | | | | | | | | | | | | | | | | | |

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| 6. | What is the need of normalization? Analyze and implement fourth normal form and fifth normal form strategy with examples in detail. |
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| UNIT III – TRANSACTIONS | |
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| Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery | |

| S.NO | PART-A |
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| 1. | List the ACID properties. |
| 2. | What is serializability? How it is tested? |
| 3. | Define conflict serializability. |
| 4. | Define view serializability. |
| 5. | List the four conditions for deadlock. |
| 6. | List the transaction states with a neat diagram. |
| 7. | What is the need of concurrency control? |
| 8. | State the difference between a shared lock and an exclusive lock. |
| 9. | List the categories of two phase locking protocols. |
| 10. | What is meant by log-based recovery? |
| 11. | List the methods used to handle deadlock. |
| PART-B | |
| 1. | Examine the attributes of database transactions that uphold data integrity within the system, providing an in-depth analysis of their significance. |
| 2. | Examine conflict serializability and view serializability, illustrating their differences through a concrete example to demonstrate their practical implications in database management |
| 3. | What is concurrency control? Analyze the two-phase locking |
| | protocol, detailing its operational phases and significance in transaction management. Provide a relevant example to illustrate its application in maintaining data consistency and concurrency in database systems. |

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| 4. | Compare the strict and rigorous two-phase locking protocols. Explain how they work differently in managing concurrent transactions in a database system, using an example to illustrate the contrast. |
| 5. | Compare the deferred and immediate types of database modification in a log-based recovery plan. Describe each method and how they manage changes to the database after a failure. |
| 6. | List the strategies for managing deadlock situations. Describe how these methods are applied to address or prevent deadlocks in a clear and straightforward manner |

UNIT IV – IMPLEMENTATION TECHNIQUES

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation

| S.NO | PART-A |
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| 1. | List all levels of RAID |
| 2. | Define ordered indices with example. |
| 3. | Distinguish between dense index and sparse index. |
| 4. | Distinguish between primary index and secondary index |
| 5. | Why is a B+ tree usually preferred as an access structure to a data file? |
| 6. | What are disadvantages of B Tree over B+ Tree? |
| 7. | What is a hash function? Give an example. |
| 8. | What is the difference between dynamic and static hashing? |
| 9. | List the costs involved in query execution. |
| 10. | Outline the steps involved in query processing. |
| PART-B | |
| 1. | Define RAID and explore the diversity of RAID levels, delving into their respective functionalities and characteristics in detail. |
| 2. | Sketch the structure of a B+ tree and give the algorithm for search in the B+ tree. Also insert the following key values 6, 16, 26, 36, 46 on a B+ tree with order = 3. |

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| 3. | Show the element wise construction of a B+ tree for the elements 1, 4, 7, 10, 17, 21, 31, 25, 19, 20, 28, 42 with order as 4. Also illustrate the deletion process by deleting any element in the root level. |
| 4. | Describe static hashing and dynamic hashing. Provide an example for each to illustrate how they work. |
| 5. | (i) Sketch and concise the basic steps involved in query processing. |
| | (ii) What does query optimization involve? Describe heuristic- based query optimization thoroughly, using an example to illustrate its application |

UNIT V – ADVANCED TOPICS

Overview of Distributed Databases – Data Fragmentation – Replication — Introduction to Object-based Databases - Enhanced Data bases: Temporal Database –Spatial Database –Multimedia Database - XML Databases: XML schema - NOSQL Database: Characteristics – Schema-less models– Applications – Current Trends

| S.NO | PART-A |
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| 1. | State the need for distributed databases. |
| 2. | Differentiate horizontal fragmentation from vertical fragmentation. |
| 3. | Define data replication. |
| 4. | What is Object based database? |
| 5. | Mention the advantages of XML databases. |
| 6. | Define XML. |
| 7. | List the differences between SQL and NOSQL databases |
| 8. | List the categories of NOSQL databases. |
| 9. | List the characteristics of NOSQL databases. |
| 10. | Mention the applications of NOSQL databases |
| PART-B | |
| 1. | Detail the distributed database architecture, elaborating on its structure and functionality. Also discuss how data replication and fragmentation are done in distributed environment with illustrative examples. |

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| 2. | <p>(i) Compare and contrast between Object Oriented databases and XML databases</p> <p>(ii) Generate an XML representation for a bank management system and develop an XML schema to define its structure and constraints, ensuring proper organization and validation of data.</p> |
| 3. | Provide an overview of temporal databases and spatial databases, detailing their respective concepts and applications in managing time-dependent and spatial data effectively |
| 4. | Compose notes on multimedia databases, covering their structure, management, and applications, while emphasizing their handling of various media types and retrieval techniques |
| 5. | <p>Summarize the following categories of NOSQL databases, providing an example for each to illustrate their respective structures and functionalities:</p> <p>(i) Key Value Store</p> <p>(ii) Document Store</p> <p>(iii) Graph Database</p> |