



SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

Programme Name & Branch : M.Tech – Integrated, CSE & specializations
Course Code and Course Name : CSI2004, Advanced Database Management Systems
Faculty Name(s) : Nageshwar Rao Ragi, Ilayaraja V, Geetha Mary A, Jayashree J
Class Number(s) : VL2025260501682, 1452, 1436, 1441
Date of Examination : 15-March-2026
Exam Duration : 90 minutes **Maximum Marks: 50**

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes
CO2 - Learn the concept of parallel and distributed database.
CO3 - Obtain the knowledge of multimedia and spatial database.
CO4 - Apply the concepts of mobile and cloud database in real-time applications.
CO5 - Distinguish various emerging database technologies and analyse various security issues in databases.

Q. No	Question	Module	Marks	CO	BL
1.	A distributed university database system consists of three sites: Admissions (Site A), Examinations (Site B), and Finance (Site C). The STUDENT relation containing attributes (RegNo, Name, Department) is stored at Site A and consists of 60,000 tuples stored in 600 pages, where each page can hold 100 tuples. The RESULT relation containing attributes (RegNo, Subject, Grade) is stored at Site B and consists of 108,000 tuples stored in 900 pages, with 120 tuples per page. Assume that the cost of reading or writing a page is denoted by td, and the cost of transferring a page between two sites is ts. A user at Site A submits the following query to retrieve the grades of students from the CSE department: SELECT S.Name, R.Grade FROM STUDENT S, RESULT R WHERE S.RegNo = R.RegNo AND S.Department = 'CSE'; a. Assume that the query is processed using a page-oriented nested-loop join and that the relations must be transferred between sites to perform the join operation. Based on this scenario, explain how the query will be executed in the distributed environment and estimate the total cost of query execution in terms of td and ts, considering both local processing and page transfer costs. b. Also discuss how the execution strategy would change if the join operation is performed at Site B instead of Site A, and compare which execution plan would be more efficient. c. If the query site is C, then what will be the total cost of shipping both the relations to site C and performing sort merge join in Site C. Ans: Given • STUDENT (Site A): 60,000 tuples → 600 pages • RESULT (Site B): 108,000 tuples → 900 pages	3	3+3+4	2	3



SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

• Page read/write cost = td • Page transfer cost = ts a) Join executed at Site A (Page-oriented Nested Loop Join) Step 1: Transfer RESULT from Site B $\rightarrow$ Site A • Pages transferred = 900 • Transfer cost = $900\ ts$ Step 2: Read relations locally • STUDENT read cost = $600\ td$ • RESULT read for nested loop = 600×900 pages Cost = $540000\ td$ Total Cost = $600td + (600 \times 900)(td + ts)$ b) Join executed at Site B Step 1: Transfer STUDENT from Site A $\rightarrow$ Site B • Pages transferred = 600 Transfer cost $600ts$ Step 2: Local nested loop join • STUDENT read = $600\ td$ • RESULT scanned 600×900 Cost Total Cost = $900td + (900 \times 600)(td + ts)$ Joining at Site A is more efficient. c) Query site = Site C (Sort-Merge Join) Step 1: Ship relations to Site C Cost = $600(2td + ts) + 900(2td + ts) + 3 \times (600 + 900)td$				
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SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

2.	Assume that you are working in Infosys and assigned a project to develop an online shopping website for selling a wide range of Apple products. Apple India sells iPhones, MacBooks, iPads, Apple Watches, and Accessories. This application requires displaying multiple product images, product description (both in English and regional language), and product demo videos to help users understand the product features and specifications. Using Multimedia Database concepts, write the multimedia queries for the following. a. Create a table for storing product details using appropriate multimedia data types. <pre>CREATE TABLE PRODUCT (PRODUCT_ID INT PRIMARY KEY, PRODUCT_NAME VARCHAR(100), CATEGORY VARCHAR(50), PRICE DECIMAL(10,2), DESCRIPTION_EN TEXT, DESCRIPTION_REGIONAL TEXT, PRODUCT_IMAGE BLOB, PRODUCT_VIDEO BLOB);</pre> b. Customer wants to view the product description of PRODUCT_NAME 'iPhone 15 Pro Max'. <pre>SELECT DESCRIPTION_EN FROM PRODUCT WHERE PRODUCT_NAME = 'iPhone 15 Pro Max';</pre> c. Admin wants to update the product image for PRODUCT_ID is 20. <pre>UPDATE PRODUCT SET PRODUCT_IMAGE = LOAD_FILE('iphone15promax.jpg') WHERE PRODUCT_ID = 20;</pre> d. Customer wants to view the product description in regional language for PRODUCT_NAME is 'MacBook Air M3'. <pre>SELECT DESCRIPTION_REGIONAL FROM PRODUCT WHERE PRODUCT_NAME = 'MacBook Air M3';</pre>	4	10	3	3
3.	A Geographic Information System (GIS) maintains the spatial locations of emergency service centers within a city. The spatial region is defined within a coordinate space of (0,0) to (100,100). The following 10 points represent the locations of the centers: (10, 80), (25, 70), (40, 90), (60, 75), (85, 85), (15, 30), (35, 20), (55, 40), (75, 10), (90, 35) Using a Quad Tree spatial index, answer the following: Construct the Quad Tree for the given set of points assuming: a. The region is recursively divided into four equal quadrants. Each leaf node can store only one point. Further subdivision is required if more than one point lies in a quadrant. b. Clearly show all levels of decomposition and represent the final Quad Tree structure diagrammatically. c. Trace the search path for the point (75,10) and state the average and worst-case time complexity of search in a Quad Tree.	4	6+2+2	3	3



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REG.NO.:

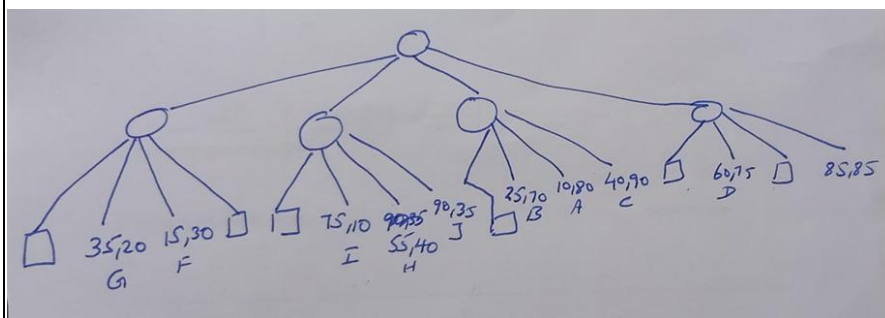
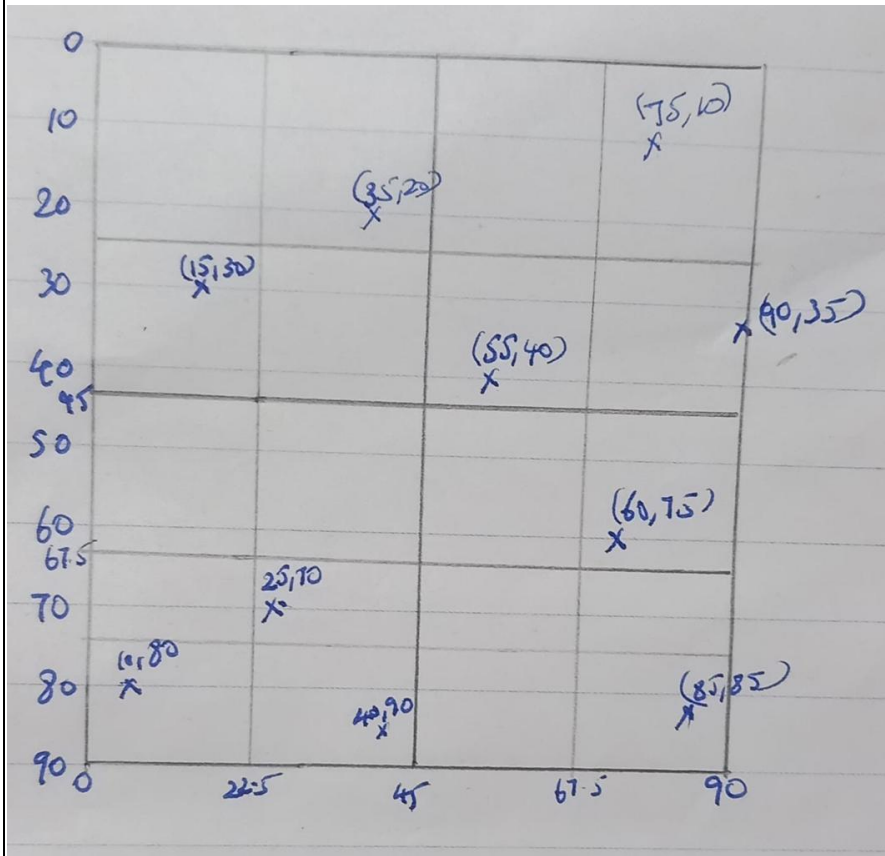
SLOT: A1+TA1

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

Ans:

a) PR Quad Tree Construction

b) Final PR Quad Tree Structure



c) Search Path for Point (75,10) in PR Quad Tree

1. Start at Root (0-90,0-90)
2. Point lies in NE quadrant
3. In NE subdivision → region (45-90 , 0-45)



SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

	4. Again in NE subdivision→ region (67.5-90, 0-22.5) 5. Leaf node contains (75,10) → Point found Search Path Root → NE → NE → (75,10) Time Complexity of Search in PR Quad Tree <table><tr><th>Case</th><th>Complexity</th></tr><tr><td>Average case</td><td>O(log n)</td></tr><tr><td>Worst case</td><td>O(n) (when tree becomes highly unbalanced)</td></tr></table>	Case	Complexity	Average case	O(log n)	Worst case	O(n) (when tree becomes highly unbalanced)				
Case	Complexity										
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4.	In a smart city environment, mobile users frequently access cloud-based services such as e-health records, online ticket booking, mobile banking, and real-time traffic updates while moving across different network cells. These applications rely on mobile database systems where data must be continuously accessed, synchronized, and managed during mobility. a. Explain the architecture of a Mobile Database System and describe the role of the Database Server (DBS). b. Discuss the challenges involved in location management, handoff management, and transaction processing in mobile database systems. c. Compare centralized and distributed placement of Database Servers in mobile environments. Justify which approach ensures better scalability and performance. Ans: a) Architecture of a Mobile Database System & Role of Database Server (DBS) Architecture Components 1. Mobile Clients (Mobile Hosts) Smartphones, tablets, or laptops used by mobile users to access services. 2. Base Stations / Wireless Access Points Provide wireless connectivity between mobile devices and the fixed network. 3. Mobile Support Station (MSS) Acts as an intermediary between mobile users and the database server. It manages communication, mobility, and data transfer. 4. Database Server (DBS) Stores and manages the actual database in the wired network. Role of Database Server (DBS)	5	3+3+4	4	3						



SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

	• Stores centralized or distributed database data. • Processes queries and transactions from mobile users. • Maintains data consistency and integrity. • Handles concurrency control and recovery. • Synchronizes data when mobile devices reconnect after disconnection. b) Challenges in Mobile Database Systems 1. Location Management • Mobile users constantly move between network cells. • The system must track the current location of the user. • Requires frequent location updates, increasing network overhead. 2. Handoff Management • Occurs when a user moves from one cell/base station to another. • Active sessions and database transactions must continue without interruption. • Poor handoff management can cause data loss or service disruption. 3. Transaction Processing • Mobile devices often experience low bandwidth and intermittent connectivity. • Transactions may be partially executed during disconnections. • Maintaining ACID properties (Atomicity, Consistency, Isolation, Durability) becomes difficult. c) Centralized vs Distributed Placement of Database Servers <table><tr><th>Aspect</th><th>Centralized DBS</th><th>Distributed DBS</th></tr><tr><td>Data Location</td><td>Stored at a single server</td><td>Stored across multiple servers</td></tr><tr><td>Network Load</td><td>High network traffic</td><td>Reduced network traffic</td></tr><tr><td>Scalability</td><td>Limited scalability</td><td>Highly scalable</td></tr><tr><td>Fault Tolerance</td><td>Single point of failure</td><td>Better reliability</td></tr><tr><td>Response Time</td><td>Higher latency for distant users</td><td>Faster local access</td></tr></table>	Aspect	Centralized DBS	Distributed DBS	Data Location	Stored at a single server	Stored across multiple servers	Network Load	High network traffic	Reduced network traffic	Scalability	Limited scalability	Highly scalable	Fault Tolerance	Single point of failure	Better reliability	Response Time	Higher latency for distant users	Faster local access				
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5.	Consider a company database containing the following tables: EMPLOYEE (EmpID, Name, Salary, DeptID) DEPARTMENT (DeptID, DeptName, Location) User A1 is the database administrator and wants to assign discretionary privileges to another user A2.	7	10	7	3																		



SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

	a. Write the SQL statements to grant INSERT and DELETE privileges on EMPLOYEE and DEPARTMENT tables to A2. GRANT INSERT, DELETE ON EMPLOYEE TO A2; b. Write the SQL statement to allow A2 to further grant these privileges to other users. GRANT INSERT, DELETE ON EMPLOYEE TO A2 WITH GRANT OPTION; c. Write the SQL command to revoke the DELETE privilege on EMPLOYEE from A2. REVOKE DELETE ON EMPLOYEE FROM A2; d. Explain the concept of Discretionary Access Control (DAC) and how GRANT and REVOKE commands enforce database security. d) Discretionary Access Control (DAC) Discretionary Access Control (DAC) is a security mechanism in which the owner or administrator of the database decides who can access specific data and what operations they can perform. • Access permissions are given using the GRANT command. • Permissions can be removed using the REVOKE command. • Users who receive privileges with WITH GRANT OPTION can also pass those privileges to other users				
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