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| **PART A/B (MODULE V)** | | | | 1\* | 2\* | 3\* | 4\* |
|  |  | ***15 Marks Questions***  *Each question can have maximum four sub division*  ***(Prepare maximum Questions possible, covering all areas of the modules assigned )*** | Marks | Course Outcome | Knowledge Level | Theory(**T**)/Problem(**P**)/ Design(**D**) | Difficulty Lev  **(S/A/D/T)** |
| 1 |  | Explain the concept of concurrency control and its significance in transaction processing. | 6 | CO5 | L2 | T | D |
| 2 |  | Define the transaction model and discuss its key components. | 6 | CO5 | L2 | T | D |
| 3 |  | What are the desirable properties of transactions? Explain each property in detail. | 6 | CO5 | L2 | T | D |
| 4 |  | Differentiate between serial schedules and concurrent schedules in transaction processing. | 6 | CO5 | L2 | T | S |
| 5 |  | Define conflict equivalence and conflict serializability. How are they related to concurrent schedules? | 6 | CO5 | L2 | T | T |
| 6 |  | Explain the concepts of recoverable schedules and cascade-less schedules in transaction processing. | 6 | CO5 | L2 | T | A |
| 7 |  | Discuss the basics of locking in transaction processing. How does locking help ensure data consistency? | 5 | CO5 | L2 | T | D |
| 8 |  | Describe the two-phase locking protocol and its variations. How do they contribute to concurrency control? | 5 | CO5 | L2 | T | D |
| 9 |  | What is log-based recovery in transaction processing? Explain the role of the system log in recovery. | 5 | CO5 | L2 | T | D |
| 10 |  | Discuss deferred database modification and its benefits in transaction processing. | 5 | CO5 | L2 | T | D |
| 11 |  | Explain the concept of check-pointing and its role in ensuring database consistency. | 5 | CO5 | L2 | T | D |
| 12 |  | What are NoSQL databases? How do they differ from traditional relational databases? | 5 | CO5 | L2 | T | D |
| 13 |  | Discuss the main characteristics of key-value databases, with examples from Redis. | 9 | CO5 | L2 | P | D |
| 14 |  | Explain the main characteristics of document databases, using examples from MongoDB. | 9 | CO5 | L2 | P | D |
| 15 |  | Describe the main characteristics of column-family databases, with examples from Cassandra. |  | CO5 | L2 | P | D |
| 16 |  | Discuss the main characteristics of graph databases, using examples from ArangoDB. | 6 | CO5 | L2 | T | D |
| 17 |  | How does concurrency control affect the performance of transaction processing systems? | 6 | CO5 | L2 | T | A |
| 18 |  | Compare and contrast optimistic and pessimistic concurrency control approaches. | 6 | CO5 | L2 | T | S |
| 19 |  | Discuss the challenges and benefits of implementing distributed concurrency control. | 9 | CO5 | L2 | P | T |
| 20 |  | Explain the concept of deadlock in transaction processing. How can it be prevented or resolved? | 6 | CO5 | L2 | T | S |
| 21 |  | What is a serializable schedule? How can it be ensured in a concurrent transaction environment? | 6 | CO5 | L2 | T | S |
| 22 |  | Describe the concept of multiversion concurrency control (MVCC) and its advantages. | 6 | CO5 | L2 | T | S |
| 23 |  | Discuss the ACID properties of transactions and explain their significance in database systems. | 6 | CO5 | L2 | T | S |
| 24 |  | Explain the concept of two-phase commit protocol and its role in distributed transaction processing. | 6 | CO5 | L2 | T | D |
| 25 |  | What are the advantages and disadvantages of using log-based recovery mechanisms? | 6 | CO5 | L2 | T | S |
| 26 |  | Discuss the concept of durability in transaction processing. How is it achieved? | 6 | CO5 | L2 | T | S |
| 27 |  | How does recovery manager handle failures in a transaction processing system? | 6 | CO5 | L2 | T | D |
| 28 |  | Explain the concept of write-ahead logging and its role in ensuring transaction durability. | 9 | CO5 | L2 | T | S |
| 29 |  | Discuss the challenges and techniques for managing concurrency in distributed databases. |  | CO5 | L2 | T | D |
| 30 |  | How does transaction isolation level affect the concurrency control mechanism? | 9 | CO5 | L2 | T | S |
| 31 |  | Describe the concept of index locking and its impact on transaction processing. | 9 | CO5 | L2 | T | S |
| 32 |  | Discuss the concept of snapshot isolation and its implications on concurrency control. | 9 | CO5 | L2 | T | D |
| 33 |  | Explain the concept of lock escalation and its role in managing resource contention. | 5 | CO5 | L2 | T | S |
| 34 |  | How can deadlock detection and resolution be implemented in a transaction processing system? | 5 | CO5 | L2 | T | D |
| 35 |  | Discuss the role of timestamp ordering in concurrency control and transaction scheduling. | 6 | CO5 | L2 | T | D |
| 36 |  | Describe the concept of data replication in distributed databases and its impact on concurrency. | 6 | CO5 | L2 | T | D |
| 37 |  | Discuss the challenges and techniques for handling distributed deadlocks in transaction processing. | 6 | CO5 | L2 | T | D |
| 38 |  | Explain the concept of optimistic concurrency control and its applications in distributed systems. | 6 | CO5 | L2 | T | D |
| 39 |  | Discuss the impact of long-running transactions on concurrency control and system performance. | 6 | CO5 | L2 | T | S |
| 40 |  | Explain the concept of data consistency and the role of concurrency control in maintaining it. | 6 | CO5 | L2 | T | D |
| 41 |  | Consider a transaction T1 that reads data item A and transaction T2 that reads and writes data item A. Both transactions run concurrently in a system with a two-phase locking protocol. Draw a schedule that demonstrates a conflict serializable execution of these transactions. Also, explain how the two-phase locking protocol ensures serializability. |  | CO5 | L3 | P | D |
| 42 |  | Given the following schedule of transactions: |  | CO5 | L2 | T | D |
| 43 |  | Determine if the schedule is conflict serializable. If it is not, demonstrate a conflict-serializable schedule that is equivalent to the given schedule. |  | CO5 | L2 | T | D |
| 44 |  | Assume a transaction T1 acquires a shared lock on data item A, followed by a shared lock on data item B, and then requests an exclusive lock on data item C. Another transaction T2 holds an exclusive lock on data item C and requests a shared lock on data item B. Determine whether the system is in a deadlock state. If it is, explain the deadlock and suggest a strategy to resolve it. |  | CO5 | L3 | P | D |
| 45 |  | Consider a distributed database system with two sites A and B. Each site has a copy of data item X, and both sites allow read-committed isolation level. If transaction T1 reads data item X from site A and transaction T2 updates data item X at site B, explain how the system ensures read-committed isolation and resolves any conflicts. |  | CO5 | L3 | P | D |
| 46 |  | Suppose a system uses the write-ahead logging protocol for recovery. Describe the steps involved in recovering a transaction after a system failure, starting from the analysis phase to the redo and undo phases. |  | CO5 | L2 | P | D |
| 49 |  | Assume a NoSQL database system based on a key-value store, such as Redis. Design a data model and propose an indexing strategy to efficiently retrieve all customer records with a specific age. Explain how your design supports efficient querying and scalability. |  | CO5 | L2 | P | A |
| 47 |  | Consider a graph database system, such as ArangoDB, that stores social network data. Design a query to find the shortest path between two users based on their connections. Describe the graph traversal algorithm you would use and discuss its efficiency and scalability. |  | CO5 | L2 | P | S |
| 51 |  | Suppose you are designing a distributed transaction processing system using the two-phase commit protocol. Outline the steps involved in executing a distributed transaction and handling failures |  | CO5 | L2 | T | S |