


Shivaji University , Kolhapur
Question Bank For Mar 2022 (Summer) Examination

Subject Code :81548

Subject Name : Database Engineering (PCC - CS603)

| | Question | Option 1 | Option 2 | Option 3 | Option 4 |
|---|---|---|---|--|--|
| 1 | Which of the following is a fundamental operation in relational algebra? | Set intersection | Natural join | Assignment | None of the mentioned |
| 2 | The DBMS acts as an interface between what two components of an enterprise-class database system? | Database application and the database | Data and the database | The user and the database application | Database application and SQL |
| 3 | The result which operation contains all pairs of tuples from the two relations, regardless of whether their attribute values match. | Join | Cartesian product | Intersection | Set difference |
| 4 | <p>Consider the Following Database Schema</p> <p>Collage DB: Student (RNo, Class, Dept_id, Prn, name, city, mobile, percent) Department (Dept_id, name, strength) Staff (Staff_id, Dept_id, Staff_name, subject, class)</p> <p>Find the correct relational algebra query to answer the following queries</p> <p>Find the names and percentage of students who have less than or equal to 60%</p> | $\Pi_{name} (\sigma_{(percent \leq 60)} (student))$ | $\sigma_{name, percent} (\Pi_{(percent < 60)} (student))$ | $\sigma_{name, percent} (\Pi_{(percent \leq 60)} (student))$ | $\Pi_{name, percent} (\sigma_{(percent \leq 60)} (student))$ |
| 5 | Which of the following is a attribute or set of attributes which is primary means of uniquely identifying a entity in a relation. | Super Key | Candidate Key | Primary Key | Foreign Key |
| 6 | <p>Consider the following DB relation and the FD's on it</p> <p>R (A, B, C, D)</p> <p>A, B \rightarrow C, D A, C \rightarrow B, D B, C \rightarrow A, D</p> <p>Based on above assumptions predict the highest normal form of the given Relation</p> | 1NF | 2NF | 3NF | BCNF |
| 7 | _____ and _____ rules in set of Armstrong's Axioms are called as Trivial | Reflexivity, Decomposition | Self-determination, Augmentation | Reflexivity, Self-determination | Decomposition, Augmentation |
| 8 | Consider the Following ERD | course(<u>course_id</u> , title, credits), | course(<u>course_id</u> , title, credits), | course(<u>course_id</u> , title, credits), | course(<u>course_id</u> , title, credits), |

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| |  <p>Which of the following is the correct reduction of the given ERD (Primary key is underlined)</p> | section(<u>sec_id</u> , <u>semester</u> , year) | section(<u>cour</u> <u>se_id</u> , <u>sec_id</u> , <u>semester</u> , <u>year</u>) | section(<u>course</u> <u>id</u> , <u>sec id</u> , <u>semester</u> , year) | section(<u>cours</u> <u>e_id</u> , <u>sec id</u> , <u>semester</u> , <u>year</u>) |
| 9 | _____ property of decomposition is mostly preserved while a relation is decomposed to BCNF, while the _____ property may not always be preserved. | Dependency Preservation, Lossy decomposition | Lossy decomposition, Dependency Preservation | Dependency Preservation, Lossless decomposition | Lossless decomposition, Dependency Preservation, |
| 10 | Which functional dependency types is/are not present in the following dependencies? Empno -> EName, Salary, Deptno, DName DeptNo -> DName EmpNo -> DName | Full functional dependency | Partial functional dependency | Transitive functional dependency | Both B and C |
| 11 | Which one of the following statements about normal forms is FALSE? | BCNF is stricter than 3 NF | Lossless, dependency -preserving decomposition into 3 NF is always possible | Loss less, dependency – preserving decomposition into BCNF is always possible | Any relation with two attributes is BCNF |
| 12 | Given the relations R1 (A, B, C) with 10 tuples and R2 (X, Y, Z) with 5 tuples, how many tuples will be produced by following SQL Query? Select * from R1 natural join R2 | 0 | 5 | 10 | 50 |
| 13 | Select emp_name from department where dept_name like ' _____ Science'; Which one of the following has to be added into the blank to select the dept_name which has Science as its ending string ? | % | _ | & | ! |
| 14 | Aggregate functions are functions that take a _____ as input and return a single value. | Collection of values | Single value | Aggregate value | Both a & b |
| 15 | All aggregate functions except _____ ignore null values in their input collection. | Count(attribute) | Count(*) | Avg() | Sum() |

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| 16 | A view is which of the following? | A virtual table that can be accessed via SQL commands | A virtual table that cannot be accessed via SQL commands | A base table that can be accessed via SQL commands | A base table that cannot be accessed via SQL commands |
| 17 | The file organization which allows us to read records that would satisfy the join condition by using one block read is | Heap file organization | Sequential file organization | Clustering file organization | Hash file organization |
| 18 | A unit of storage that can store one or more records in a hash file organization is denoted as | Buckets | Disk pages | Blocks | Nodes |
| 19 | In ordered indices the file containing the records is sequentially ordered, a _____ is an index whose search key also defines the sequential order of the file. | Clustered index | Structured index | Unstructured index | Nonclustered index |
| 20 | A data dictionary is created when a _____ created. | Instance | Segment | Database | Dictionary |
| 21 | The file organization that provides very fast access to any arbitrary record of a file is | Ordered file | Unordered file | Hashed file | B-tree |
| 22 | In multiple granularity of locks SIX lock is compatible with | IX | IS | S | SIX |
| 23 | If a transaction T has obtained an exclusive lock on item Q, then T can | read Q | write Q | read and write Q | write Q but not read Q |
| 24 | Which one is true statement : | With finer degree of granularity of locking a high degree of concurrency is possible | Locking prevents non – serializable schedules | Locking cannot take place at field level | An exclusive lock on data item X is granted even if a shared lock is already held on X |
| 25 | Which of the following concurrency control schemes is not based on the serializability property? | Two – phase locking | Graph-based locking | Time-stamp based locking | None of these |
| 26 | Which of the following ensures the atomicity of the transaction? | Transaction management component of DBMS | Application Programmer | Concurrency control component of DBMS | Recovery management component of DBMS |
| 27 | A transaction is in _____ state after the final statement has been executed | active | partially committed | committed | none of the above |
| 28 | Which of the following protocols ensures conflict serializability and safety from deadlocks? | Two-phase locking protocol | Time-stamp ordering protocol | Graph based protocol | Both (a) and (b) above |
| 29 | Which of the following are introduced to reduce the overheads caused by the log-based recovery? | Indices | Checkpoints | Locks | Stable Storage |
| 30 | Before a block of data in main memory can be output to the database, all log records pertaining to data in that block must have been output to stable storage. This is | Read-write logging | Read-ahead logging | Write-ahead logging | None of the mentioned |
| 31 | Consider a scenario in log where we have <start t2> , <start t1> and <commit t2> log records. What would be recovery procedure if | redo t1, undo t2 | redo t1, redo t2 | undo t1, redo t2 | undo t1, undo t2 |

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| | immediate database modification scheme is used for updating the database. | | | | |
| 32 | In shadow paging, which of the page tables contains the modifications done by the active transaction | current page table | shadow page table | both | none |
| 33 | Which of the following recovery schemes is likely to have the highest commit overhead | Immediate Database Modification with Redo and Undo | Deferred Database Modification with Redo | Shadow Paging | All have equal commit overhead. |
| 34 | What is the following assumption is called: “non-volatile storage contents are assumed to not be corrupted by system crash” | Failure Recovery | Stable Storage | Permanent Storage | Fail stop assumption |
| 35 | The ____ connective tests for set membership, where the set is a collection of values produced by a select clause. The ____ connective tests for the absence of set membership. | Or, in | Not in, in | In, not in | In, or |
| 36 | In the _____ normal form, a composite attribute is converted to individual attributes. | 1NF | 2NF | 3NF | BCNF |
| 37 | A schedule is in a _____ state if there exists a set of transactions in which every transaction is waiting for another transaction in the set. | Deadlock | Starved | Isolated | None of the mentioned |

Note: Each MCQ carries 2 marks.

Chapter 1:

1. What is data model? Explain 2 data models in brief.
2. Define and Differentiate between Super Key, Candidate Key and Primary Key. Give appropriate example
3. Consider a two-dimensional array of $n*m$ size that is to be used in your favorite programming language. Using the array as an example demonstrate the difference between: (a) the three levels of data abstraction and (b) schema and instance.
4. List the basic operators of Relational Algebra. Explain any 3 operators with respective syntax and example.
5. List different types of users in Database environment. Explain the role played by each of the listed users.
6. List and explain different types of attributes with appropriate examples for each.
7. List and Explain the Drawbacks of using file systems to store data
8. List the types of database languages. Explain each type with appropriate example.
9. Define Database. List and explain the applications of Database.
10. Explain the ER Model in details.

Chapter 2

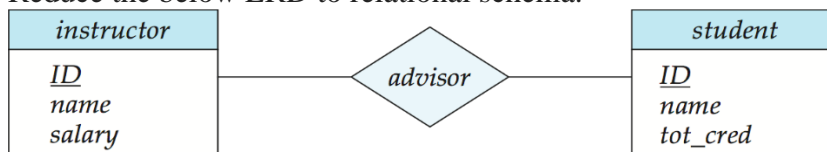
1. Consider the following schema and set of functional dependencies:

Class (course_id, title, dept_name, credits, sec_id, semester, year, building, room_no, capacity, time_slot_id)

F={
course_id -> title, dept_name, credits,
building, room_no -> capacity
course_id, sec_id, semester, year -> building, room_no, time_slot_id
}

Assume the above relation is in 1NF. Check the current highest normal form of the given relation. Decompose the schema to BCNF.

2. Design an ER diagram for keeping track of exploits of your favorite sports Team. You should store the matches played, the scores in each match, the players in each match and individual player statistics for reach match. Summary statistics should be modeled as derived attributes.
3. Reduce the below ERD to relational schema.



4. Consider the relation R with attributes:

R(A, B, C, D, E, F, G, H)

The set of FD's for given relation is:

F => {
A -> D
F -> H
A, B -> C, E, F, G, H
B, F -> H
B, C, H -> A, D, F, G, E
}

Given the relation is in 1NF, normalize the schema till BCNF.

5. List and explain the desired properties of decomposition.
6. List and explain the Extended Features of ER model.
7. Design an ER diagram for keeping track of exploits of your favorite sports Team. You should store the matches played, the scores in each match, the players in each match and individual player statistics for reach match. Summary statistics should be modeled as derived attributes.
8. Consider the following DB Schema and respective FD's for each relation in schema,

Client (clientNo, cName)

fd1: clientNo → cName

PropertyOwner (propertyNo, pAddress, rent, ownerNo, oName)
fd1: propertyNo \rightarrow pAddress, rent, ownerNo, oName
fd2: ownerNo \rightarrow oName

Rental (clientNo, propertyNo, rentStart, rentFinish)
fd1: clientNo, propertyNo \rightarrow rentStart, rentFinish
fd2: clientNo, rentStart \rightarrow propertyNo, rentFinish
fd3: propertyNo, rentStart \rightarrow clientNo, rentFinish

Predict the highest normal form of the given schema. Normalize the above schema till BCNF.

9. Compare BCNF & 3NF
10. Explain the rules for reduction of following notation in ERD, with appropriate examples
 - a. Weak Entity set
 - b. Multivalued attribute in Strong Entity set
 - c. Many to One relationship set.

Chapter 3

1. Assume the Relations given below.
Student(Enrno, name, courseId, emailId, cellno)
Course(courseId, course_nm, duration)

Write SQL statements for following:

- a. Find out list of students who have enrolled in “computer” course.
 - b. List name of all courses with their duration.
 - c. List name of all students start with “a”.
 - d. List email Id and cell no of all mechanical engineering students.
2. Write the basic structure of SQL Queries. Explain working of each keyword in the structure.
3. How are the following integrity constraints implemented in SQL:
 - a. Domain constraint
 - b. Referential integrity.Explain the above with appropriate syntax and example.
4. List and explain aggregate functions of SQL with appropriate examples.
5. List and explain the different DML statements in SQL

6. Explain the following SQL constructs with examples: (1) order by, (2) group by, (3) having, (4) as, (5) in

7. Consider the following Database design

Customer (cid, custname, custstreet, custcity)

Account (accno, branchname, balance)

Loan (loanno, branchname, amount)

Borrower (cid, loanno)

Branch (branchname, branchcity, asset)

Depositor (cid, accno)

Solve the following queries in SQL

- Display the name of customers who have both account and loan at the bank.
- Update amount of loan to 10000 where loan number is "L-101".
- Change the column name custcity to ccity.
- Find all customers who an account but no loan at bank.

8. The following relations keep track of Library Management system.

Book_info(bookid, bname, bauthor, price, edition, publication, pur_date,)

Student(lib_car_num, stud_name, class, branch, roll_no)

Issue_table(issue_date, sub_date, bookid, lib_car_num, due)

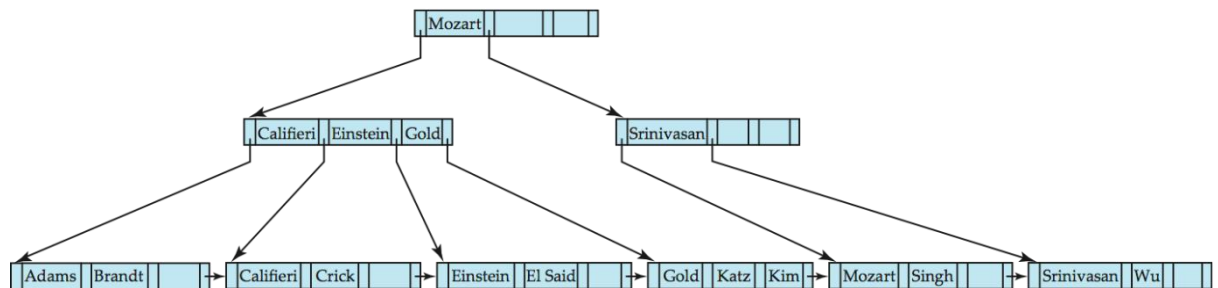
Write the following SQL queries:

- Find the details of the books issued to the library card number 1.
 - Give all the information about student and the book issued with ascending order of library card number
 - Find the author, edition, price of book.
 - Find the names of the students with dues on the book issue.
9. List and explain the types of Join in SQL.
10. Why is the Domain Constraint called as elementary Database constraint?

Chapter 4

- Construct a B+ tree with $n=3$ for given set of key values
52, 40, 55, 12, 34, 56, 55, 90, 87, 50, 70
- Define the terms Primary Index and Secondary Index. Differentiate between them on basis of the Evaluation Criteria for indices

3. When does a collision occur in hashing? Illustrate various collision resolution techniques.
4. Explain how Variable Length records are Represented in file.
5. List and explain in brief the ways of Organization of Records in Files.
6. Define the terms Dense Index and Sparse Index. Differentiate between them on basis of the Evaluation Criteria for indices
7. Illustrate Multiple Key Access with appropriate example.
8. Elaborate Deficiencies of Static Hashing and probable solutions to those deficiencies.
9. Consider the following B+ tree instance



Perform the following operations on the above tree

- a. Delete Crick
- b. Insert Ben in tree after step a
- c. Insert Anil in tree after step b

10. List and explain the Index Evaluation Metrics

Chapter 5

1. Illustrate testing of Conflict Serializability with appropriate example.
2. Write the rules for Thomas Write Rule. Elaborate how Thomas' Write Rule allows greater potential concurrency as compared to Timestamp based protocol.
3. List and explain the variants of Two Phase Lock Protocol
4. Explain with appropriate example the following terms
 - a. Recoverable Schedules
 - b. Cascadeless Schedules
5. What is transaction? Explain its ACID properties of transaction
6. Draw and explain the Transaction State Diagram
7. List and elaborate the Pitfalls of Lock-Based Protocols

8. Consider the Partial Schedule as given below with transaction having timestamps 1,2,3,4 respectively.

| T1 | T2 | T3 | T4 |
|-----------|---------------------------|---|------------------------------|
| Write (A) | Read (B) Write (B) | Read (A) Write (A) Read(B) Write (B) | Read (A) Read (B) |

Predict the state of transactions after every operation, by applying the timestamp-based protocol.

9. List and elaborate the Intention Lock Modes in Multiple Granularity? Draw the Compatibility Matrix with Intention Lock Modes

10.

| T_3 | T_4 |
|--|--------------------------------------|
| lock-x (B) read (B) $B := B - 50$ write (B) lock-x (A) | lock-s (A) read (A) lock-s (B) |

Consider the above partial schedule. Check if the schedule is following the rules of 2PL. Also predict the state of execution of the given schedule.

11.

| T_1 | T_2 |
|--|--|
| read (A) write (A) read (B) write (B) | read (A) write (A) read (B) write (B) |

Given the above schedule, check if it is conflict serializable. If yes show serial schedule to which the above schedule is conflict equivalent, if no state why?

Chapter 6

1.

| | | |
|---|---|--|
| <p><T₀ start> <T₀, A, 1000, 950> <T₀, B, 2000, 2050></p> | <p><T₀ start> <T₀, A, 1000, 950> <T₀, B, 2000, 2050> <T₀ commit> <T₁ start> <T₁, C, 700, 600></p> | <p><T₀ start> <T₀, A, 1000, 950> <T₀, B, 2000, 2050> <T₀ commit> <T₁ start> <T₁, C, 700, 600> <T₁ commit></p> |
| (a) | (b) | (c) |

Elaborate the Recovery actions given the log as it appears at three instances of time

2. Elaborate the Deferred Database Modification schemes. Also mention the recovery mechanism.
3. Explain the purpose of Checkpoint mechanism. Explain the steps for performing a checkpoint.
4. State and explain various classes of failure in database system.
5. Explain Shadow paging in detail.
6. List and elaborate the Drawbacks of Shadow Paging.
7. Elaborate the Immediate Database Modification with its Recovery mechanism.
8. Elaborate with appropriate diagram the process through which the transactions read data residing in permanent storage.
9. Compare Deferred Database Modification and Immediate Database Modification
10. Explain log-based recovery technique.