

# SEMESTER END EXAMINATIONS JANUARY – FEBRUARY 2021

Program : **B.E. : Computer Science and Engineering**  
Course Name : **Database Systems**  
Course Code : **CS52**

Semester : **V**  
Max. Marks : **100**  
Duration : **3 Hrs**

## Instructions to the Candidates:

- Answer one full question from each unit.

### UNIT- I

1. a) Explain the three-schema architecture with a neat diagram .Justify the need of mappings between schema levels. CO1 (08)
- b) A university database contains information about professors (identified by a social security number) and courses (identified by a course ID). Each of the following situations concerns the relationship set between the teacher and the student. Draw an ER diagram for each situation (assuming that no further constraints hold)
- (i.) Professors can teach the same course over several semesters and each offering must be recorded.
- ii. Each professor teaches exactly one course.
- iii. Each professor teaches at least one course and some professors may teach multiple courses.
- Each professor teaches at least one course and some professors must teach all the courses.
- c) Explain the advantages of Database approach. CO1 (06)
2. a) Illustrate the different components of DBMS with a neat diagram. CO1 (10)
- b) Draw ER Diagram for the given scenario CO1 (10)
- Set up a database company, ArtBase, which builds a product for art galleries. The core of this product is a database with a schema that captures all the information that galleries need to maintain.
- Galleries keep information about artists, their names (which are unique), birthplaces, age, and style of art.
  - For each piece of artwork, the artist, the year it was made, its unique title, its type of art (e.g., painting, lithograph, sculpture, photograph), and its price must be stored. Pieces of artwork are also classified into groups of various kinds, for example, portraits, still lifes, works by Picasso, or works of the 19th century; a given piece may belong to more than one group.
  - Each group is identified by a name (like those just given) that describes the group.
- Finally, galleries keep information about customers. For each customer, galleries keep that person's unique name, address, total amount of dollars spent in the gallery (very important!), and the artists and groups of art that the customer tends to like.

### UNIT – II

3. a) What is the difference between a key and a super key? Explain with an example. Also, discuss the various reasons that lead to the occurrence of NULL values in relations. CO2 (06)
- b) What is Union compatibility? Explain set difference operation in relational algebra. CO2 (04)

- c) Consider the schema given below: CO2 (10)  
 Vehicle(reg-no, make, color)  
 Person (eno, name, address)  
 Owner(eno, reg-no)  
 Write relational algebra expressions for the following queries.  
 i) List the names of persons who do not own car  
 ii) List the names of persons who own only Hyundal cars  
 iii) List the names of persons who own purple color cars  
 iv) List the colors of vehicles grouped by make.

4. a) Explain in detail about various constraints used in database system. CO2 (08)  
 b) Assume the following relations: CO2 (06)  
 BOOKS(DocId, Title, Publisher, Year)  
 STUDENTS(StId, StName, Major, Age)  
 AUTHORS(AName, Address)  
 borrows(DocId, StId, Date)  
 has-written(DocId, AName)  
 describes(DocId, Keyword)  
 Write relational algebra expressions for the following queries.  
 i. List the year and title of each book  
 ii. List the names of all students who have borrowed a book and who are CS majors.  
 iii. List the title of books written by the author 'Silberschatz'.  
 c) Write a note on Aggregate functions and Grouping in Relational algebra. CO2 (06)

### UNIT - III

5. a) Explain about any four aggregate functions in SQL. CO3 (08)  
 b) Consider the following tables: CO3 (08)  
 BRANCH(branch-name:string, branch-city:string, assets:real)  
 ACCOUNT(accno:int, branch-name:string, balance:real)  
 DEPOSITOR(customer-name:string, accno:int)  
 CUSTOMER(customer-name:string, customer-street:string, customer-city:string)  
 LOAN(loan-number:int, branch-name:string, amount:real)  
 BORROWER(customer-name:string, loan-number:int)  
 Write SQL Queries for the following  
 i. List in alphabetical order all customers who have a loan at Perryridge branch.  
 ii. Find the names of all customers who street address includes the substring "Main".  
 iii. List the loan numbers in descending order of amount.  
 iv. Find the average account balance at each branch.  
 c) Explain about union compatibility in SQL. CO3 (04)
6. a) Differentiate between HAVING and where clause in SQL. CO3 (06)  
 b) Consider insurance database (primary key attributes are underlined): CO3 (06)  
 Person(id#, name, city, street, street\_number)  
 Car( license, model, year)  
 Accident( report#, date, city, street, street\_number)  
 Owns( id#, license)  
 Participated( id#, license, rep#, damage\_amt)  
 Write SQL Queries for the following  
 i. Update the damage amount for the car with license number "AABB2000" in the accident with report number "AR2197" to \$3000.  
 ii. Count the no of cars participated in the accident.  
 iii. Display the no of cars owned by each driver.



- c) Explain the Impedance mismatch problem. Which of the database programming approaches minimize this problem? CO3 (08)

**UNIT – IV**

7. a) Explain any two Informal design guidelines for relation schemas. CO4 (04)  
 b) Write an algorithm to find the minimal cover F for a set of functional dependencies? Explain with an example. CO4 (10)  
 c) Explain first and second normal forms with an example each. CO4 (06)
8. a) Differentiate between 3NF and BCNF. CO4 (03)  
 b) Using the Algorithm for Testing Nonadditive (Lossless) Join property, test if the decomposition of R into  $\{R_1, \dots, R_5\}$  is a lossless join decomposition.  
 Let  $R = ABCDE$ ,  $R_1 = AD$ ,  $R_2 = AB$ ,  $R_3 = BE$ ,  $R_4 = CDE$ , and  $R_5 = AE$ .  
 Let the functional dependencies be:  $A \rightarrow C$ ,  $B \rightarrow C$ ,  $C \rightarrow D$ ,  $DE \rightarrow C$ ,  $CE \rightarrow A$   
 c) Consider the universal relation  $R = \{A, B, C, D, E, F, G, H, I, J\}$  and the set of functional dependencies,  
 $F = \{ \{A, B\} \rightarrow \{C\}, \{A\} \rightarrow \{D, E\}, \{B\} \rightarrow \{F\}, \{F\} \rightarrow \{G, H\}, \{D\} \rightarrow \{I, J\} \}$   
 What is the key for R? Decompose R into 2NF and then into 3NF relations. CO4 (10)

**UNIT – V**

9. a) Explain the problems which may encounter when transactions run concurrently with examples. CO5 (06)  
 b) Explain in detail about the ACID properties in transaction processing. CO5 (08)  
 c) Explain about the two phase commit protocol. CO5 (06)
10. a) With a neat diagram write and explain the state transition diagram illustrating the states for transaction execution. CO5 (08)  
 b) Which of the following schedules is (conflict) serializable? For each serializable schedule, determine the equivalent serial schedules. CO5 (12)  
 a.  $r_1(X); r_3(X); w_1(X); r_2(X); w_3(X);$   
 b.  $r_1(X); r_3(X); w_3(X); w_1(X); r_2(X);$   
 c.  $r_3(X); r_2(X); w_3(X); r_1(X); w_1(X);$   
 d.  $r_3(X); r_2(X); r_1(X); w_3(X); w_1(X);$

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