**COURSE PACK FOR DATABASE MANAGEMENT SYSTEMS (A5506)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Title** | **DATABASE MANAGEMENT SYSTEMS(DBMS)** | | | | **Course Type** | | **Integrated** | |
| **Course Code** | **A5506** | **Credits** | **4** | | **Class** | | **II Year I Semester** | |
| **Course Structure** | TLP | Credits | Contact Hours | Work Load | Total Number of Classes  Per Semester | | Assessment in Weight age | |
| Theory | 3 | 3 | 3 |
| Practice | 1 | 2 | 2 | Theory | Practical | CIE | SEE |
| Tutorial | 0 | 0 | 0 |
| **Total** | **4** | **5** | **5** | **42** | **28** | **30%** | **70%** |
| **Course Instructors** | **Course Lead: Dr. K.Dhanasree Devi** | | | | | | | |
| **Theory** | | | | **Practice** | | | |
| 1. Dr. K .Dhana sree Devi 2. Dr. K Ramesh | | | | 1. Dr. K .Dhana sree Devi 2. Dr. K Ramesh | | | |

**COURSE OVERVIEW**

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design theory: E-R modeling, data definition and manipulation languages, database security and administration. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery and various types of databases like distributed database, and intelligent database, Client/Server. Students undertake a semester project to design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

**COURSE OBJECTIVE**

The course enables the students to model, design and implement a database for any real world scenario given. The student will be able to write optimum queries to retrieve data from database.

**COURSE OUTCOMES (COs)**

After the completion of the course, the student will be able to:

|  |  |  |  |
| --- | --- | --- | --- |
| CO# | Course Outcomes | POs | PSOs |
| A4508.1 | Understand design and implementation of a database for a given problem domain. | - | - |
| A4508.2 | Construct Queries in Relational algebra, relational calculus and SQL. | 2,5 | 1,2 |
| A4508.3 | Apply Normalization techniques to reduce data redundancy in data base. | 1,3 | - |
| A4508.4 | Analyze various transaction control and recovery methods to keep data base consistent | 1,5 | - |
| A4508.5 | Construct the file of data records by using appropriate storage and access structure. | 2,3 | 2 |

**BLOOM’S LEVEL OF THE COURSE OUTCOMES**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CO# | Bloom’s Level | | | | | |
| Remember  (L1) | Understand  (L2) | Apply  (L3) | Analyze  (L4) | Evaluate  (L5) | Create  (L6) |
| A45081 |  | ✔ |  |  |  |  |
| A45082 |  |  | ✔ |  |  |  |
| A45083 |  |  | ✔ |  |  |  |
| A45084 |  |  |  | ✔ |  |  |
| A45085 |  |  | ✔ |  |  |  |

**COURSE ARTICULATION MATRIX**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO#/**  **POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| A4508.2 |  | 3 |  |  | 3 |  |  |  |  |  |  |  | 1 | 1 |
| A4508.3 | 3 |  | 3 |  |  |  |  |  |  |  |  |  |  |  |
| A4508.4 | 2 |  |  |  | 3 |  |  |  |  |  |  |  |  |  |
| A4508.5 |  | 3 | 3 |  |  |  |  |  |  |  |  |  |  | 1 |

**Note:** 1-Low, 2-Medium, 3-High

**COURSE ASSESSMENT**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| S No | Component | | Duration in Hours | Component Wise  Marks | Total Marks | Weightage | Marks |
| 1 | Continuous Internal Evaluation (CIE) | Theory: Test-1 | 1 | 20 | 100 | 0.3 | 30 |
| 2 | Theory: Test-2 | 1 | 20 |
| 3 | Alternate Assessment**\*** | - | 20 |
| 4 | Practical Exam | 2 | 40 |
| 5 | Semester End Exam (SEE) | | 3 | 100 | 100 | 0.7 | 70 |
| **Total Marks** | | | | | | | **100** |

\* Assignment, Quiz, Class test, SWAYAM/NPTEL/MOOCs and etc..

**COURSE CONTENT**

**THEORY**

|  |
| --- |
| Contents |
| **INTRODUCTION:** introduction to database management systems, database system applications, database systems versus file systems, view of data, , Database users and administrators, database system structure.  **DATABASE DESIGN:** E-R diagrams, entities, attributes and entity sets, relationships and relationship sets, additional features of the E-R model  **SQL - PART I:** database languages- DDL , DML, DCL and TCL commands ,Overview, the form of a basic SQL query, basic SQL queries examples, union, intersect and except operators, aggregate operators.  **THE RELATIONAL MODEL:** Introduction to the relational model, integrity constraints over relations, querying relational data, logical database design: E-R to relational  **SQL-PART II:** joins, nested queries , null values,, PL/SQL basics for writing triggers, cursors, stored procedures, SQL VsNoSQL.  **RELATIONAL ALGEBRA AND CALCULUS**: relational algebra and relational calculus.  **SCHEMA REFINEMENT AND NORMAL FORMS:** Introduction to schema refinement, functional dependencies, reasoning about FDs. Normalization , Normal forms: 1NF, 2NF, 3NF, BCNF, 4NF,5NF, properties of decompositions, schema refinement in database design.  **TRANSACTIONS MANAGEMENT:** Transaction concept, transaction state, implementation of atomicity and durability, concurrent executions, Anomalies due to interleaved execution of transactions, serializability, recoverability.  **CONCURRENCY CONTROL:** Concurrency control - lock based protocols, time-stamp based protocols, validation based protocols, deadlock handling.  **OVERVIEW OF RECOVERY AND INDEXING:** Recovery system – failure classification, log-based recovery, shadow paging, recovery with concurrent transactions, ARIES Algorithm. RAID, Overview of File organization, Tree index structures: ISAM and B+ trees. |

**PRACTICE:**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.N o** | **Title of the Experiment** | **Tools and Techniques** | **Expected Skills/Ability** |
|  | **CASE STUDY : EMPLOYEE AND DEPARTMENT DATABASE** | Oracle SQL Plus  IDE: SQL Developer  OS: Windows / Linux | Able to write SQL Queries by using various operators |
|  | The BlueX Company pvt.ltd has maintaining Employee information contains employee details .The company has four departments. Any employee working in the company belongs to any one of the department. An employee joined in company above 25 years only. The company may give commission for every employee if and only if more than 2 years experience. Construct the database design with that there is no redundancy.  **Consider the table structure as follows:**  Employee(empno,ename,job,mgr,hiredate,sal,comm,deptno)  Department(deptno, dname,location) Construct queries for the following:  1. Write queries for creating above relations Employee and Department. 2. Write queries for inserting necessary data into above relations 3. display all information of emp table 4. display unique jobs from emp table 5. list the employes in ascending order of their salaries 6. display unique job groups in descending order 7. Display all the details of all ‘Mgrs’ 8. List the emps who joined before 1981. 9. List the Empno, Ename, Sal, Daily sal of all emps in the asc order of Annsal 10. Display the Empno, Ename, job, Hiredate, Exp of all Mgrs 11. List the Empno, Ename, Sal, Exp of all emps working for Mgr 7369 12. Display all the details of the empswhose Comm. Is more than their Sal. 13. List the emps in the asc order of Designations of those joined after the second half of 1981. 14. List the emps along with their Exp and Daily Sal is more than Rs.100. 15. List the emps who are either ‘CLERK’ or ‘ANALYST’ in the Desc order. 16. List the emps who joined on 1-MAY-81,3-DEC-81,17-DEC-81,19-JAN-80 in asc order of seniority. 17. List the emp who are working for the Deptno 10 or20 18. List the emps who are joined in the year 81. 19. List the emps who are joined in the month of Aug 1980. 20. List the emps Who Annual sal ranging from 22000 and 45000 21. List the Enames those are having five characters in their Names. 22. List the Enames those are starting with ‘S’ and with five characters. 23. List the emps those are having four chars and third character must be ‘r’. 24. List the emps whose Sal is four digit number ending with Zero. 25. List all the emps except ‘PRESIDENT’ & ‘MGR” in asc order of Salaries. 26. List all the emps who joined before or after 1981. 27. List the emps whose Empno not starting with digit78 28. Display the details of SMITH. 29. Display the location of SMITH. 30. Display the total information of the emps along with Grades in the asc order. 31. List the details of the empswhose Salaries more than the employee BLAKE. 32. List the emps whose Jobs are same as ALLEN 33. List the emps who are senior to King 34. List the emps Whose Jobs are same as MILLER or Sal is more than ALLEN. 35. Find details of highest paid employee. 36. Find the highest paid employee of sales department. 37. List the employee in dept 20 whose sal is >the average sal 0f dept 10 emps. 38. List the no. of emps in each department where the no. is more than 3. 39. Display the number of employee for each job group 40. Display the number of employee for each job group deptno wise. 41. List the department, details where at least two emps are working 42. List the employees whose salary is more than 3000 after giving 20% increment. 43. List the empsname ,dept, sal and comm. For those whose salary is between 2000 and 5000 while loc is Chicago. 44. List the name ,job, dname, location for those who are working as MGRS. |
|  | CASE STUDY: SAILORS, RESERVES, BOATS DATA BASE |  |
|  | In Database user has to maintain sailors information with sailors sid, sailor name and every sailor age is more than 25 years and has a rating i.e (rating >=10),the sailors reserved the boats for shipment of goods. Each boat identified by bid, name, color. Every sailors may reserve more than one boat. Reservation can notice based on the date. Answer to the following Queries  1. Create above relations and create indexing for accessing records faster. 2. First insert data into sailors table , then insert data into Boats table and last insert data into Reserves table. Use data shown in above tables to insert. 3. display the sailors names and age 4. display the unique sailor names and age 5. Find the names of sailors who have reserved at least one boat. 6. Find all information of sailors who have reserved boat number 101 7. Find the names of sailors who have reserved a red boat 8. Find the name and the age of the youngest sailor 9. Calculate the average age of all sailors 10. Find the average age of sailors for each rating level 11. Find the sid’s , names of sailors who have reserved all boats and having age greater than30. 12. Find the sids ,names of sailors who have reserved a red or a greenboat 13. Find the sids of sailors with age over 20 who have not reserved a redboat 14. Compute increments for the rating of sailors who have sailed two different boats on the sameday 15. Find the average age of sailors who are of voting age (i.e., at least 18 years old) for each rating level that has at least twosailors. 16. Find those ratings for which the average age of sailors is the minimum overallratings 17. Find sailors whose rating is better than some sailor called“Horatio” 18. Find sailors whose rating is better than every sailor called“Horatio 19. Find the names of sailors who are older than the oldest sailor with a rating of10 20. Find the average age of sailors for each rating level that has at least twosailors | Able to write SQL Queries by using various operators |
|  | Design an ER diagram for Bank Database | Apply ER model concepts to design ER diagram |
|  | **CASE STUDY :BANK DATABASE** |  |
|  | A bank has many branches and a large number of customers. A customer can open different kinds of accounts with the bank. The bank keeps track of a customer by his SSN, name, address, and phone number. Age is used as a factor to check whether he is a major. There is different type of loans, each identified by a loan number. A customer can take out more than one type of loan, and all branches can give loans. Loans have a duration and interest rate. The account holder can enquire about the balance in his account; create a data base design for the bank. Make any suitable assumptions.  **Create necessary relations and create indexing for accessing records faster.**  **Answer to the following Queries**:   * 1. Find all account whose balance is smaller than 500.   2. Find all employees who se salary is greater than 1400 and working branch is not ‘Downtown’   3. Give the name of the customer having maximum deposit among deposits of city “Harrison” for branch “Perry ridge”.   4. Give the names of cities in which the maximum number of branches located.   5. Add amount “100” to the account of all those depositors who are having the highest deposit amount in their respective branches.   6. Find t he name, account number, and balance of all customers who have an account with a balance of $400 or less.   7. Find the names ,street, addresses and cities of residence of all employees who work for First Bank Corporation and earn more than 10000/-   8. Give all loans numbers for a loan made at the Perryidge branch with loan amount greater than 1200   9. Find customer name, loan number, loan amount branch name for all loans   10. Find customer name, loan number , loan amount branch name for all loans given by “perryridge” branch   11. Find names of all branches that have asserts greater than all branches located in Brooklyn   12. Find names of all branches that have asserts greater than at least one branch located in Brooklyn.   13. Find average balance for each customer who lives in Harrison and has at least 2 accounts   14. Delete borrower of branches having the minimum number of customers. | Able to write SQL Queries by using various operators |
|  | Design an ER diagram for inventory management system database.  Convert the ER diagram into relational model tables.  Normalize the above tables upto3rd Normal Form to reduce redundancy. | Apply ER model concepts, normalization techniques in developing a database |
|  | **CASE STUDY: INVENTORY MANAGEMENT SYSTEM DATA BASE** |  |
|  | There are many items in a departmental store, which are sold to customer and purchased from supplier. An order is placed by the customer-required details, which are listed below:   * + Item number   + Part number   + quantity   The order processing executes, look up the stock of each item (parts) is available or not then order fulfilled by the management of departmental store. The system periodically checks the stock of each item if it is found below the reorder level then purchase order placed to the supplier for that item, if the supplier is not able to supply whole order then rest of quantity supplied by the another supplier. After fulfilled the formalities, bill generated by the system and sent to the customer. Create a database design to maintained by the management for whole process is being done  **Answer to the following Queries**  **Create necessary relations and create indexing for accessing records faster.**   1. Display supplier names for supplier who supply at least one part supplied by supplier s2 2. Get supplier names for supplier who supply all parts 3. Get supplier names for suppliers who do not supply part P2 4. Find supplier numbers for suppliers who supply at least all those parts supplied by supplier S2 5. Get a part numbers for parts that either weight more than 16 pounds, or are supplied by supplier S2, or both. 6. For each part , get the pat number and the total shipment quantity 7. For each supplier , get the supplier number and the total number of parts supplied 8. Get all Paris of supplier numbers such that the who suppliers are located in the same city 9. Get color and city for “non Paris” parts with weight greater than ten 10. Get part number for all parts supplied by more than one supplier 11. Get supplier numbers for supplier with less than the current maximum status in the “s” table 12. Get supplier names for supplier who supply at least one brown part | Able to write SQL Queries by using various operators |
|  | **B] PL/SQL PROGRAMS** |  |
|  | 1. Write a PL/SQL program to read number from a user and find out whether it is Odd or Even. | 1. Able to write PL/SQL programs |
| 1. Write a PL/SQL program to insert a row into emp table using variables |
| 1. Write a PL/SQL program to get the name and salary of employee whose eno is 501.(use %type) |
|  | 1. Write a PL/SQL program to display Salary of a employee whose eno is 502 by increasing with 500 if its salary is more than 3000. | 1. Able to write PL/SQL programs |
| 1. Write a PL/SQL program to read employee number from a user and increase its salary depends on the current salary as follows.   Salary Increment  >= 5000 10%;  <5000 05% |
| 1. Write a PL/SQL Block to read employee name from a user if it is exist display its salary otherwise display appropriate message using exception handling. |
|  | 1. Write a PL/SQL Block to insert add one row in employee table. Display appropriate message using exception handling on duplication entry of employee number.(use Dup\_val\_on\_index exception) |  |
| 1. Write a PL/SQL program to read number from a user and find out whether it is Odd or Even. |
| Write the PL/SQL program to retrieve the data from emptable? |
|  | The L& T Pvt.ltd Company has maintaining Employee information contains employee details .The company has four departments. Any employee working in the company belongs to any one of the department. Write a PL/SQL block to insert a record in emp table and update the salaries of Blake andClarkby2000and1500.Thnchecktoseethatthetotalsalarydoesnotexceed20000.Iftotal >20000 then undo the updates made to salaries of Blake and clerk? | Able to write PL/SQL programs |
| 1. A table Product attributes pno, pname, sales price . A table old price attributes pno, old sales price. If the price of product pool1 is <4000 then change the price to 4000. The price change is to berecordedintheoldpricetablewithproductnumber,dateonwhichthepricewaslastchanged? |
|  | **CURSORS** |  |
|  | 1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paidemployees. | 1. Implement cursors |
| 1. Update the balance –stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the itemID is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the itemid is not present in the item master table then the record is inserted in the item mastertable. |
| 1. The table trans has the following structure acno, transtype, trans date. The table bank has acno, bal, minbal. Assuming that the same acno exists in both tables update the bank table. If trans.type=’d’ then Balance=bank.balance + trans.amount. if transtype=’w’ then balance = bank.balance-trans.amount . Take precaution in case ofwithdrawals. |
|  | 1. **TRIGGERS** |  |
|  | 1. Write a PL/SQL block that will display the name, deptno ,salary of fist highest paidemployees. | 1. Implement triggers |
| 1. Display sailors information using cursor. if the sailor is not available insert the sailorsdetails |
| Create pl/sql program to insert and update record in customer table usingcursors |
| 1. Write a PL/SQL program for deletion of row from employee table usingTriggers. |
| 1. Write a PL/SQL program to update a row from employee table usingTriggers. |

**TEXT BOOK:**

1. Raghurama Krishnan, Johannes Gehrke (2007), Database Management Systems, 3rd Edition, Tata McGraw-Hill, New Delhi, India.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2010), Database System Concepts, 6th Edition, McGraw- Hill, New Delhi, India.

**REFERENCE BOOKS:**

1. ElmasriNavate (2014), Fundamentals of Database Systems, Pearson Education, India

**JOURNALS/MAGAZINES**

1. <https://www.oracle.com/database/>

**SWAYAM/NPTEL/MOOCs:**

1. <https://swayam.gov.in/nd1_noc19_cs46/preview>
2. <https://www.edx.org/learn/databases>
3. <https://www.coursera.org/learn/database-management>

**SELF-LEARNING TOPICS:**

1. Relational Calculus
2. Types of NoSQL
3. Query Mechanism of NoSQL

**LESSON PLAN**

| **Lecture #** | **Topics to be Covered** |
| --- | --- |
|  | introduction to database management systems, database system applications, database systems versus file systems |
|  | view of data, , Database users and administrators |
|  | database system structure |
|  | **DATABASE DESIGN:** E-R diagrams, entities, attributes and entity sets |
|  | relationships and relationship sets |
|  | additional features of the E-R model |
|  | **SQL - PART I:** database languages- DDL , DML, DCL and TCL commands |
|  | Overview, the form of a basic SQL query, basic SQL queries examples |
|  | union, intersect and except operators, aggregate operators. |
|  | **THE RELATIONAL MODEL:** Introduction to the relational model, integrity constraints over relations |
|  | querying relational data |
|  | logical database design: E-R to relational |
|  | **SQL-PART II:** joins |
|  | nested queries |
|  | null values,, PL/SQL basics for writing triggers |
|  | PL/SQL basics for writing cursors |
|  | stored procedures |
|  | SQL VsNoSQL |
|  | **RELATIONAL ALGEBRA AND CALCULUS**: relational algebra |
|  | relational calculus |
|  | **SCHEMA REFINEMENT AND NORMAL FORMS:** Introduction to schema refinement, functional dependencies, reasoning about FDs |
|  | Normalization , Normal forms: 1NF, 2NF |
|  | 3NF, BCNF |
|  | 4NF,5NF |
|  | properties of decompositions, schema refinement in database design |
|  | **TRANSACTIONS MANAGEMENT:** Transaction concept, transaction state, implementation of atomicity and durability |
|  | concurrent executions, Anomalies due to interleaved execution of transactions |
|  | serializability |
|  | recoverability |
|  | **CONCURRENCY CONTROL:** Concurrency control - lock based protocols |
|  | time-stamp based protocols |
|  | validation based protocols |
|  | deadlock handling |
|  | **OVERVIEW OF RECOVERY AND INDEXING:** Recovery system – failure classification, log-based recovery |
|  | shadow paging, recovery with concurrent transactions |
|  | ARIES Algorithm |
|  | RAID |
|  | Overview of File organization |
|  | Tree index structures: ISAM |
|  | B+ trees |
|  | Case Study or Micro-project |
|  | Case Study or Micro-project |

**PROBLEM BASED LEARNING**

| **S. No** | **Title of the Experiment** |
| --- | --- |
|  | A university database contains information about professors (identified by social security number, or SSN) and courses (identified by courseid). Professors teach courses; each of the following situations concerns the Teaches relationship set. For each situation, Show or draw an ER diagram that describes(assuming no further constraints hold).   1. Professors can teach the same course in several semesters, and each offering must be recorded. 2. Professors can teach the same course in several semesters, and only the most recent such offering needs to be recorded. (Assume this condition applies in all subsequent questions.) 3. Every professor must teach some course. 4. Every professor teaches exactly one course (no more, no less). 5. Every professor teaches exactly one course (no more, no less), and every course must be taught by some professor. |
|  | A company database needs to store information about employees (identified by *ssn*, with *salary* and *phone* as attributes), departments (identified by *dno*, with *dname*and*budget*as attributes), and children of employees (with *name* and *age* as attributes). Employees *work* in departments; each department is *managed by* an employee; a child must be identified uniquely by *name* when the parent (who is an employee; assume that only one parent works for the company) is known. We are not interested in information about a child once the parent leaves the company.Translate the above information into ER diagram that captures this information. |
|  | How many distinct tuples are in a relation instance with cardinality 22? |
|  | What is the difference between a candidate key and the primary key for a given relation? What is a super key? |
|  | What is a foreign key constraint? Why are such constraints important? What is referential integrity? |
|  | Emp(*eid:* integer, *ename:* string, *age:* integer, *salary:* real)Works(*eid:* integer, *did:* integer, *pcttime:* integer)Dept(*did:* integer, *dname:* string, *budget:* real, *managerid:* integer)Based on above schema, answer the following questions(7-12): |
|  | Give an example of a foreign key constraint that involves the Dept relation. What are the options for enforcing this constraint when a user attempts to delete a Dept tuple? |
|  | Construct SQL statements required to create the preceding relations, including appropriate versions of all primary and foreign key integrity constraints. |
|  | BuildDept relation in SQL so that every department is guaranteed to have a manager. |
|  | Construct an SQL statement to add John Doe as an employee with *eid*= 101, *age* = 32 and *salary* = 15*,* 000. |
|  | Construct an SQL statement to give every employee a 10 percent raise. |
|  | Construct an SQL statement to delete the Toy department. Given the referential integrity constraints you chose for this schema, explain what happens when this statement is executed. |
|  | Consider the following relational schema and briefly answer the questions that follow:  Emp(*eid*: **integer**, *ename*: **string**, *age*: **integer**, *salary*: **real**) Works(*eid*: **integer**, *did*: **integer**, *pct time*: **integer**) Dept(*did*: **integer**, *budget*: **real**, *managerid*: **integer**)   1. Define a table constraint on Emp that will ensure that every employee makes at least $10,000. 2. Define a table constraint on Dept that will ensure that all managers have age > 30. 3. Define an assertion on Dept that will ensure that all managers have age > 30. Compare this assertion with the equivalent table constraint. Explain which is better. 4. Construct SQL statements to delete all information about employees whose salaries exceed that of the manager of one or more departments that they work in. Be sure to ensure that all the relevant integrity constraints are satisfied after your updates. |
|  | Consider the following schema:Suppliers(*sid:* integer, *sname:* string, *address:* string), Parts(*pid:* integer, *pname:* string, *color:* string), Catalog(*sid:* integer, *pid:* integer, *cost:* real). The key fields are underlined, and the domain of each field is listed after the field name. Therefore *sid*is the key for Suppliers, *pid*is the keyfor Parts, and *sid*and*pid*together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers.  Organize the following queries in relational algebra, tuple relational calculus.   1. Find the *name*s of suppliers who supply some red part. 2. Find the *sid*s of suppliers who supply some red or green part. 3. Find the *sid*s of suppliers who supply some red part or are at 221 Packer Street. 4. Find the *sid*s of suppliers who supply some red part and some green part. 5. Find the *sid*s of suppliers who supply every part. 6. Find the *sid*s of suppliers who supply every red part. 7. Find the *sid*s of suppliers who supply every red or green part. 8. Find the *sid*s of suppliers who supply every red part or supply every green part. 9. Find pairs of *sid*s such that the supplier with the first *sid*charges more for some part than the supplier with the second *sid*. 10. Find the *pid*s of parts supplied by at least two different suppliers. 11. Find the *pid*s of the most expensive parts supplied by suppliers named Yosemite Sham. 12. 12. Find the *pid*s of parts supplied by every supplier at less than $200. (If any supplier either does not supply the part or charges more than $200 for it, the part is not selected.) |
|  | Consider the following relation database, where the primary keys are underlined.  employee (person name, street, city ) works (person name, company name, salary) company (company name, city) manages (person name, manager name)  Construct relational algebra queries for the following:   1. Find the names of all employees who live in the same city and on thesame street as do their managers. 2. Find the names of all employees in this database who do not workfor “First Bank Corporation”. 3. Find the names of all employees who earn more than every employeeof “Small Bank Corporation”. |
|  | Experiment on the Suppliers table to show the difference between truncate and delete commands. |
|  | Experiment on the Parts table to show the difference between delete and drop commands. |
|  | Given schemas:  Students(rollno,sname)  Courses(Courseno,cname)  Registration(rollno,courseno,percent)  Answer the query in RA: Find the distinct names of all students who score more than 90% in the course number 100. |
|  | Design ER diagram for Hospital Management System |
|  | Design ER diagram for Insurance Companies |
|  | Design ER diagram for Banking System |
|  | Design ER diagram for Online Bus Reservation System |
|  | Illustrate the conversion mechanism of ER diagram to Relation Model using ER diagram of Hospital Management System |
|  | Convert the ER diagram of Insurance Companies into Relational model |
|  | Construct Simple DDL,DML SQL Queries on Insurance Companies |
|  | Construct DDL,DML SQL Nested Queries on Insurance Companies |
|  | Construct Simple DCL,TCL SQL Queries on Insurance Companies |
|  | The relation book ( title & price ) contains the titles and prices of different books. Assuming that no two books have the same price, Identify the output of the following SQL query list? select title from book as B where (select count(\*) from book as T where T.price>B.price)<5 |
|  | Consider the following schema: Emp (Empcode, Name, Sex, Salary, Deptt) Make use of Aggregate functions of SQL and Identify the output of the following SQL Query: SELECT Deptt FROM Emp WHERE sex = 'M' GROUP by Dept Having avg (Salary) > {select avg (Salary) from Emp} |
|  | Find the attribute closures of given FDs R(ABCDE) = {AB->C, B->D, C->E, D->A} |
|  | Identify the minimal key for relational scheme R(A, B, C, D, E) with functional dependencies F = {A → B, B → C, AC → D} |
|  | Find Candidate key of given FDs R = (ABCDE), F = {A -> C, E -> D, B -> C} |
|  | Find Candidate key of given FDs R = ABCDE, F = {A -> BE, C -> BE, B -> D} |
|  | Find Candidate key of given FDs R = ABCDEF, F = {A -> B, B -> D, C -> D, E -> F} |
|  | Find Candidate key of given FDs R = ABCD, F={AB -> C, BC -> D, CD -> A} |
|  | Functional dependencies: For each of the following sets of functional dependencies on a schema r(A, B, C, D, E)   * 1. Identify a candidate key for this schema   2. Construct the attribute closure of AB   3. AB 🡪 C, D --> E, B --> E   4. A --> CD, B --> DE   5. AB --> C, C --> D |
|  | A Relation R with FD set {A->BC, B->A, A->C, A->D, D->A}. How many candidate keys will be there in R? |
|  | Choose the highest normal form of a relation R(A,B,C,D,E) with FD set as {BC->D, AC->BE, B->E} |
|  | Illustrate the differences between lossy and lossless decomposition with examples? |
|  | **Consider a schema R(A,B,C,D) and functional dependencies A->B and C->D. Then find whether the decomposition of R into R1(AB) and R2(CD) is lossy or lossless or dependency preservation.** |
|  | Select the highest normal form in R (A, B, C, D, E) under following functional dependencies.  ABC --> D  CD --> AE |
|  | Select the highest normal form of a relation R(A,B,C,D,E) with FD set {A->D, B->A, BC->D, AC->BE} |
|  | Select the highest normal form of a relation R(A,B,C,D,E) with FD set {B->A, A->C, BC->D, AC->BE} |
|  | Consider a relation R with five attributes ABCDE. You are given the following dependencies: A 🡪B, BC 🡪 E, and ED 🡪 A. 1. List all keys for R. 2. Is R in 3NF? 3. Is R in BCNF? |
|  | Consider a database  student(ID, name, courseID, year, semester, grade) instructor(ID, name, deptname, deptbudget) List the functional dependencies you would expect to hold on the above relations, and decompose them into BCNF. |
|  | Let R= (A, B, C, D, E, F) be a relation scheme with the following dependencies: C->F, E->A, EC->D, A->B. Build thecandidate keys for R using closure? |
|  | R = (A, B, C, D, E, H) on which the following functional dependencies hold: {A–>B, BC–>D, E–>C, D–>A}. Build the candidate keys of R using closure? |
|  | The following functional dependencies are given:  AB->CD, AF->D, DE->F, C->G , F->E, G->A  Construct the closure of the FDs |
|  | Consider a relation R (A, B, C, D, E, F, G, H), where each attribute is atomic, and following functional dependencies exist: {CH->G, A->BC, B->CFH, E->A}. Identify which normal form is satisfied by the above. |
|  | Student(sid,sname,deptname,age)  Sid,sname->deptname  Deptname ->age  Check Whether The above table is in 3NF or not |
|  | Translate or Normalize the Relational model of Hospital Management System up to 3rd Normal Form |
|  | Employee(eid,ename,salary,designation)  Eid->ename  Ename->salary  Salary->designation  Designation->eid  Identify the all possible candidate keys in above relation |
|  | Translate or Normalize the Relational model of Insurance Companies up to BCNF Normal Form |
|  | Consider the following actions taken by transaction T1 on database objectsX and Y : R(X), W(X), R(Y), W(Y) 1. Give an example of another transaction T2 that, if run concurrently to transaction T without some form of concurrency control, could interfere with T1. 2. Examine how the use of Strict 2PL would prevent interference between the two transactions. 3. Strict 2PL is used in many database systems. Give two reasons for its popularity |
|  | What is Schedule? Prove that the following Schedule is Conflict Serializable or not  S  T1 T2  R(a)  W(a)  R(b)  W(b)  W(b)  R(b)  W(a)  R(a) |
|  | **Consider the following schedules involving two transactions. Find whether given schedules are conflict serializable and conflict equivalent or not.**  S1: R1(X) R1(Y) R2(X) R2(Y) W2(Y) W1(X)  S2: R1(X) R2(X) R2(Y) W2(Y) R1(Y) W1(X) |
|  | Find whether the given schedule S is conflict serializable or not:  S: R1(X),R2(X),R2(Y),W2(Y),R1(Y),W1(X) |
|  | Consider the following two transactions:  T11: read(A);  read(B);  if A=0 then B:=B+1;  write(B)  T12: read(B);  read(A);  if B=0 then A:=A+1;  write(A);  Add lock and unlock transactions to transaction T11 and T12, so that they observe the two phase locking protocol. Analyze whether the execution of these transactions result in a deadlock or not? |
|  | Consider the following locking protocol: All items are numbered, andonce an item is unlocked, only higher-numbered items may be locked.Locks may be released at any time. Only X-locks are used. Show by anexample that this protocol does not guarantee serializability |
|  | The Oracle database system uses undo log records to provide a snapshotview of the database, under snapshot-isolation. The snapshot view seenby transaction Ti reflects updates of all transactions that had committedwhen Ti started, and the updates of Ti; updates of all other transactionsare not visible to Ti.  Describe a scheme for buffer handling whereby transactions are givena snapshot view of pages in the buffer. Include details of how to use thelog to generate the snapshot view. You can assume that operations as wellas their undo actions affect only one page. |
|  | UNDO Logging Consider the content of the following undo log:   |  |  | | --- | --- | | LSN1 | <START T1> | | LSN2 | <T1 X 5> | | LSN3 | <START T2> | | LSN4 | <T1 Y 7> | | LSN5 | <T2 X 9> | | LSN6 | <START T3> | | LSN7 | <T3 Z 11> | | LSN8 | <COMMIT T1> | | LSN9 | < START CKPT (T2, T3)> | | LSN10 | <T2 X T3> | | LSN11 | <T3 Y 15> | |  | CRASH |  1. Show how far back in the recovery manager needs to read the log. Write below the earliest LSN that the recovery manager reads. 2. Show below the actions of the recovery manager during recovery: 3. What is the value of X at the end of the recovery? |
|  | In the ARIES method, assuming NO checkpoints have been used, explain what happens during the ANALYSIS pass of recovery. Your answer should indicate at least (1) what part of the log the system reads and in what direction and (2) what data structures the system rebuilds. |
|  | A database table T1 has 2000 records and occupies 80 disk blocks. Another table T2 has 400 records and occupies 20 disk blocks. These two tables have to be joined as per a specified join condition that needs to be evaluated for every pair of records from these two tables. The memory buffer space available can hold exactly one block of records for T1 and one block of records for T2 simultaneously at any point in time. No index is available on either table. If Nested-loop join algorithm is employed to perform the join, with the most appropriate choice of table to be used in outer loop, find the number of block accesses required for reading the data. |
|  | Given a block can hold either 3 records or 10 key pointers. A database contains n records, find how many blocks do we need to hold the data file and the dense index. |
|  | Find the order of leaf(pleaf) and non leaf(p) nodes of a B+ tree based on the information given below Search key field = 12 bytes Record pointer = 10 bytes Block pointer = 8 bytes Block size = 1 KB |
|  | A B+ tree of order d is a tree in which each internal node has between d and 2d key values. An internal node with M key values has M+1 children. The root (if it is an internal node) has between 1 and 2d key values. The distance of a node from the root is the length of the path from the root to the node. All leaves are at the same distance from the root. The height of the tree is the distance of a leaf from the root. a). What is the total number of key values in the internal nodes of a B+ tree with l leaves (l≥2)? b). What is the maximum number of internal nodes in a B+ tree of order 4 with 52 leaves? c). What is the minimum number of leaves in a B+ tree of order d and height h(h≥1)? |
|  | In a B+ tree, if the search-key value is 12 bytes long, the block size is 1024 bytes and the block pointer is 6 bytes, Find the maximum number of keys that can be accommodated in each non-leaf node of the tree. |
|  | The order of a leaf node in a B+ tree is the maximum number of (value, data record pointer) pairs it can hold. Given that the block size is 1K bytes, data record pointer is 7 bytes long, the value field is 9 bytes long and a block pointer is 6 bytes long, what is the order of the leaf node? |
|  | A FAT (file allocation table) based file system is being used and the total overhead of each entry in the FAT is 4 bytes in size. Given a 100 x 106 bytes disk on which the file system is stored and data block size is 103 bytes, find the maximum size of a file that can be stored on this disk in units of 106 bytes. |
|  | A power failure that occurs while a disk block is being written could result in the block being only partially written. Assume that partially written blocks can be detected. An atomic block write is one where either the disk block is fully written or nothing is written (i.e., there are no partialwrites). Suggest schemes for getting the effect of atomic block writes with the following RAID schemes. Your schemes should involve work on recovery from failure.  a. RAID level 1 (mirroring) b. RAID level 5 (block interleaved, distributed parity) |
|  | Construct a B+-tree for the following set of key values: (2, 3, 5, 7, 11, 17, 19, 23, 29, 31) Assume that the tree is initially empty and values are added in ascendingorder. Construct B+-trees for the cases where the number of pointers thatwill fit in one node is as follows: a. Four b. Six c. Eight |

**PROJECT BASED LEARNING**

To enhance the skill set in the integrated course, the students are advised to execute course-based **design projects**. Some sample projects are given below:

| **S No.** | **Suggested Projects** |
| --- | --- |
|  | Model, design and develop a database for Online Bus Ticket Booking system |
|  | Model, design and develop a database for Insurance policies management |
|  | Model, design and develop a database for Banking System |
|  | Model, design and develop a database for E-commerce application |
|  | Model, design and develop a database for Hospital Data Management Application |

For any above project, the below steps to be followed:

1. Requirement Analysis
2. Draw ER diagram
3. Convert ER diagram to Relational model
4. Do schema refinement
5. add security measures to database