Ref. No. Ex/CSE/PC/B/T/321/2024

BCSE 3rd Year 2nd Semester Examination, 2024

Database Management Systems

Full marks: 100 **Time: 3 hours**

Group A[CO1: Recognize and associate the fundamental concepts of DBMS and relational model]:15 Marks

1) a) i) Define relation as per relational model. 3

ii) Relational algebra is procedural but relational calculus is not so – explain with example. 2

iii) Comment on the properties of an attribute of a relation in relational model. 2

iv) Mention the task of DDL pre-compiler. 2

2) Consider the relations: PROJECT(PROJ_ID, PROJ_NAME, START_DT, END_DT), EMPLOYEE(EMP_CODE, EMP_NAME) and WORKS_IN(EMP_CODE, PROJ_ID, ROLE_IN_PROJECT).

i) Write down the relational calculus expression to find out the name of the employees who work in the project named as 'ABC'.

ii) Write down the relational algebra expression to find out the name of the employees who work in all projects. 3+3

Group B[CO2: Illustrate the database using Entity-Relation Model and design the database]:20 Marks

3) a) i) How will you design the primary key of weak entity type? 2

ii) Define existential dependency. 2

iii) Compare union and specialization in ER/EER model? 3.5

iv) Consider 1:N binary relation between two entity types A and B. Database is to be designed so that related pair of entities can be retrieved and in this effort null value is to be avoided. None of the entity type participates in relation totally. Explain, how will you design the database? 2.5

OR

b) i) What is ER Model? 1.5

ii) Consider two entity types A(a1, a2, a3) and B(b1,b2,b3). There exists one to one relation R between them. Suppose to capture whole scenario a table is designed as ABR(a1, a2, a3, b1, b2, b3) where a1 is a candidate key and b1 is another candidate key. Discuss the pros and cons of the design. 3

iii)What is identifying relation? 2.5

iv)What are the constraints on Generalization-Specialization? 3

[Turn over

4) Draw the ER diagram for the following system:
In an academic institute number of programs (like, UG-CSE, UG-ETC etc.) are there. Each program has program-id (unique), program name. In each program numbers of courses (i.e. subjects) are taught. Each course in the institute has unique course –id and other attributes like, course name, type etc. There are two types of program outcomes – PO/graduate attributes which are same for all programs and PSO (program specific outcome) that varies from program to program. Each course has its own set of COs (course outcomes) and the number of COs may vary from course to course. Each CO has a correlation with POs and PSOs and correlation values to be stored.
System must be able to find the program outcomes (PO and PSOs) for any program asked by user, can find the COs for any course asked by user, can find the correlation values between CO and PO/PSO.
Also, design the tables indicating primary and foreign keys. 6+4

Group C[CO3: Analyze the functional dependency and design the database]:20 Marks

5) a) Why do we need normalization? 5

b) Each student has unique roll number. A relation stores following information for each student: roll, name, date of birth, dept code and dept name and hod of the deprtment in which he/she studies and (semester number, score) for each semester. Further assume the following FDs:

roll → name, date of birth, dept code

dept code → dept name, hod

roll, semester number → score

Normalize the schema up to 3NF. Indicate primary and foreign key at each step. Discuss whether the final decomposition is loss-less or not. 8+2

6) a) i) What is functional dependency? 2
ii) MVD is a consequence of 1NF -- explain. 3

OR

b) i) Discuss the importance of removing transitive dependency . 2.5
ii) BCNF may not be dependency preserving – explain. 2.5

Group D[CO4: Interact with database using SQL, PL/SQL, Trigger]:30 Marks

7) Consider the following tables:
ORDER_HEAD(**order_id**, order_dt, cust_code)
ITEM(**icode**,iname,rate, stock)
ORDER_DETAILS(**order_id,icode**,qty)
ITEM contains information of all items. For each order a row is stored in ORDER_HEAD and for each requested item in an order a row is stored in ORDER_DETAILS.
Write down one SQL statement for each of the following:
a) Assume, ORDER_HEAD and ITEM tables are there. Now create the ORDER_DETAILS table with suitable constraints. 4
b) For each order show order_id and total value (∑qty*rate for the order). In the list only those with total value more than 50000 will appear. The list must be in the descending order of total value. 5
c) Find the icode for which total ordered quantity is maximum. 4
d) Decrease the rate by 10% for the items which do not appear in any order. 3
e) Find out the customer code who have placed order for item name 'ABC' 4

8) a) Consider the three tables described in question 7.

Write a trigger so that whenever an entry is modified in ODER_DETAILS it is allowed only if modified qty (may increase/decrease) of the item in ODER_DETAILS can be accommodated with the corresponding stock in ITEM table. Also modify the stock accordingly. 10

OR

b) Consider the three tables described in question 7.
Assume there exists a table: SUMMARY(**cust_code, order_id**, value).
Write a PL/SQL block for the following. For each customer, store the top three order_id (based on ordered value, ∑qty*rate for the order) and ordered value in SUMMARY table. If a customer places less than three orders then do not consider him/her. 10

Group E[CO5: Interpret and explain the principles of query optimization, transaction processing, concurrency control, recovery]: 15 Marks

9) a) i) What does actually happen when a transaction commits? 3
ii) In the context of log based recovery in a concurrent environment what happens at the time of checkpoint. 3

iii) Explain the dirty read problem with example. Explain whether it can happen or not in two phase locking protocol. 3+3

iv) Consider the relations as STUDENT(**ROLL**, NAME) SUBJECT(**SCODE**, SNAME) and RESULT(**ROLL, SCODE**, SCORE). Assume ROLL of RESULT references STUDENT and SCODE of RESULT References SUBJECT. Find the equivalent but efficient expression for

$\pi_{\text{ROLL, NAME}} (\sigma_{\text{SCORE>=80 and SNAME='ABC'}} (\text{STUDENT} * \text{RESULT} * \text{SUBJECT}))$ 3

OR

b) i) What does actually happen when a transaction commits? 3

ii) Suppose, a database block is to be read into buffer and there exists no free buffer. What will happen? 3

iii) In a concurrent environment how will you ensure recoverability under time stamp based protocol? Explain whether it will lead to deadlock or not. 3+2

iv) Secondary index provides logical ordering of data – explain. 2

v) What is the use case/scenario for hash join? 2