

BCSE 3rd Year 2nd Semester Examination, 2022

Database Management Systems

Full marks: 100

Time: 3 hours

Group A|CO1: Understand the fundamental concepts of DBMS and relational model|:15 Marks

- 1) a) i) Compare intension and extension of a relation in relational model. 3
 ii) Explain schema level and model level constraint in relational model. 4
 OR
 b) i) Why do we need DML pre-compiler? 2.5
 ii) What is the significance of Data Dictionary? 2.5
 iii) Explain the relation between $\text{NOT}(\exists x) (\text{NOT } P(x))$ and $(\exists x) (P(x))$. 2

2) Consider the following relations:

PROJECT(PROJ_ID, PROJ_NAME), PROGRAMMER(PROG_ID, PROG_NAME), WORKS(PROJ_ID, PROG_ID)

PROJECT and PROGRAMMER relations keep the list of all projects and programmers respectively. WORKS notes down which programmer works in which project. A programmer may work in multiple projects. Write down both, relational algebra and relational calculus expression to find the following:

- i) Name of the projects in which programmer with PROG_ID 'E009' works.
 ii) Name of the programmers who work in all projects (1.5+2)+(1.5+3)

Group B|CO2: Represent the database using Entity-Relation Model and design the database|:20 Marks

- 3) a) i) What is ER diagram? Explain the structural constraints in ER diagram. 5
 ii) A and B are two entity types. A totally participates in the one to many (From A to B) relation with B. Explain, how will you implement the relationship avoiding the occurrence of null value? 3

OR

- b) i) As per ER model, explain the value set of a mandatory and single valued attribute. Define weak entity type. 2+2
 ii) Explain union in ER model and compare with shared subclass? 4

4) A system will store information of the students. For each student roll number (it is unique), name, contact number and e-mail id are to be stored. Based on the attribute resident_or_not, students are categorized either as day scholar or as

resident. For resident students, hostel information like hostel name, room number is stored. Based on the attribute scholarship_holder_or_not, students are categorized either as self financed or as scholarship holder. For scholarship holders, information like funding authority, reference number, scholarship amount are stored.
Draw The ER/EER diagram and also design the necessary tables optimally with justification.

7+5

Group C [CO3: Understand functional dependency and normalize the database]: 20 Marks

- 5) a) Explain, why normalization is required? 5
b) Consider a schema $R(A, B, C, D, E, F, G, H)$. Assume, the schema is in 1NF. Normalize it up to 3NF subjected to the following FDs:

$A \rightarrow C, D, G$

$AB \rightarrow F, H$

$B \rightarrow E$

$C \rightarrow D$

Show the steps and indicate primary key and foreign key at each step. Explain whether the decomposition is dependency preserving or not. 7+3

- 6) a) Consider two FD sets F and G on a relation are as follows.
 $F = \{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$ $G = \{A \rightarrow CD, E \rightarrow AH\}$

Explain whether F and G are equivalent or not.

5

OR

- b) i) Compare BCNF and 3NF.
ii) 4NF is a consequence of 1NF -- explain.

2

3

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

- 7) Consider the following tables:

VENDOR(V_ID, VNAME)

ITEM(ICODE, INAME, PRICE)

DEPT(DCODE, DNAME)

DELIVERY(DELIVERY_ID, V_ID, ICODE, DCODE, QUANTITY, DELIVERY_DATE)

Assume, in DELIVERY table, V_ID, ICODE and DCODE are foreign keys.
Write down the SQL statements for the following:

- a) Drop the records from **VENDOR** corresponding to the vendors who have not delivered any item in the year 2021. 3
- b) Find the name of the vendors whose total delivery value is more than 100000. Total delivery value for a vendor is computed as sum of the product of quantity and price of corresponding item and it takes into account all the deliveries made by the vendor. 5
- c) Find out **ICODE** and **DCODE** combinations denoting that the particular item was not supplied to that department. 4
- d) Find out the name of the departments where the item named 'ABC' has been delivered. 4
- e) For each item show name and total quantity delivered. 4

8) a) Explain **NO_DATA_FOUND** and **TOO_MANY_ROWS** exceptions in the context of PL/SQL in oracle? 3

b) Consider the tables: **ITEM(ICODE, INAME, PRICE, QTY_IN_STOCK)**, **CUSTOMER(CCODE, CNAME)**, **ORDER(ORDER_ID, CCODE, ORDER_DT)**, **ORDER_DETAILS(ORDER_ID, ICODE, QTY)**

Write a trigger to reduce **QTY_IN_STOCK** in **ITEM** table whenever an entry is made in **ORDER_DETAILS**. But, the entry is not allowed if **QTY_IN_STOCK** is less than the ordered **QTY** for the item. 7

OR

Write a PL/SQL code to find out top three orders based on their value. Value of an order stands for sum of (qty x price) of all items appearing in that order. 7

Group E|CO5: Conceptualize the principles of query optimization, transaction processing, concurrency control, recovery|: 15 Marks

- 9) a) i) Discuss incorrect summary problem with suitable example. Explain whether it can happen or not in timestamp based protocol. 2.5+2.5
- ii) How does the log based recovery differ for immediate and deferred database modification? Suppose, log based recovery is followed for a concurrent environment and periodically checkpoint operation is done. How can you find out the list of transactions whose effects are to be cancelled? 2+4
- iii) Consider the relations as **STUDENT(ROLL, NAME)** **SUBJECT(SCODE, SNAME)** and **RESULT(ROLL, SCORE, SCORE)**. Assume **ROLL** of **RESULT** references **STUDENT** and **SCODE** of **RESULT** References **SUBJECT**. Find the equivalent but efficient expression for the following:

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

Explain your answer. 4

OR

- b) i) Describe transaction states and transition. 4
- ii) Discuss the security feature of DBMS. 3
- iii) Two relations R1 and R2 are to be joined based on the equality of primary key of R1 and foreign key of R2. In R1, number of tuples is very less and tuples are of very small size. Specify an optimal way for join operation and also explain the number of block accesses required. 5
- iv) Two phase locking protocol is not free from deadlock -- explain. 3