

## BCSE 3<sup>rd</sup> Year 2<sup>nd</sup> Semester Examination, 2017

### Database Management Systems

Full marks: 100

Time: 3 hours

#### Attempt any five questions

- 1) a) Define a relation according to relational model. Also describe the same as a mathematical relation. 5
- b) Define referential integrity 4
- c) Number of tuples in returning relation of PROJECT operation is always less than or equal to number of tuples in input relation. Explain. 2
- d) Consider  $R(A,B)$  and  $S(A)$  are two relations. Implement  $R \div S$  with the help of basic relational algebra operation. 3
- e) When  $\text{NOT}(\exists x) (P(x))$  and  $(\forall x) (Q(x))$  will be equivalent? What is the relation between  $\text{NOT}(\exists x) (\text{NOT } P(x))$  and  $(\exists x) (P(x))$ ? 3
- f) Consider  $R(A,B)$  and  $S(A)$  are two relations. Represent  $R \div S$  using relational calculus expression. 3
- 2) a) An institute maintains student database. Each student has unique registration number. Periodically examinations are conducted. For each exam, unique id is assigned and date of exam, type of exam (Regular/supplementary), course, semester are also stored. Depending on course, semester and type of examination, tests are conducted for a set of subjects. Each subject has unique subject code. In order to appear in exam, students submit form. Unique examination roll number is assigned to each student and the mapping (registration number to exam roll number) is to be stored. For each subject there is atleast one paper setter cum examiner. One may act as paper setter cum examiner for multiple subjects. On evaluating the answerscripts, they submit score sheet that has subject code, a list of examination roll number and score. System will also maintain information about examinations, paper setters for the subjects in an exam.  
Draw the ER diagram for the described system. 10
- b) Describe structural constraints in ERD. 5
- c) Applicants submit application. Each application has unique ID. Along with ID, name of the applicant, phone number, date of birth and for each examination he/she has passed, name of the examination, year of passing and score obtained are to be stored in disk. Suggest your storage design with justification. 5

- 3) a) In an auction, teams bid for players. A team may bid for number of players. Zero or more number of teams may bid for a player. Highest bidder will get the player. Represent the scenario in ER Diagram. So that, who bids for whom and which team owns which players can be identified. Design the database with necessary constraints and write the SQL statements to create the schemas. Assume team-id and player-id are the unique id for team and player respectively. Other attributes you may consider as per your need. 9
- b) Consider a generalization-specialization scenario. It is implemented by considering tables only for each specialized class. Comment on this design. 5
- c) Consider two relations: DEPT (DCODE, DNAME) and EMP (ECODE, ENAME, BASIC, DCODE). i) Write down relational algebra expression to show department name and number of employees with basic more than 50000 for each department. ii) Write down the relational calculus expression to find out the name of the departments in which nobody works. 3+3
- 4) a) Define functional dependency? What is denormalization? State and prove reunion rule to infer FD. 5
- b) Each employee has unique ECODE. A data structure stores following information of an employee: ECODE, ENAME, BASIC, DT\_JN, DCODE, DNAME, DEPT\_LOCATION, and for every project in which he/she is involved PCODE, PNAME, COORDINATOR. Consider the following FDs:  
 i) DCODE → DNAME, DEPT\_LOCATION  
 ii) ECODE → ENAME, BASIC, DT\_JN, DCODE  
 iii) PCODE → PNAME, COORDINATOR  
 Normalize the data structure up to 3NF showing the steps. Identify primary and foreign keys at each step.  
 Now, assume ECODE → PCODE. Explain whether your 3NF output satisfies 4NF or not. 10
- c) What is dependency preserving decomposition? Mention its significance. 5
- 5) Consider the following tables: EMP(ECODE, ENAME, GRADE, BASIC), PROJECT(PCODE, PNAME, LEADER\_ID) and WORKS\_IN(ECODE, PCODE, HOURS\_WORKED). Consider WORKS\_IN keeps the record of which employee has so far worked for how many hours in which project. LEADER\_ID is ECODE of the employee acting as the project leader. Write down the SQL statements for the following:
- a) Delete the records of those employees from EMP who have so far worked for none of the projects. 3
- b) For each project show the project name and number of Grade 'A' employees working in the project. The list will have only projects in which number of such employees is more than 10 and list will appear in the descending order of such count. 5

- c) Find out the name of the employees who are leading the projects in which employees have already devoted 60 hours or more. 5
- d) Create a table LEADER (schema same as EMP) by taking the tuples from EMP corresponding to the project leaders. 4
- e) Increase the basic of the employees working in the project named as 'ABC' by 20%. 3
- 6) a) 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)
- i) 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 insufficient. 6
- ii) 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) for all items appearing in the order. 6
- b) Compare -- i) ordered and unordered file, ii) files with fixed length and variable length record. 4
- c) Provide the outline of multilevel indexing. Mention its advantage and disadvantages. 4
- 7) a) Define ACID properties of a transaction. 3
- b) Discuss incorrect summary problem with suitable example. Explain whether it can happen or not if two phase locking protocol is followed. 6
- c) Explain whether or not deadlock can occur in timestamp based protocol for concurrency control. 4
- d) 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? 7
- 8) Write short notes on the following:
- a) Hash join strategy
- b) States of a transaction and transition
- c) Security features of DBMS
- d) Functional units of DBMS 6+4+4+6