Ref. No. Ex/CSE/T/312/2016

BCSE 3rd Year 1st Semester Examination, 2016

Database Management Systems

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

Attempt any five questions

1) a) Consider the system described as follows.
An organization runs number of projects whose information are to be stored. Each project is identified by unique project-id. Faculty members are there in the organization. Each faculty member has unique faculty-id. One faculty member can act as the coordinator of one or more projects. In a project apart from a coordinator, any number of other faculty members may be associated. A faculty member may also work for multiple projects. Students may get involved in the projects. Number of students may work in a project. But a student works for only one project. Based on the project output, articles are published of which at least one of the associated faculty members (may or may not be the coordinator) will be one of the authors of the article. Some or all or none of students working in the project may be part of the author list. Each article for a given project has a unique serial number and an article is related to one project only. The system must be able to identify who is working in which projects, what are the articles published in relation to a project, who is coordinating which project, who are the authors for an article.

Draw the ER/EER diagram showing the structural constraints. 10

b) 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 is stored.

Draw The ER/EER diagram and also design the necessary tables optimally with justification. 10

2) a) In the context of ER model, explain relation type and value set of a mandatory and single valued attribute. 2+3

b) In an institute, number of teachers is there. A teacher is specialized in number of subjects. For a subject there exist multiple specialized teachers. In a curriculum number of subjects is taught. Same subject may be taught in multiple curriculums.

In a curriculum same teacher may teach multiple subjects. Represent the scenario in an ER diagram using only binary relations so that who teaches which subject in which curriculum can be identified. 5

c) In the context of relational model define relation. Comment on the ordering of tuples in a relation and ordering of attributes in a tuple. 3+4

d) Provide one example for each type of constraint in relational model. 3

3) a) In relational algebra, express division operation in terms of projection, Cartesian product and minus operation. 4

b) R and S are two relations. When can we perform R – S? 2

c) Consider the relations: DEPT(DCODE, DNAME) and EMP(ECODE, ENAME, BASIC, DCODE). DCODE of EMP refers to DCODE of DEPT. Answer the following:

i) Write down the relational algebra and relational calculus expression to find out the name of the employees with basic more than 20000 and working in the department named as XYZ. 3+3

ii) Write down the relational algebra expression to find out the name of the departments in which nobody works. 4

iii) Write down the relational calculus expression to find the name of the employees with highest basic in his/her department. 4

4) a) Consider a relation R(A, B, C, D, E, F) and the functional dependencies on R are as follows.

C→F, E→A, EC→D, AF→B

Find the candidate key. 3

b) Consider two FD sets F and G on a relation as follows.

F={A→C, AC→D, E→AD, E→H} G={A→CD, E→AH}

Explain whether F and G are equivalent or not. 5

c) Information regarding the books is to be stored. It may be authored by multiple authors. For every book following information is to be stored:

BOOK _TITLE, BOOK _TYPE, PRICE, PUBLISHER _NAME, PUBLISHER_ADDRESS and AUTHOR _NAME AUTHOR _AFFILIATION of every author of the book.

Consider the following FDs:

BOOK _TITLE→ BOOK _TYPE, PUBLISHER _NAME

PUBLISHER _NAME→ PUBLISHER_ADDRESS

BOOK _TYPE→PRICE

AUTHOR _NAME→ AUTHOR _AFFILIATION

Normalize the schema up to 3NF. Indicate the primary key and foreign key at each step. 8

d) Under what circumstances issue of MVD may arise? How will you resolve the problem? 4

5) 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 2015. 3

b) Find the name of the vendors whose total delivery value is more than 50000. 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

6) a) Considering the tables described in question 5, write a PL/SQL blocks to show the name of the items which have been delivered to all the departments. 6

b) Consider the tables:

ACCOUNT(AC_NO, BALANCE) WITHDRAW(TRANS_ID, AC_NO, AMOUNT)

In WITHDRAW table AC_NO is foreign key. ACCOUNT keeps information of all the accounts. WITHDRAW keeps the information of all the transactions which are allowed to withdraw money from account. AC_NO in WITHDRAW is foreign key. A transaction is allowed to withdraw money from an account provided the balance does not fall below 1000. Write a trigger to implement it. 6

c) How does secondary index can help in join operation? 4

d) Two files are to be joined. One is very large and one is very small. Provide the outline of an optimal join strategy without making further assumption. Also specify number of block accesses required. 4

7) a) What is write ahead logging? 3

b) Why steal/no force approach is preferred in transaction processing? 4

c) A data item is to be read from disk. What steps are to be followed? 3

d) Consider a concurrent environment and log based recovery with checkpoint is adopted. Assume immediate database modification. What actions are taken during checkpoint operation? Also describe how does the effect of rolled back transactions are removed at the time of recovery. 3+7

8) a) Why is concurrency control needed? 6

b) Two phase locking protocol is not free from deadlock – illustrate. 4

c) Consider the two schedules as follows.

i) $r_1(x); r_3(x); w_1(x); r_2(x); w_3(x)$

ii) $r_3(x); r_2(x); w_3(x); r_1(x); w_1(x)$

$r_i(x)$ and $w_i(x)$ stand for read and write operation on data item x by i-th transaction. In the schedules, operations are in chronological order from left to right. Check whether the schedules are conflict serializable or not. If yes then find out the equivalent serial schedule. 7

d) How the time stamp based protocol for concurrency control can be modified to ensure recoverability? 3