THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE
B.Sc. DEGREE PROGRAMME : LEVEL 04
CPU2241- DATABASE MANAGEMENT SYSTEMS
FINAL EXAMINATION – 2014/2015

DURATION:Three Hours (3 Hours)

Date: 24.05.2015 **Time: 9.30 a.m. – 12.30 p.m.**

Answer FOUR (4) Questions ONLY.

QUESTION 01

1) DBMS is a general purpose software system that facilitates three processes. What are the three processes and give a brief description about each process?

2) State whether the following statements are **True** or **False**. If **False** state why.

   a) Database design is the design of the DBMS software.

   b) We call the database and the DBMS together as a database system.

   c) Data inconsistency means that the same data are stored in many different locations.

   d) Procedures are the instructions and rules that govern the design and use of the database system.

   e) The DBMS is able to eliminate structural and data independency.

3) What are the DBMS components and give a brief description about each component?

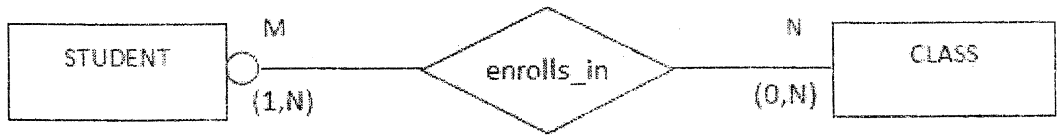
4) Database models can be grouped in to two categories. Mention these two categories and give two examples for each category.

5) What is meant by data definition language (DDL)?

6) State three advantages and disadvantages of relational data model.

7) What are the three types of relationships that can be found in the entity relationship model? Show the ER notation with one suitable example for each.

8) Convert the below entity relationship diagram with a (M:N) relationship into an entity relationship diagram with a composite entity and two (1:M) relationships.



QUESTION 02

1) A DBMS can be classified according to the database site locations. State the two types of DBMSs under the database site locations and briefly describe each DBMS type.

2) Fill in the blanks with appropriate terms.

   a) ..... database model is an example for a conceptual database model.

   b) ..... is used to reveal the meaning of data.

   c) Data ..... is the lack of data integrity.

   d) A DBMS that powers a database primarily designed to support immediate response transactions is classified as a ..... DBMS.

   e) Qualified to be selected, but not selected as the primary key are known as ..... keys.

   f) ..... expresses the specific number of entity occurrences associated with one occurrence of the related entity.

   g) The column`s range of permissible values are known as its .....

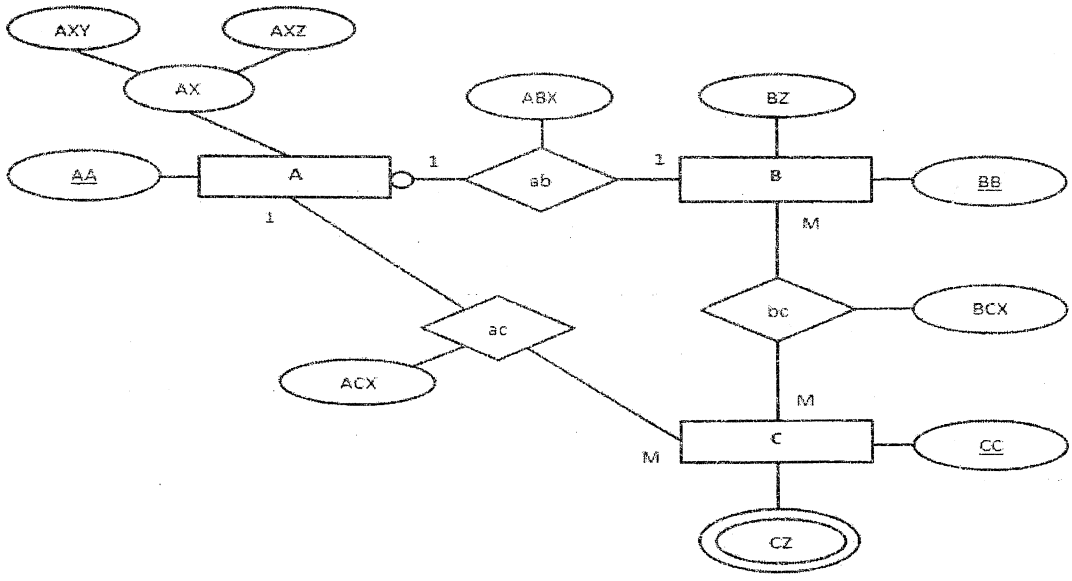
   h) A ..... key is defined as a key that is used strictly for data retrieval process.

   i) ..... DBMS supports multiple users at the same time.

   j) A ..... is a collection of logical constructs used to represent the data structure and the data relationships found within the database.

3) State the two conditions satisfied by a weak entity in an Entity Relationship diagram and briefly explain each condition.

4) Consider the following ER diagram.



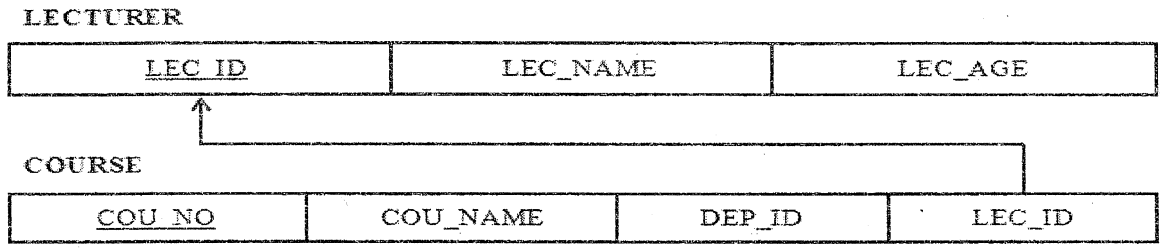
Draw the appropriate relational schema for the given ER diagram.

5) The following shows a part of the relational schema drawn for 'ABC_UNIVERSITY' database. Create this database and implement the tables on it.

Primary keys should not allow NULL values. Foreign keys should change accordingly on deletions and updates.

LEC_ID, LEC_AGE, COU_NO, DEP_ID: INTEGER

LEC_NAME, COU_NAME: VARCHAR (20)



QUESTION 03

Consider the following tables.

A

MODEL	CAPACITY
1	50
2	30
3	70

B

COLOR	WEIGHT
BLACK	30
WHITE	20

C

ITEM	BRAND
LED TV	LG
BR PLAYER	SAMSUNG
HOME THEATRE	SONY
LED TV	SAMSUNG
DVD PLAYER	LG

D

ITEM
LED TV
DVD PLAYER

E

LECT_NAME	COURSE_ID
Anil	10
Malith	20
Sunil	15
Ajith	25
Nalin	30

F

LECT_NAME	COURSE_ID
Malith	20
Ajith	25
Sahan	05
Nalin	30

1) What are the output tables you get, when you apply the following relational database operators to the above tables (A, B, C, D, E and F are table names).

   a) **A** PRODUCT **B**

   b) **C** DIVIDE **D**

   c) **E** DIFFERENCE **F**

   d) **E** INTERSECT **F**

2) Write suitable SQL queries to do the following tasks.

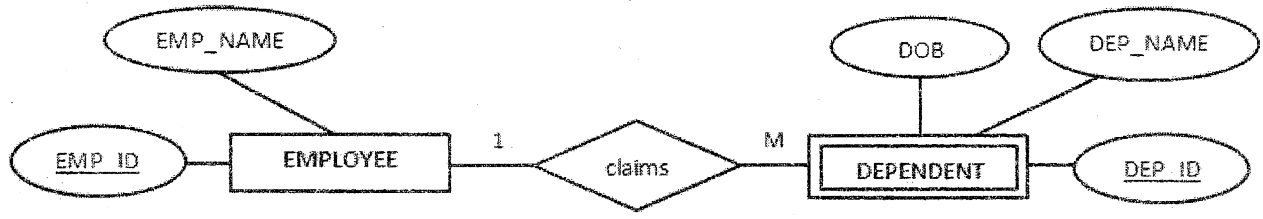
   a) Select the models which have the capacity greater than 50 from table **A**.

   b) Select the items from table **C** which has the brand name starting from character 'S'.

   c) Select the lecturer names from table **E** which contains the letter 'i' as the third character.

   d) Sort the lecturer names of table **F** in the descending order by lecturer name.

3) Draw the appropriate relational schema for the following ER diagram.



4)

Consider an online purchase database system in which buyers and sellers participate in the sale of items.

The online site has buyers and sellers. Each buyer has an ID to identify them. Apart from that they keep the name, email address and a shipping address.

Each seller has an ID to identify them. Apart from that they keep the name, email address and a phone number. A seller may have several phone numbers.

Items are advertised by a seller for sale. Each item has an ID to identify them. Apart from that it keeps the name and a description of the item.

Each seller must advertise at least one item and each item must be advertised by at least one seller.

Each buyer may order many items and each item may be ordered by many buyers. Once a buyer orders an item, the ordered date should be stored appropriately.

Each buyer must place at least one feedback and each seller must receive feedback by at least one buyer.

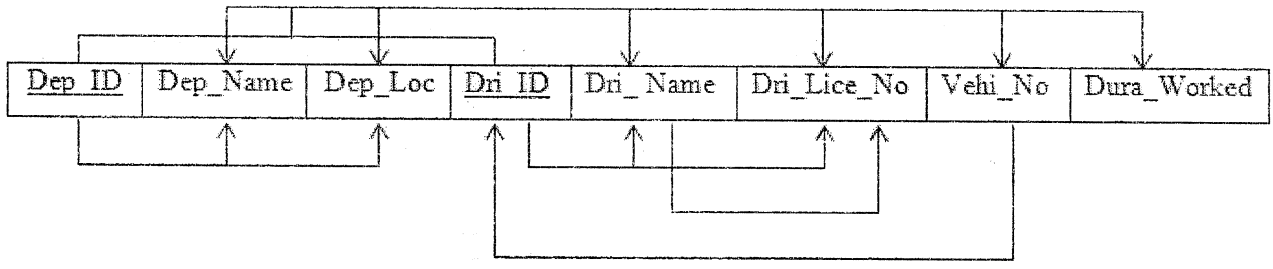
Draw the complete ER diagram (use Chen notation).

- Show the proper connectivity of the relationships.
- Show the cardinalities of each entity with each relationship.
- Represent the relationship's participation as optional or mandatory.

QUESTION 04

1) State two disadvantages of Normalization.

2) Consider the following diagram.



a) What is the Normal form that this table is currently in?

b) What is "Partial Dependency"? If there are any partial dependencies in the above diagram, identify and mark them.

c) What is "Transitive Dependency"? If there are any transitive dependencies in the above diagram, identify and mark them.

d) Normalize this table conform to both Third Normal Form (3NF) and the Boyce-Codd Normal Form (BCNF).

Clearly show the steps (1NF, 2NF, 3NF and BCNF) you follow and mark the primary keys of each decomposed table.

3) By looking at the two tables (TEACHER and SECTION) in the 'SCHOOL' database, write the outputs of the following SQL queries.

TEACHER

TEA_ID	TEA_NAME	TEA_AGE	TEA_SAL	SEC_NO
110	Ranjan Perera	32	50000	3
112	Saman Pieris	26	45000	1
118	Ramani Soyza	40	60000	3
124	Himali Perera	24	43000	2
138	Hashan Liyanage	38	55000	1
140	Saduni Perera	28	48000	2

SECTION

SEC_NO	SEC_NAME	SEC_HEAD_ID	NO_OF_STAFF
1	Primary	124	15
2	Middle	140	12
3	Upper middle	110	18
4	Upper	124	22

a) SELECT **TEA_ID** FROM **TEACHER** WHERE **TEA_NAME** LIKE '_a%';

b) SELECT MAX(**TEA_SAL**) FROM **TEACHER** WHERE EXISTS(SELECT * FROM **SECTION** WHERE **NO_OF_STAFF** > 20);

c) SELECT **TEA_ID** FROM **TEACHER** WHERE **TEA_AGE** > ANY (SELECT **TEA_AGE** FROM **TEACHER** WHERE **TEA_SAL** > 45000);

d) SELECT **SEC_NO**, COUNT(*) FROM **TEACHER** GROUP BY **SEC_NO**;

e) SELECT **TEA_NAME**, REPLACE(**TEA_NAME**, 'a', 'i') FROM **TEACHER**;

f) SELECT **SEC_NAME**, INSTR(**SEC_NAME**, 'i') FROM **SECTION** WHERE **NO_OF_STAFF** < 20;

g) SELECT SUBSTRING(**TEA_NAME**, 1, 4) FROM **TEACHER**;

h) SELECT **TEA_NAME**, LENGTH(**TEA_NAME**) FROM **TEACHER**;

4) What is meant by a group function, give two examples for it?

QUESTION 05

1) According to the classification of "The expected type and extent of use", what are the two types of database management systems? Briefly explain each of them.

2) Assume we have the following application that models football teams, the matches they play and the players in each team. In the design, we want to capture the following.

   We have a set of teams, each team has an ID (unique identifier), name and to which city this team belongs.

   Each team has many players and each player belongs to one team. Each player has an ID (unique identifier), name and phone number. A player may hold several phone numbers.

   Teams play matches, in each match there are two teams and each team can play only one match at a given time.

   Each match has a number (unique identifier) and the score of the match. Once a team plays a match, the played date should be stored appropriately.

   Each match has three referees and each referee can participate for only one match at a given time.

a) Draw the complete ER diagram (use Chen notation) and show the proper connectivity of the relationships.

b) Draw the appropriate relational schema for the ER diagram.

3) Read the following description.

ABC University students registered for many courses under the computer science degree program. The table below lists the grades of the ABC University students for their registered courses.

The Course_ID and the Student_ID together uniquely identify the grades of the students for their subjects.

Course_ID	Student_ID	Course_Name	NIC	Student_Name	Grade
CPU2241	112233	DBMS	861114527V	K.T Perera	B
CPU1142	212250	Data Structures	871209302V	S.K Liyanage	C
CPU2241	253190	DBMS	891115411V	P.D Ranasinghe	A
CPU1142	112233	Data Structures	861114527V	K.T Perera	B

The attributes have the following functional dependencies.

- Course_ID, Student_ID → Course_Name, NIC, Student_Name, Grade
- Course_ID → Course_Name
- Student_ID → NIC, Student_Name
- NIC → Student_Name

a) What is the Normal Form that this table is currently in?

b) If there are any partial dependencies and transitive dependencies, identify and show them.

c) Normalize this table conform to Third Normal Form (3NF).

Clearly show the steps (1NF, 2NF and 3NF) you follow and mark the primary keys of each decomposed table.

d) What is the main requirement of a table to be in Boyce-Codd Normal Form (BCNF)?

e) Are the tables you acquire in part(c) also in BCNF?

QUESTION 06

1) What are the main roles of SQL (Structural Query Language)?

2) What is meant by the sentence 'SQL is a non-procedural language'?

3) Consider a database that is used to represent a large business. In this business, there is a division that operates several departments. The division is run by one employee and each department is managed by one employee.

The department employs many employees who work on projects that are assigned to them. Projects are assigned only for the employees who are assigned to a department. An employee is assigned to many projects and a project must have many employees assigned to it.

There are employees that are not assigned to any department.

Draw the complete ER diagram (use Chen notation)

- Show the proper connectivity of the relationships.
- Show the cardinalities of each entity with each relationship.
- Represent the relationship`s participation as optional or mandatory.

4) Consider the following tables 'Employee' and 'Department' in the company database.

Emp_ID	Emp_Name	Emp_Sal	Dep_ID
21	Sunil	36000	2
26	Nimal	28000	3
32	Kamal	26000	3
37	Namal	40000	1

Dep_ID	Department
1	Accounts
2	Sales
3	IT

a) Write INSERT statement to insert the following record to the 'Employee' table.

Emp_ID: 28

Emp_Name: Anil

Emp_Sal: 32000

Dep_ID: 2

b) Use NATURAL JOIN operator to join the two tables using Dep_ID.

c) Draw the resulting table you get after joining the tables.

d) Write SQL statement to show all the employee details, whose salary is not between 22000 and 30000.

e) Write SQL statement to show the average salary, minimum salary and maximum salary of employee.