

THE OPEN UNIVERSITY OF SRI LANKA  
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE  
B.Sc. DEGREE PROGRAMME : LEVEL 04  
FINAL EXAMINATION - 2013 / 2014  
CPU 2241: DATABASE MANAGEMENT SYSTEMS



DURATION: THREE HOURS (3 Hours)

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Date: 02 - 07 - 2014

Time: 01.00 p.m - 04.00 p.m

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Answer FOUR (4) Questions ONLY.

QUESTION 01

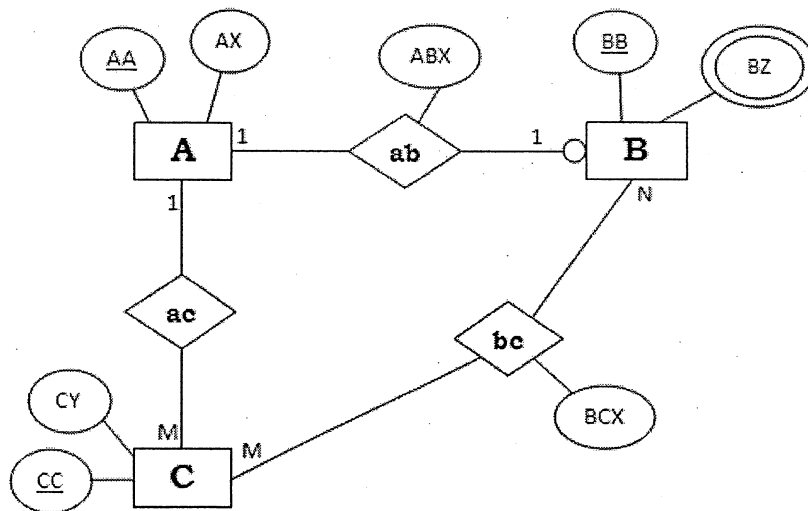
1. What is Data Management and why an organization needs proper data management?
2. State whether these statements are **True** or **False**. If **False** state why?
  - (a) File systems have structural independence.
  - (b) File systems have data dependence.
  - (c) Data redundancy can lead to data anomalies.
  - (d) Meta data are the data we store in the database which generate information in order to get decisions.
  - (e) We can easily change the design of the DBMS software.
3. State 3 advantages and disadvantages of Database Management Systems.
4. What is meant by a database model?
5. What is the **key** difference between the conceptual data model and the logical (implementation) data model?
6. What are the two types of participation of a Relationship that can be found in the Entity Relationship Model? Give the definition and then show the ER notation with one suitable example for each.
7. "A Doctor may treat patients. Maximum number of patients treated by a doctor is 6. A patient must be treated by one and only one doctor."  
Using the chen notation draw the Entity Relationship Diagram for this description. Show the connectivity, cardinality and participation of the relationship properly.
8. Why Object Oriented Data Model (OODM) is suitable for modern data requirements? Give two reasons.

QUESTION 02

1. Write a function performed by a DBMS and generally describe how a DBMS performs that function.
2. Fill in the blanks with suitable words.
  - (a) Hierarchical data model has \_\_\_\_ independence.
  - (b) \_\_\_\_ relationships are very difficult to model in Hierarchical data model.
  - (c) When designing a hierarchical database, frequently access data should be located \_\_\_\_ side of the tree.
  - (d) In relational database model, tables are also known as \_\_\_\_ .
  - (e) A \_\_\_\_ allows us to uniquely identify a record in a table in relational model.
  - (f) Table in the relational model is equivalent to an \_\_\_\_ in Entity relationship model.
  - (g) A primary key should not allow \_\_\_\_ values.
  - (h) If an attribute can have more than one value at a time, it is a \_\_\_\_ attribute.
  - (i) When we connect 2 or 3 attributes together to create a primary key, it is known as a \_\_\_\_ key.
  - (j) If an attribute can further divide into sub attributes, then it is a \_\_\_\_ attribute.
3. To apply **INTERSECT** relational database operator, there should be two tables as its operands and those two tables should be "**Union Compatible**".

What is meant by **Union Compatibility of Two tables**?

4. Look at the following ER Diagram.

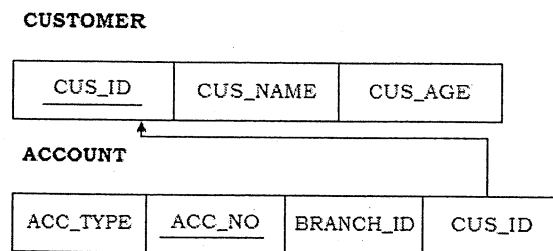


Draw the appropriate Relational Schema for the given ERD.

5. Following shows a part of the relational schema drawn for "XYZ.BANK" 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.

CUS\_ID, CUS\_AGE, ACC\_NO, BRANCH\_ID: INTEGER  
CUS\_NAME, ACC\_TYPE: VARCHAR(10)



### QUESTION 03

A		B		C		D	
FNAME	AGE	FNAME	AGE	PCODE	PRICE	LOCATION	DISTANCE
Kamal	15	Kasun	25	1	40	Colombo	19
Kasun	25	Saman	30	2	55	Horana	21
Lilan	20	Dasun	18				
Sarath	22	Samadhi	28				
Dasun	18						

E		F	
BOOK	BOOKSHOP	BOOK	
Ambayahaluwo	Sarasavi	Hathpana	
Gamperaliya	Godage	Gamperaliya	
Hathpana	Wijithayapa		
Hathpana	Godage		
Kaliyugaya	Sarasavi		

- What are the output tables you get, when you apply the following Relational Database Operators to the above tables. (A, B, C, D, E, F are table names)
  - A DIFFERENCE B
  - A INTERSECT B
  - C PRODUCT D
  - E DIVIDE F
- Write suitable SQL queries to do the following tasks.
  - Select all the first names from table A.
  - Select the first names whose age is greater than 26 from table B.
  - Select all the records whose distance is greater than 20 from table D.

- (d) Select the records from table **E** whose second letter of the name of the bookshop is 'a'.
- (e) Order the records in table **B** to the descending order of the first names.
3. State 3 different situations that can be represented using a NULL value in the relational model.
4. Read the following scenario carefully.

A studio allows artists to create their own song albums.

Each artist has an ID to identify them. Apart from that, they keep the name and the contact number of an artist. An artist may have several contact numbers.

An artist **may** play only one instrument and each instrument **may be** played by several artists. An instrument has its own ID to identify each, a name and a purchased date.

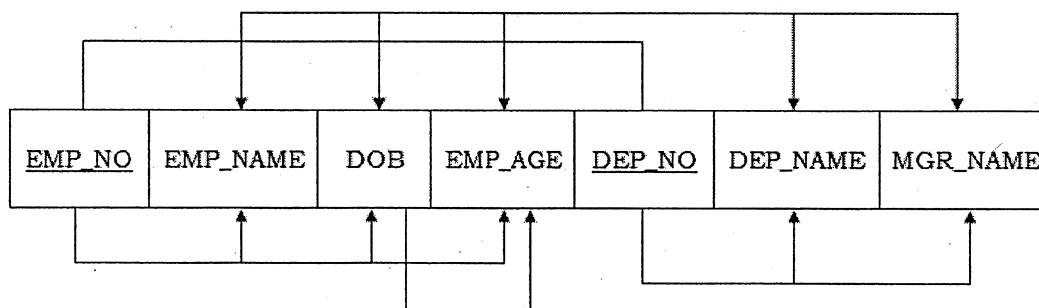
An artist **must** perform in **at least one** song and a song is performed by **at least one** artist. A song has an ID for its identification, a name and recorded date.

An instrument **may** supply music to many songs and a song **may** need music from many instruments. There can be songs recored with no instruments.

- (a) To draw the ER Diagram, identify Entities and their Attributes.  
Draw each entity with its attributes using the ER notation (Use Chen notation). When drawing, use standard naming conventions you learned.
- (b) Draw the complete ER Diagram with proper relationships.
- You don't need to show all the attributes of an Entity (Because you showed them in the previous question). Show only the primary key of each Entity.
  - Show the proper connectivities of the relationships.
  - Show the cardinalities of each entity with each relationship.
  - Represent the relationship's participation as Optional or Mandatory.
  - Use standard Chen notation to draw the ER Diagram.

#### QUESTION 04

1. State 2 advantages of Normalization.
2. Look at the following dependency diagram.



- (a) What is a Partial Dependency? Identify Partial Dependencies in the diagram and mark them.
- (b) What is a Transitive Dependency? Identify Transitive Dependencies in the diagram and mark them.
- (c) What is the Normal form that this table is currently in?
- (d) Clearly show the steps you follow to normalize this table into the third normal form (3NF). Mark the primary keys of each decomposed table.
3. By looking at the two tables (employee, department) in the 'company' database, write the outputs of the following SQL queries.

EMP_ID	EMP_NAME	EMP_AGE	EMP_SAL	DEP_NO
1111	Amal Silva	26	55000	2
1122	Samon Perera	30	35000	4
1133	Rasuni Barath	32	30000	1
1177	Danuka Senarath	NULL	52000	3
2234	Samadi Perera	40	60000	1
2244	Ramal Dias	NULL	60000	2
3322	Dacun Jayalath	28	42000	1
3444	Jayani Lanka	32	NULL	4

D_NO	D_NAME	D_LOCATION	MGR_ID	MGR_SRT_DATE
1	HR	Colombo	1122	2010-01-22
2	Finance	Moratuwa	1177	2010-10-25
3	IT	Nawala	2244	2005-05-10
4	Accounts	Horana	3322	2009-05-05

- (a) select EMP\_NAME from employee where NOT EXISTS (select \* from department where MGR\_ID=1111);
- (b) select EMP\_NAME from employee where EXISTS (select \* from department where MGR\_ID=1111);
- (c) select EMP\_AGE from employee where EMP\_AGE > ALL (select EMP\_AGE from employee where EMP\_SAL < 45000);
- (d) select count(EMP\_AGE) from employee;
- (e) select DEP\_NO, MIN(EMP\_SAL) from employee GROUP BY DEP\_NO;
- (f) select DEP\_NO, MAX(EMP\_SAL) from employee GROUP BY DEP\_NO having max(EMP\_SAL > 45000);
- (g) select EMP\_ID from employee where EMP\_AGE IN ('28', '30', '32', '34');
4. State two disadvantages of Entity Relationship data model.

### QUESTION 05

1. What is a Database?
2. What is meant by a 'Foreign Key'? Explain your answer using a suitable example.
3. Read the following description about Samadhi's DVD Collection database.

Samadhi has a large DVD movie collection.

Her friends like to borrow her DVD's, and she needs a way to keep track of who has what. She maintains a list of friends, identified by unique FID's (friend identifiers) and a list of DVD's, identified by DVDID's (DVD identifiers). Apart from the FID, she keeps friend's name and the all-important telephone numbers which she can call to get the DVD back.

With each DVD is the star actor name and title. Whenever a friend borrows a DVD, Samadhi will enter that fact into her database along with the date borrowed. Whenever the DVD gets returned, that fact, too, gets noted along with the date returned.

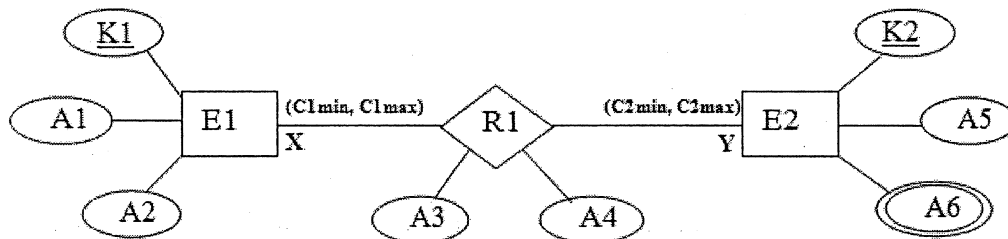
She does not keep information about the friends who does not borrow DVDs. But she has DVDs which has not yet borrowed by any of her friends.

Samadhi wants to keep a complete history of her friends' borrowing habits so that she can ask favors of the heavy borrowers (or perhaps refuse to make further loans to those who habitually don't return them quickly).

(a) Below is an E-R diagram for a database to help Samadhi.

Identify primary keys **K1** and **K2**.

Provide appropriate names for entities **E1**, **E2**; attributes **A1**, **A2**, ..., **A5**; multi-valued attribute **A6**, relationship **R1**, connectivity **X**, **Y** and cardinality constraint **C1min**, **C1max**, **C2min** and **C2max**.



- i. Entity E1 :\_\_\_\_\_
- ii. Key K1 :\_\_\_\_\_
- iii. Attribute A1 :\_\_\_\_\_
- iv. Attribute A2 :\_\_\_\_\_
- v. Entity E2 :\_\_\_\_\_
- vi. Key K2 :\_\_\_\_\_
- vii. Attribute A5 :\_\_\_\_\_
- viii. Multi-value Attribute A6 :\_\_\_\_\_
- ix. Relationship R1:\_\_\_\_\_
- x. Attribute A3 :\_\_\_\_\_
- xi. Attribute A4 :\_\_\_\_\_
- xii. Connectivity X:\_\_\_\_\_
- xiii. Connectivity Y:\_\_\_\_\_
- xiv. Cardinality C1min:\_\_\_\_\_ C1max :\_\_\_\_\_
- xv. Cardinality C2min:\_\_\_\_\_ C2max :\_\_\_\_\_

(b) Draw the appropriate Relational Schema for the ERD.

4. Read the following description

ABC consultancy firm supplies temporary specialized staff to bigger companies in the country to work on their project for a certain amount of time.

The table below lists the time spent by each of the ABC Company's employees at other companies to carry out projects.

The National Identity Card Number (NIC) and the Contract No together uniquely identifies a member of staff.

NIC	Contract No	Hours	Employee Name	Company ID	Company Location
616681B	C1025	72	S. Dimal	SC115	Horana
674315A	C1025	48	R. Vidura	SC115	Colombo
323113B	C1026	24	K. Sumith	SC23	Galle
616681B	C1026	29	M. Roshana	SC23	Colombo

The attributes have the following functional dependencies.

- NIC, Contract No → Employee Name, Hours, Company ID, Company Location
- NIC → Employee Name
- Contract No → Company ID, Company Location
- Company ID → Company Location

- (a) In which normal form this table currently is?
- (b) Normalize the table to 2NF.
- (c) Find the transitive dependencies on the 2NF tables and mark them.
- (d) Normalize the tables to 3NF.
- (e) What is the main requirement of a table to be in Boyce-codd normal form (BCNF)?
- (f) Are the tables you acquire in part (d) also in BCNF?

### QUESTION 06

1. What is SQL stands for (The meaning of 3 letters)?
2. What are the two sub languages in SQL?
3. Write names of two DBMS s' that use SQL as their database language.
4. Write two aggregate functions in SQL and briefly explain what they do.
5. Consider the following two tables 'student' and 'course' in the 'SCHOOL' database.

std_id	std_name	std_age	course_id	crs_id	crs_name
11	Chamal	20	3	1	Science
12	Sadun	25	2	2	Maths
21	Kavidu	19	3	3	History
25	Sasidu	22	1		

- (a) Write **INSERT** statements to insert the following record to the 'course' table.  
course id: 4  
course name: Sinhala
  - (b) Use **INNER JOIN** operator to join the two tables using course id.
  - (c) Draw the resulting table you get after joining the tables.
  - (d) Write SQL statement to change the course id to 4, whose student id is 25 in the 'student' table.
  - (e) Write SQL statements to count the students course wise (course\_id) and display.
6. **Entity Relationship data model complemented the Relational data model.**  
Discuss on this.

7. Write equivalent components in the Relational Model for the following components in the Entity Relationship Model.
- (a) Entity Set / Entity
  - (b) Entity Occurrence
  - (c) Attribute
8. Read the following description about AIRLINE systems in a certain country and clearly showing the connectivities between entities, draw the **complete ER diagram** for the process. (Use Chen notation)

A country has several airlines and they need to keep records on the processes in them. Each airline has an ID (AIRID) to identify them, an interesting name and a location.

An airline owns many airplanes. each plane has an ID (PID), type, amount of weight it can take and manufactured date.

Each airline employees many Pilots to fly their planes. They have an ID (PILOTID) to identify them. Also they keep pilot name, age, flying hours, gender and their citizenship. A pilot may own citizenships in many countries.

When a Pilot flies a plane, the company needs to track the date and the time the plane departed.

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