

The Open University of Sri Lanka  
B.Sc. Degree Programme: LEVEL 04  
Department of Mathematics and Computer Science  
Final Examination 2011/2012  
**CPU2241 – DATABASE MANAGEMENT SYSTEMS**  
**DURATION: Three Hours (3 hours)**



**Date: 17/01/2012**

**Time: 1.00pm – 4.00 pm**

Answer **FOUR** Questions **Only**

**QUESTION 1**

- 1.1) Describe the properties of data.
- 1.2) Explain why data redundancy must be controlled in a database.
- 1.3) Explain the disadvantages of file systems over database management systems.
- 1.4) Compare the conceptual database models with the implementation database models.
- 1.5) Briefly describe the terms *hardware*, *software*, *people* and *procedures* in the context of a database system environment.

**QUESTION 2**

- 2.1)
  - a) Define an *Entity* in an Entity-Relationship (ER) model?
  - b) Identify **two** (2) different entity types with suitable examples. Please note that you should use the correct symbols to illustrate the entity type.
- 2.2)
  - a) Draw an ER diagram for the following situation stating appropriate assumptions.

A telephone company offers various services to its customers namely telephony, internet and television services. A package is offered to a customer which may consist of a single or a combination of the above services. Customer information requires name, address, national identity card as mandatory information. Promotions are given to a package. A package has a defined group of tariffs (eg. connection fee, startup fee, refundable deposit, package change fee, service provision fee of per minute, per hour, per month or based on the volume). Customers are divided into two categories namely cooperate and home customers. Packages are divided into prepaid and postpaid categories. A customer can obtain a maximum of 5 packages hence will receive multiple bills with different account numbers.

- b) Produce the relations with appropriate attributes (you may introduce new attributes) matching the ER diagram you have drawn for 2.2 a) above.

**QUESTION 3**

- 3.1) Explain the **three (3)** types of relationships that can exist in a relational model with suitable examples.
- 3.2) *Maintaining Referential Integrity is important in a relational database management system.* Comment on the above statement using a suitable example. Focus on the update and the delete operations.

3.3)

Table1		
UserID	Applicant	NIC
samanp	Saman	792264547V
kasuns	Kasun	893263587V
janakap	Janaka	852441452V

Table2		
NIC	Payment	Deduction
792264547V	2000	500
893263587V	4000	1000
852441452V	4000	1000

Table3		
UserID	Address	Telephone
samanp	homagama	2526525
namalp	gampaha	2445856
sumanr	Colombo	2552544

Use the tables 1 to 3 in order to answer the parts a) to f).

- a) Identify suitable primary keys for the table 1 and the table 2 separately.  
 b) Identify foreign keys in the table1

Obtain the output of Part c) to part f) which are based on relational algebraic notations.

- c) "PROJECT table1.userid and table1.nic"  
 d) "table1.userid INTERSECT table3.userid"  
 e) "table1.userid DIFFERENCE table3.userid"  
 f) "JOIN table1 and table2"

**QUESTION 4**

- 4.1) List **four (4)** types of users in a database system and briefly describe their functions.
- 4.2) In the context of relational database modeling, what are the **three(3)** types of relationships with one, two and three participants? Also give an example for each type of relationship.
- 4.3) How do you convert M:N type relationship in E-R model to a relational database tables? Explain with a suitable example.

- 6.2) Consider the following tables. Primary keys are underlined.  
Based on the above information write SQL statements to create the table structures of vehiclepark, payment and customer tables including the creation of proper primary and foreign keys. (Do not write SQL to insert the data to tables)

Table name: *vehiclepark*

<u>parkid</u>	location	hourlyrate	extraminrate
A	gampaha	200	4
B	bambalapitiya	150	3
C	bambalapitiya	250	5

Table name: *payment*

<u>bookingid</u>	vehiclenu	Carparkid	timespent	Usedate
D2000	HX2345	A	235	2011-12-01
D2001	HN1124	B	160	2011-12-01
D2002	KC2252	B	300	2011-12-01
D2003	HX2345	C	145	2011-12-02

Table name: *customer*

<u>phoneno</u>	firstname	lastname	vehiclenu
077252555	dinal	Perera	HX2345
071545666	ridma	gamage	HN1124
075665686	sisil	Fernando	KC2252
078445625	janaka	Silva	LW2525

- 6.3) Based on the Table structure given in 6.2, write appropriate SQL statements to obtain results for the following. (you do not need to write the output)
- Write a SQL statement(s) to insert the first data row of each table.
  - Write a SQL statement to list the full name of the customer by combining the firstname and the lastname with a space in middle as a single field.
  - Write a SQL statement to show the phone numbers of the owners of the vehicles which are parked in the vehicle park B.
  - Write a SQL statement to subtract 20 minutes from each booking which belongs to ridma gamage from the payment table.
  - Write a SQL statement to calculate the total payment for all the bookings carried out by dinal perera. Note that the timespent is given in minutes. Extra-minutes are calculated by taking the remainder of timespent divided by 60.  
(formula: payment = no-of-hours x hourrate + extra-minutes x extraminrate)
  - Write a SQL statement to obtain total vehicle count per-day per-vehicle park. Query should return date, parkid, noofvehicles as the output fields.

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- 4.4) Stating the assumptions, draw an ER diagram to match the following requirement.

An Institution has a group of developers, software engineers, project managers, software architects and quality assurance staff. A project manager could be in charge of a maximum of 3 projects and may be on the standby pool as well. A software engineer, developer and quality assurance staff member is assigned for only one project at a time. A software architect may be assigned to maximum of 2 projects and assigned the task of verifying the software design of the project. A client may register for more than one project with the institution. Each client has to sign a maintenance agreement with the institution after delivery of the software. All software issue complaints made by the clients are handled after checking validity of the agreement. Several part time developers are in the standby pool for handling contingency situations. Software engineers are supervised by senior software engineers; a project manager is responsible for the team that comprises of all the mentioned persons above except the client. The institution purchases software and hardware from a group of registered vendors.

### QUESTION 5

- 5.1) State the rules used to convert a relation into 1NF, 2NF, 3NF. (NF-Normal Form).
- 5.2) Produce the 2NF and 3NF relations from the following table. Identify suitable Keys to the relations you obtain. State any assumptions you make.

Tablename : T1

toolid	toolname	userid	username	designation	jobclass	jobrate
A1	hammer	G100	nimal	carpenter	A	1000
A2	saw	G101	kamal	mason	B	500
A3	ladder	G102	saman	supporter	C	1250
A4	drill	G103	janaka	driller	D	750
A5	tape	G101	kamal	carpenter	B	500

- 5.3) Produce BCNF from the above dataset if possible. State reasons if you cannot obtain BCNF.
- 5.4) Write SQL statements to obtain the results of the following using the un-normalized table T1 given in 5.2) above.
- Obtain 3<sup>rd</sup> letter of the designation
  - List the usernames of people who are not belonging to the job class B and D
  - Change the jobrate of the job class C by getting the totals of the jobrate of the job classes A and B.

### QUESTION 6

- 6.1) a) Define DML in the context of SQL.
- b) Explain the difference between the IN operator and the BETWEEN operator in a SQL query?