The Open University of Sri Lanka
B.Sc. Degree Programme: Level 05

Final Examination - 2007

CSU3278: Database Management Systems: Paper I

Duration: 2½ Hours

Date: 08.06.2007   Time: 10.00am – 12.30pm

Answer **FOUR** questions **ONLY**

01)

(a) Differentiate between *conventional files* and *databases*.

(b) Differentiate between *entities* and *entity instances*.

(c) What are *attributes*? What are the different types of attributes?
Give example of each.

(d) Consider the following items that are likely to be in a library administration system. Categorize these items into *entities* (entity types), *attributes*, an *occurrence of an entity* (tuple) or none of these.

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Book, ISBN (International Standard Book Number),
Author, Author Name, Librarian, Programming in
Pascal, Introduction to Operating Systems,
Loan Date, Fine
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(e) Draw *Entity Relationship* (ER) *diagrams* showing the *cardinality* for the following descriptions.

(i) Students select subjects. Many students can take each subject and each student can take as many subjects.

(ii) An invoice is sent to one customer and there can be many invoices sent to the same customer.

02)

(a) What is a *relationship*? Why is it important to identify them?

(b) Differentiate between *cardinality* and *degree*.

(c) How would you implement a *recursive relationship* in a *relational database system*?

(d) Given below is a structure of an existing database used to record consumer loans by ABC Finance Co. In the current database, one can store a maximum of three loans per customer, including the recent loan availed. Now, the company wants to expand the historical capabilities, so that complete loan records are available for each consumer.

The attributes associated are:

NAME	Name of consumer
NICNUM	National identity card number
ADDRESS	Location where consumer resides
CITY	City where consumer resides
CCODE	Code of city
AMT1	Amount of most recent loan
DATE1	Date of most recent loan
RATE1	Payment rating for most recent loan
AMT2	Amount of second most recent loan
DATE2	Date of second most recent loan
RATE2	Payment rating for second most recent loan
AMT3	Amount of third most recent loan
DATE3	Date of third most recent loan
RATE3	Payment rating for third most recent loan

Construct the above relation and normalize to *third normal form* (3NF).

(03)
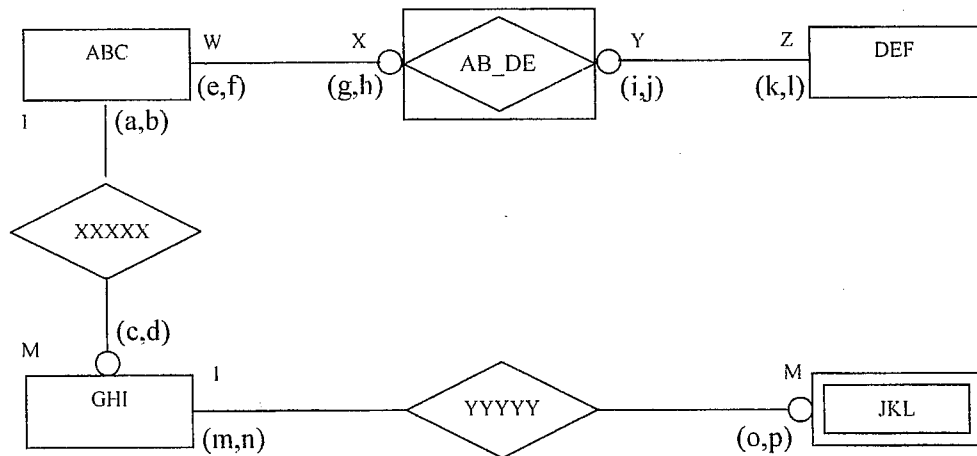
The following questions are based on the above ER diagram.

(a) Write the proper *connectivities* for W, X, Y and Z.

(b) Write the proper *cardinalities* for (a,b), (c.d), (e,f), (g,h), (i,j), (k,l), (m.n) and (o,p).

(c) What two *attributes* must be contained in the *composite entity*? Use proper terminology in your answer.

d) Describe precisely the composition of the *weak entity's primary key*. Use proper terminology in your answer.

e) In a real estate database, there is an entity called as PROPERTY, which is a property for sale by the agency. Each time a potential property buyer makes a purchase offer on a property, the agency records the date, offering price and name of the person making the offer.

  (i) Represent the PROPERTY entity and its purchase offer attributes using the notation for *multivalued attributes*.

  (ii) Represent the PROPERTY entity and its purchase offer attributes using *two entity types*.

  (iii) Finally, assume that the agency decides also to keep data about buyers and potential buyers including their name, phone number and address. Augment your answer to part (ii) above to accommodate this new entity type.

4)

The following *dependency diagram* is given:
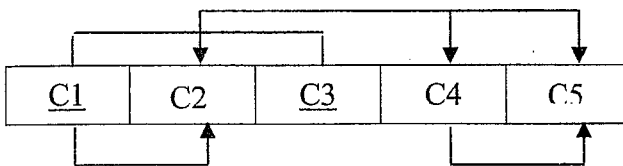
Identify and discuss each of the indicated *dependencies*.

(a) Use the dependency diagram given above to create a database whose tables are at least in 2NF, showing the dependency diagrams for each table.

(b) Use the dependency diagram given above to create a database whose tables are at least in 3NF, showing the dependency diagrams for each table.

(c) Consider the following two relations:

    EMPLOYEE (EMP_NO, EMP_NAME, EMP_SALARY)

  (i) Is the employee number (EMP_NO) *functionally dependent* on either EMP_NAME or EMP_SALARY or on both?

    TRANSACTION (TRAN_DATE, TRAN_TYPE, TRAN_NO, TRAN_AC, TRAN_AMOUNT)

  (ii) Is the transaction no (TRAN_NO) *functionally dependent* on transaction account (TRAN_AC)?

  (iii) In the above relation in part (ii), which combination of keys will identify a given transaction for an account?

(05)

A company employs several salesmen to sell their products. For a salesman, the employee number, date of appointment and area code (this identifies the area that the salesman is supposed to cover) are recorded. A salesman visits a number of cities and in each city he visits a number of shops. Purchases made by the shops must be recorded in order to assist in determining the commission for a salesman. For a purchase, the name of the shop, the date on which the item was purchased, the items purchased together with the corresponding quantities involved are recorded.

Sales are also made on a bulk basis by the company, by selling direct (i.e. without using a salesman) to wholesalers. Details recorded for these transactions are the same as that for normal sales except that a discount is offered for each unit of each item sold. This discount varies from wholesaler to wholesaler.

The company makes purchases from suppliers for raw materials for the production of items. In order to price the items, the company keeps track of the types of raw materials and their amounts required to produce each item.
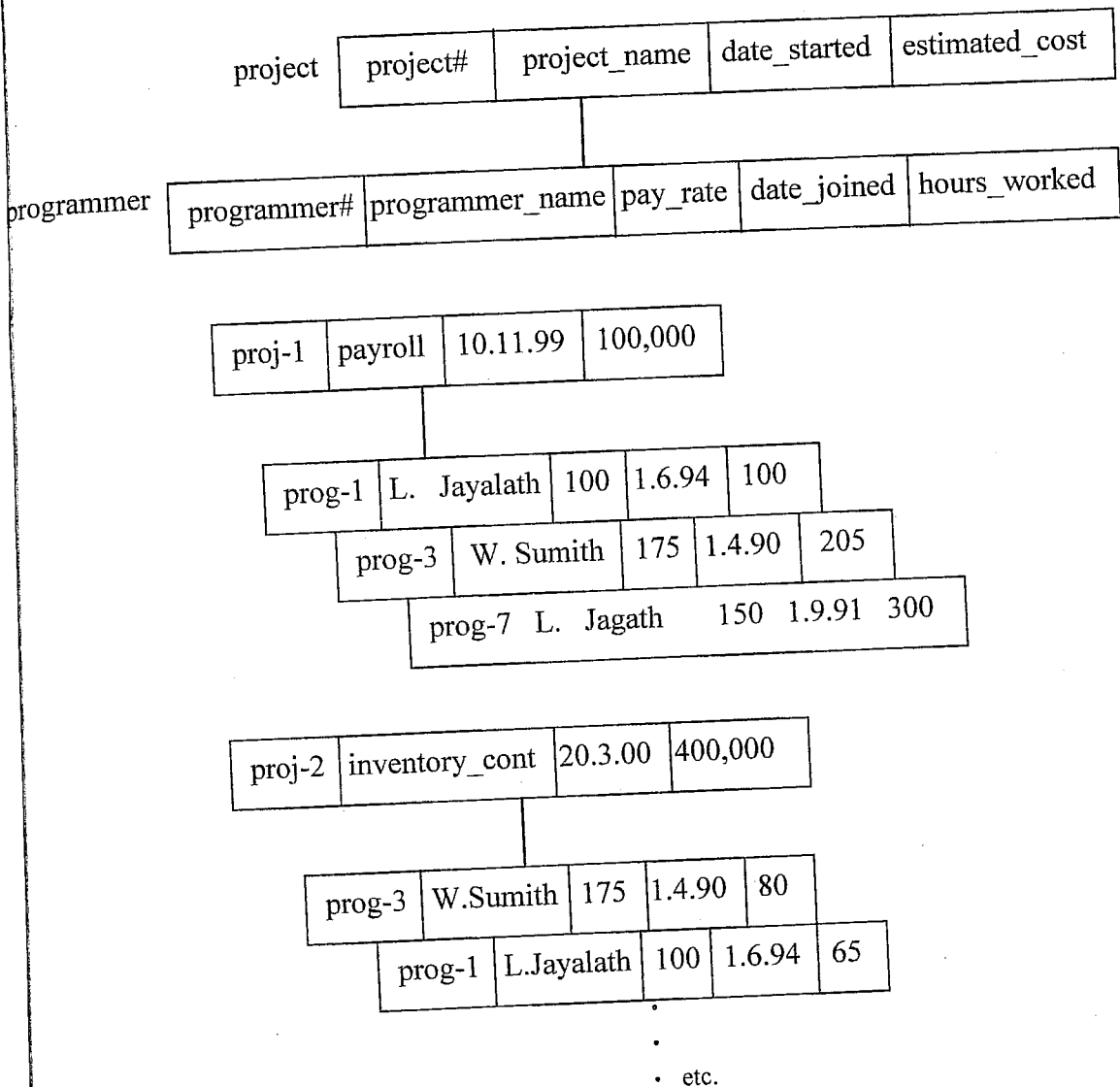
Suppose the company wants to build an information system to store these details.

(a) Derive a *conceptual model* for the information given above . State any assumptions used.

(b) Convert the *conceptual model* developed in part (a) to a *relational schema* that shows the relation name, attributes, primary key and foreign keys, if any.

(06)

(a) Compare and contrast the three popular *data models* with respect to their structure and implementation.

(b) Explain why navigation is simpler in the *Relational model* than in the *Hierarchical data model*.

(c) State the *two structures* that are used to construct a *Network database*. What can be considered as the main disadvantage of the *Network model*?

(d) A computer software company database keeps track of projects and programmers involved in projects. The database must hold data about the following:

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PROJECT: name of project, date started, estimated cost
PROGRAMMERS: name, pay rate, date of joining
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The tree Structure for the above problem may be as follows:

project	project#	project_name	date_started	estimated_cost

programmer	programmer#	programmer_name	pay_rate	date_joined	hours_worked

proj-1	payroll	10.11.99	100,000

prog-1	L. Jayalath	100	1.6.94	100

prog-3	W. Sumith	175	1.4.90	205

prog-7	L. Jagath	150	1.9.91	300

proj-2	inventory_cont	20.3.00	400,000

prog-3	W.Sumith	175	1.4.90	80

prog-1	L.Jayalath	100	1.6.94	65

- etc.

Consider the following queries:

Q1: List all projects on which L. Jayalath works
Q2: List all the programmers working on the payroll project

(i)   What problems would you detect when you answer the above two queries?

(ii)   What happens if the database is inverted?

Using the given sample data, discuss the *update*, *insertion* and *deletion* problems that exist in the above model.