THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

FINAL EXAMINATION 2005
BACHELOR OF TECHNOLOGY PROGRAM - COMPUTER ENGINEERING

ECX 5240   INFORMATION SYSTEMS

Date: 23rd March 2005	Time: 9.30 – 12.30

Answer **ONLY FIVE** *questions:*

Consider the following database for answering questions 1, 2 and 3. These tables contain information about electronic products made by several factories. Each product is identified by a unique model number (ModelNo). Spare parts required are each identified by a unique spare part number. (SparePartNo). The origin of the spare parts is given in Origin field as 'L' for local and 'I' for imported. Cost is the unit price of the each spare part and Quantity is the number of spare parts required for the relevant model.

Note: When answering questions please ***produce general answers, not just the ones that will*** ***work with the test data*** *given.*

SpareParts

SparePartNo	Cost	Origin
S1	3	L
S2	2	I
S3	1	L
S4	10	I
S5	25	I
S6	7	L
S7	5	L
S8	5	I
S9	5	L
S10	25	I

MODEL

ModelNo	Factory	Price
M1	BestFit	550.00
M2	Excel	500.00
M3	eLine	650.00
M4	Techpro	800.00

ASSEMBLE

ModelNo	SparePart	Qty
M1	S1	3
M1	S5	8
M1	S10	20
M1	S6	5
M2	S4	1
M2	S2	3
M2	S7	6
M3	S3	7
M3	S2	5
M3	S8	8
M4	S9	8
M4	S5	10
M4	S6	4

1. Write expressions in relational algebra for the following queries.

   a) (5 marks) All spare parts used in the factory 'Excel'.

   b) (5 marks) A list of spare parts used in Model 'M1'.

   c) (5 marks) A list of spare parts and their unit costs used at the factory 'Excel'.

   d) (5 marks) Models which use any imported spare parts in quantity of 5.

2 Write expressions in relational calculus for the following queries.

   a) (5 marks) Spare parts used in model M3, and unit cost more than 5.

   b) (5 marks) Spare parts which are not used for models M1 and M2.

   c) (5 marks) Quantities of imported spare parts used in any model.

   d) (5 marks) A list of spare part numbers and their prices used at the factory "eLine".

3   Write SQL queries to obtain following expressions.

   a) (5 marks) The maximum quantity of spare parts used in each model.

   b) (5 marks) The average cost of spare parts of local origin.

   c) (5 marks) The spare parts of local origin and used in quantity of 5 for any model.

   d) (5 marks) Names of the models in the price range of 500.00 to 700.00.

4 a) (4 marks) What is the difference between a read-lock and a write-lock?

   b) (6 marks) Discuss two ways in which deadlock might be detected. What are their advantages and disadvantages?

   c) (10 marks) Suppose you are told that the following transactions are run concurrently on a (locking-based) database system that has just been restarted. Suppose the system crashes while executing the statement marked by an "***" in Transaction 2. Suppose that Transaction 1 and 4 have committed, and Transaction 1 has passed the checkpoint. The state of Transaction 3 is unknown (e.g., it may or may not have committed.) Assume that each object (e.g., X, Y, etc.) occupies exactly one page of memory.

```
Trans 1:             Trans 2:            Trans 3:           Trans 4:
x1 = READ X          WRITE Y, 0          z3 = READ X        a4 = READ A
WRITE X, x1 + 1      WRITE B, 0          a3 = READ A        z4 = READ Z
y1 = READ Y          x2 = READ X         WRITE A, a3 + 10   WRITE B, (a4 - z4)
WRITE Y, y1 + x      WRITE Z, x2         z3 = READ X        committed
Committed            ***y2 = READ Y      WRITE Z, z3 -10
*Checkpoint          WRITE A, x2 + x1
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   If using **deferred update** within a multi-user environment explain how the recovery is done in this case.

5 a) (6 marks) What is controlled redundancy? In what kind of situations would a database administrator practise controlled redundancy?

b) (4 marks)Briefly explain de-normalization.

c) (6 marks) What are the tasks involved in de- normalization?

d) (4 marks)What are the disadvantages of de-normalization?

6 Give the name of the database package you studied for the mini-project. You may answer following questions regarding to the DBMS you studied (i.e. SQL, Oracle or Access).

a) (i) (3 marks) Explain what is meant by 'a declarative language' with an example.

(ii) (3 marks) Is the query language of your system procedural, or does it simply let the user describe the results he/she wants?

b) (6 marks) What provision does your system provide for producing specially-formatted reports? Compare and contrast it with another database system.

c) (i) (4 marks) Briefly explain two (2) transaction recovery procedures.
(ii) (4 marks) What facilities does your system provide to recover form a computer crash while someone is in middle of updating records? Can a transaction be "rolled back"?

7 a) (i) (6 marks) Briefly explain 3 popular techniques used for data mining.

(ii) (4 marks) What are the advantages and disadvantages of data mining in databases compared to data mining in flat-files?

b) (10 marks) Analyse the statement "What is the sustainability of The Open University of Sri Lanka in 20 years time" in the view-points of value chain model and porter's competitive forces.

Points to consider : Govt. recommendation for the state universities to go for dual mode of teaching i.e. to offer courses in distance mode (on-line), and the other universities accepting the challenge ; promotion of e-learning by the Govt. as well as the ADB, world bank etc

8 Consider the following scenario:

A part of a proposed database for a money lending section of a bank is shown below.
Lending_scheme (Br_name, Assets, Br_city, Cust_no, Scheme, Amount)

The bank has several branches located in different cities. Each branch has its own assets and a unique branch name. Each customer is identified by an unique customer number. The company offers several lending schemes and a customer is restricted not to borrow more than once from the same scheme at the same time.

a)
   (i)   (2 marks) Find any undesirable features in the above relation.
   (ii)   (3 marks) Show how these features (if any) can be eliminated and identify candidate keys and primary keys.
   (iii) (2 marks) Verify whether the answer you obtained in (ii) is in Boyce/Codd Normal form.

b)
   (i)   (5 marks) Formulate Enterprise Rules for the above scenario.

   (ii)   (8 marks) Draw an ER diagram with entities, associations between entities, and major attributes.