UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2005/2006 –3rd Year Examination – Semester 6

IT6402: Advanced Database Management Systems

Structured Question Paper

20th August, 2006

(THREE HOURS)

To be completed by the candidate

BIT Examination Index No: .....

Important Instructions:

- The duration of the paper is **3 (three) hours**.
- The medium of instruction and questions is English.
- This paper has **4 questions** and **16 pages**.
- **Answer all questions (**25 marks each**)**.
- **Write your answers** in English using the space provided **in this question paper**.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper.
  If a page is not printed, please inform the supervisor immediately.

Questions Answered

Indicate by a cross (×), (e.g. [X]) the numbers of the **4** questions answered.

	Question numbers				
To be completed by the candidate by marking a cross (×).	1	2	3	4	
To be completed by the examiners:					

1) (a) Name three primary file organisations which determine how the records of a file are physically placed on the disk. Indicate how records are placed and accessed with respect to the file organisation techniques which you have named.

(03 marks)

ANSWER IN THIS BOX

(b) (i) Give the most commonly used structure for a high-level SQL query statement.

(02 marks)

ANSWER IN THIS BOX

(ii) Describe briefly the process of formulating an initial query tree from the query statement of (b)(i).

(02 marks)

ANSWER IN THIS BOX

(iii) Transformation rules are used to optimise a query. List the main transformation rules used in the query optimisation process.

(03 marks)

ANSWER IN THIS BOX

(c) The examination branch uses a relational database to record and process student examination results. The following are some of the relations of this student database. Here, Student relation records student data and Subject relation records subject data. Actual marks gained by the students for respective subjects are recorded in the Marks relation along with a grade.

```
Student(index no, name, address)
Subject(subject code, subject_name, lecturer)
Marks(index no, subject code, mark, grade)
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(i) Write an SQL statement to list all the students taking the subject called "Database Systems" giving the index no, name and grade of each.

(03 marks)

ANSWER IN THIS BOX

(ii) Applying the more restrictive operators first, express the query of (b)(i) above in relational algebra.

(03 marks)

ANSWER IN THIS BOX

(iii) Draw the optimised query tree for the above query.

(06 marks)

ANSWER IN THIS BOX

(d) What areas of queries, applications and transactions have to be analysed to identify the factors which influence physical database design?

(03 marks)

ANSWER IN THIS BOX

2) (a) Use of several isolation levels is possible when implementing database transactions. When executing simultaneous transactions, one or more violations may occur under most isolation levels.

(i) Describe briefly these violations.

(04 marks)

ANSWER IN THIS BOX

Continued…

(ii) Specify the type of violations for isolation levels which you identified in (a)(i) above.

(03 marks)

ANSWER IN THIS BOX

(b) Consider the following two transactions T1 and T2 with the database value for X as 500.

T1	T2
READ(X)	READ(X)
Y = X + 100	Y = X – 100
WRITE(Y)	WRITE(Y)
COMMIT	COMMIT

(i) Without considering the locking technique, write a possible serial schedule for T1 and T2. What is the final database value of Y?

(03 marks)

ANSWER IN THIS BOX

Continued…

(ii) Without considering the locking technique, write a possible non-serial schedule for T1 and T2 that would yield a correct result. What is the final database value of Y?

(03 marks)

ANSWER IN THIS BOX

(iii) Write a database log for the above schedule of (b)(ii).

(03 marks)

ANSWER IN THIS BOX

(iv) Assume that the last checkpoint record is just before the commencement of the schedule given in (b)(ii) above and the database is using immediate update technique. If the schedule for T1 and T2 fails prior to the very last commit statement, explain the database recovery actions which would take place. Indicate what changes took place in the database and what has to be done after the database is recovered to ensure the complete execution of the expected schedule.

(05 marks)

ANSWER IN THIS BOX

(v) If binary lock concept is used, write a possible non-serial schedule for T1 and T2 that would yield a correct result. Show the locks acquired and released.

(04 marks)

ANSWER IN THIS BOX

Continued…

3) (a) (i) Legal, ethical and policy issues control the right to access information. Using examples identify them.

(03 marks)

ANSWER IN THIS BOX

(ii) System level security can be encorded to control access to a database system. Identify what they are.

(02 marks)

ANSWER IN THIS BOX

(iii) Some organisations classify data into multiple security levels. Using examples, identify what they are.

(03 marks)

ANSWER IN THIS BOX

(b) The following two relations are part of a Univerity examinations database.

Course(coursecode, coursename, lecturername, departmentname)
Marks(coursecode, studentid, mark)

The University has provided all heads of departments (e.g. users H1, H2) full rights to change data in Marks relation which was entered by their teaching staff (e.g. users S1, S2). University has given only insert rights to all teaching staff to enable them to insert Marks data for their courses.

To facilitate the above functionality, two roles named as head and staff are to be defined. Login access is to be provided to all users with appropriate previleges.

(i) Write (a) SQL statement(s) to retrieve the data accessible by a paticular teaching staff member. You may assume that user account names tally with lecturer name of Course relation.

(02 marks)

ANSWER IN THIS BOX

(ii) Write (a) SQL statement(s) to retrieve the data accessible by a paticular head of a department. You may assume that user account names tally with department name of Course relation.

(02 marks)

ANSWER IN THIS BOX

(iii) Create roles for each user group and assign previleges to manipulate authorised relations.

(06 marks)

ANSWER IN THIS BOX

(c) (i) What actions chould be taken to protect the confidentiality of sensitive data when such data are transmitted over a network?

(02 marks)

ANSWER IN THIS BOX

(ii) Audit trail is used to keep track of database activities. Identify the type of information that should be recorded in a database log file to assit in tracing back database changes.

(02 marks)

ANSWER IN THIS BOX

(iii) Identify possible useful activites to monitor to enable one to detect irregular database activities.

(03 marks)

ANSWER IN THIS BOX

4) (a) (i) In a distributed database, data replication is one of the possible activities. What are the advantages in replicating the data of a database?

(02 marks)

ANSWER IN THIS BOX

(ii) Data in a distributed database can be replicated using snapshots or replicated master. Describe what it is and its main purpose.

(02 marks)

ANSWER IN THIS BOX

(iii) Several types of transparencies are possible in a distributed database. Name and briefly explain them.

(05 marks)

ANSWER IN THIS BOX

Continued…

(b) Explain which relational database problems can be solved by using XML databases. Use an example to illustrate the identified problems.

(03 marks)

ANSWER IN THIS BOX

(c) Data warehouse facilitates complex, data-intensive and frequent ad hoc queries. Briefly describe the typical functions available in a data warehouse to perform these queries.

(04 marks)

ANSWER IN THIS BOX

(d) Type constructors have been added to specify complex objects. Using an example, describe how one could define a construct for the address of an employee.

(03 marks)

ANSWER IN THIS BOX

(e) Database systems allow the management of extremely large objects like video, audio and text documents. Identify the new data types available to support these requirements.

(03 marks)

ANSWER IN THIS BOX

(f) Describe briefly the goal of clustering the data.

(03 marks)

ANSWER IN THIS BOX

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