**UNIVERSITY OF MORATUWA**
Faculty of Information Technology

B.Sc. (Hons) in Information Technology
B.Sc. (Hons) in Information Technology and Management
Level 2 Semester 1
**IN 2400 – DATABASE MANAGEMENT SYSTEMS**

Time Allowed: 3 hours November 2022

**ADDITIONAL MATERIAL**

None

**INSTRUCTIONS TO CANDIDATES**

1. This paper contains 5 questions on 3 Pages (including cover page)
2. The total marks attainable for this examination is 100. The marks assigned for each question are included in square brackets.
3. This examination accounts for 50% of the module assessment.
4. This is a closed book examination.
5. Answer ALL questions.

*Continued...*

**Question 01** [20 Marks]

Answer the questions with regard to the following relational schema.

**Product**(ProductID, ProductName, UnitPrice, ManufacturedDate, Category, SupplierID)

Assume the following:

- There are 10000 records in the Product relation
- Maximum 50 records can be held in a single disk block
- At a given time, the main memory can accommodate only 50 records without writing back to hard disk
- Records in the data blocks are ordered according to ProductID

(a) If indexing structures are not present, calculate how many data blocks to be read when searching a student records using ProductID;

i. At the best case
ii. At the average case
iii. At the worst case

State briefly about how you arrive at your answer.

*[06 marks]*

(b) If an index is created over the ProductID, how many disk blocks need to be read at maximum when searching over ProductID. Compare this with the three cases considered under part (a).

Draw the index structure to support your answer.
*Note: It is not required to draw all the leaf nodes.*

*[09 marks]*

(c) Considering a secondary index created over ProductName, describe the process of inserting a new product record.

*[05 marks]*

**Question 02** [20 Marks]

(a) How does a Stored Procedure differ from a Sub routine? State the advantages of using Stored procedures in databases.

*[04 marks]*

(b) Discuss the role of Views, Stored Procedures and Triggers in separating data and logic in applications.

*[08 marks]*

(c) Assume that you need to implement an Object database to represent the following scenario.

"A professional chef keeps records of recipes of food items. One food will use several ingredients and the same ingredient will be used in several food recipes."

- 'Recipe' has two attributes: Name and Category.
- 'Ingredient' has three attributes: IngredientName, Medicianl_Value, SpecialNotes

Write Object Definition Language (ODL) statements to implement 'Recipe' and 'Ingredient' templates.

*[08 marks]*

*Continued...*

**Question 03** [20 Marks]

(a) Give practical scenarios to illustrate each of the following situations.

(i) It is essential to upgrade the hardware to enhance the query performance.

(ii) Query performance is poor, even with high-end processors and high capacities of memory.

*[10 marks]*

(b) *'When executing a query involving more than one relation, it is advised to delay the 'JOIN' operation as much as possible.'*

Give your views on this statement, with the use of a suitable example.

*[10 marks]*

**Question 04** [20 Marks]

(a) Why is it important to have different levels at which database security measures can be taken? With the use of appropriate examples, illustrate how to impose security at different levels of security.

*[10 marks]*

(b) What is meant by Discretionary Access Control? By relating to example taken in part (a), illustrate the terms *'non-cascading revoke'* and *'cascading revoke'*.

*[10 marks]*

**Question 05** [20 Marks]

Consider a hotel reservation system which gives the customer the following options for making room reservations.

- Call over at the hotel front office, and reserve rooms over the counter
- Call reservations office, and reserve rooms through the reservations officer
- Make reservations online

(a) Relating to the above scenario, describe why 'Atomicity' and 'Isolation' of transactions is important.

*[06 marks]*

(b) Discuss the role of concurrency control, in maintaining the consistency and the durability of the reservations database, and effectiveness of the application given above.

*[08 marks]*

(c) Briefly describe how time-stamp based protocols are used to ensure maximum possible concurrency in the scenario given above.

*[06 marks]*

**End of Paper.**