The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc. IT Degree Programme

Department	: Computer Science
Level	: 6
Name of the Examination	: Final Examination
Course Title and – Code	: COU6303 – Advanced Database Management Systems
Academic Year	: 2024/2025
Date	: 13th June 2025
Time	: 1.30pm -3.30am
Duration	: 02 Hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of SIX (06) main questions in Five (5) pages. Each question has sub questions.
3. Answer **FOUR** (04) questions ONLY.
4. Answer for each main question should commence from a new page.
5. Draw clear diagrams where necessary.
6. Involvement in any activity that is considered an exam offense will lead to punishment.
7. Use blue or black ink to answer the questions.
8. Clearly state your index number in your answer script.

QUESTION 01

1. What does DBLC (Database Development Life Cycle) mean, in your own words?
2. How is the Database Development Life Cycle (DBLC) related to the System Development Life Cycle (SDLC), and why is this relationship important in software development?
3. Define the term **Transaction** in the context of database system with the aid of an example.
4. Briefly describe each of the following concepts in database systems:

    i Conflict operations
    ii Interleaving process
    iii Database request
    iv Consistent state

5. Draw the transaction state diagram and explain each state briefly.

QUESTION 02

1. a) Explain what is meant by concurrency in your own words.
   b) Discuss with proper justification whether you agree with the following statements:
      i. The use of locking methods is essential for maintaining data consistency in multi-user environments.
      ii. Optimistic concurrency control is preferable in environments with high contention.

2. Briefly define the following terms:
    i Lock granularity
    ii Deadlock
    iii Timestamp method

3. Describe the basic concepts of distributed database system. Explain why it is important.

4. a) Define the Lost Update Problem.

   b) Refer to the transaction table given below. What is the final incorrect value of X and why?

T1	T2	
Read X		X = 80, N = 50, Y =10
	Read X	
X = X + N		
	X = X - Y	
Write X		
	Write X	

QUESTION 03

1. Describe the three types of fragmentation strategies used in distributed database design.
2. Differentiate each of the following transparencies in the context of distributed database with the aid of an example:
   - i Location transparency
   - ii Local mapping transparency
   - iii Fragmentation transparency
3. What is the Mutual Consistency Rule in distributed databases, and why is it important when dealing with replicated data?
4. Define the term 'Object-Oriented Data Model' in database management.
5. Object and relational databases (OODBMS and RDBMS) take fundamentally different approaches to the idea of identity. Discuss how.

QUESTION 04

1. What is the role of ODL (Object Definition Language) in OQL (Object Query Language)?

2. Given an object-oriented database with a *Student* class that has attributes such as *name, address, DOB, sex, subjectCombination, age*, and *noOfCourses*, write an **Object Query Language (OQL)** query to:

   i Retrieve the name and address of all students whose *subjectCombination* contains "Science" and order by name.

   ii Retrieve the names of all students who have more than 3 courses.

3. How does indexing in Object Oriented Database Management Systems (OODBMS) differ from indexing in Relational Database Management Systems (RDBMS)?

4. Define data warehouse? Discuss design principles.

5. Explain the significance of multidimensional data analysis in OLAP systems and how it enhances decision-making compared to one-dimensional data analysis.

QUESTION 05

1. Explain the Star Schema technique used for multidimensional data modeling in a relational database.

2. Explain the difference between ROLAP and MOLAP in OLAP tools.

3.

```
<?xml version="1.0" encoding="UTF-8"?>
<students>
  <student roll="101">
    <name> Dilani </name>
    <grade> A </grade>
    <subject> Mathematics </subject>
  </student>
  <student roll="102">
    <name> Kamal </name>
    <grade> B </grade>
    <subject> Science </subject>
  </student>
```

a) What does the attribute roll="101" represent?

b) Write an XPath expression to select the grade of the student whose name is "Bob".

c) Is this XML well-formed? Justify your answer.

d) Write an additional <student> entry for a student named "Niluka", roll number 103, grade "A+", subject "Tamil".

QUESTION 06

1. What is the purpose of XML Schema in relation to XML documents?
2. Explain the difference between a **simple type** and a **complex type** element in XML Schema with a suitable example.
3. Given the following XML document ***books.xml***:

```
<bookstore>
  <book>
    <title>Sherlock Holmes</title>
    <author>Arthur Conan Doyle</author>
    <price>45.99</price>
  </book>
  <book>
    <title>Oliver Twist</title>
    <author>Charles Dickens</author>
    <price>18.50</price>
  </book>
</bookstore>
```

   Write an XQuery FLWOR expression to select the titles of books priced less than 45 from the *books.xml* file.

4. Explain the difference between data and information. Give some examples of raw data and information.
5. Define the concept of a data dictionary and explain the differences between active and passive data dictionaries.