

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical & Computer Engineering



Study Programme	: Bachelor of Software Engineering Honors
Name of the Examination	: Final Examination
Course Code and Title	: EEI4266/ ECI4166: Data Modeling and Database Systems
Academic Year	: 2019/2020
Date	: 26 th September 2020
Time	: 1330-1630hrs
Duration	: 3 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Six (6)** questions in **Five (5)** pages.
3. Section A consist of One (1) question and Section B consist of Five (5) questions.
4. Questions in Section A carry 20 marks. Questions in Section B carry 20 marks in each.
5. Section A is **COMPULSORY** and select any **FOUR (04)** questions from Section B.
6. Answer for Section B should write in the book provide and each question should commence from a new page.
7. This is a Closed Book Test (**CBT**).
8. Answers should be in clear handwriting.
9. Do not use red colour pen.

Section A (Answer All Questions)

Question 1 [20 marks]

- a) Oscar awards created a database to store the following details. Normalize the following table, showing functional dependencies. (Show how you progress from 1NF through 2NF to a set of 3NF relations).

At each stage, show the primary key and any foreign keys of each relation and state assumptions that you make.

(10 marks)

MovieID	Director	ProducerId	Producer	Movie Name	GenreID	Genre	Review Score
1	George Abbott	Abb1	Dodo Abashidze	Good Will Hunting	001	Fiction	3/5
1	George Abbott	Abb1	Dodo Abashidze	Good Will Hunting	002	Documentary	3/5
2	Ben Affleck	Ben1	Maren Ade	Mulan 3	002	Documentary	2/5
3	Jim Abrahams	Abr1	Dodo Abashidze	Lion King	005	Drama	4/5
3	Jim Abrahams	Abr1	Dodo Abashidze	Lion King	003	Family	4/5
3	Jim Abrahams	Abr1	Dodo Abashidze	Lion King	006	Animation	4/5

- b) The table below shows the details of the students and the overall grade of each student obtained in the different courses.

Orders Table

StudentID	StudentName	CourseID	CourseName	Grade
SI1	Senarathne	C01	Web	A
SI1	Senarathne	C02	Python	B
SI2	Peter	C01	Web	B

- i. Which Normal Form does the above table violate and why? (3 marks)
- ii. Give an example of an update anomaly and an example of a delete anomaly that may occur if the table is left un-normalized. Explain the problems that are caused. (3 marks)
- iii. Show how you would normalize the table. (4 marks)

Section B (Answer any FOUR (4) Questions)

Question 2 [20 marks]

- a) In direct file organization, the key value is mapped directly to the storage location. The usual method of direct mapping is by performing some arithmetic manipulation of the key value. This process is called hashing. Discuss advantages and disadvantages of hashing. (3 Marks)
- b) What are the three different types of schema corresponding to the three levels in the ANSI-SPARC architecture? (2 Marks)
- c) Consider the following XML document, *autoloan.xml*

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<AutoLoans>
  <person>
    <name>
      <firstname> Thanuja </firstname >
      <lastname> Samaranayake </ lastname >
    </name>
    <mobile> 0775584869 </mobile>
    <address> No345, maharagama </address>
    <loan>
      <amount> 150000 </ amount >
      <payoutdate> 2018-04-20 </ payoutdate>
    </loan>
    <loan>
      <amount> 100000 </ amount >
      <payoutdate> 2017-06-29 </ payoutdate>
    </loan>
  </person>
  <person>
    <name>
      <firstname> Kamal </ firstname >
      <lastname> Wickramasinghe </ lastname >
    </name>
    <mobile> 0771486923 </mobile>
    <address>No56,kottawa rd,pannipitiya </address>
    <loan>
      <amount> 50000 </ amount >
      <payoutdate> 2018-01-05 </ payoutdate>
    </loan>
  </person>
</AutoLoans>
```

- 00029
- i. Write a FLWOR expression that returns the *'name'* (name element) in autoloan.xml. Write the expected output of the FLWOR expression you wrote. (5 Marks)
 - ii. Write a FLWOR expression that returns all the *'name'*, *'payoutdate'* and *'amount'* where the loan amount is higher than 75000/-. Write the expected output of the FLWOR expression you wrote. (5 Marks)
 - iii. Show how you going to add new element *'LoanID'* to the above xml document. (5 Marks)

Question 3 [20 marks]

The following is an SQL script.

```
CREATE TABLE Students (StudentID CHAR(6)
,StudentFname VARCHAR(20) NOT NULL
,StudentLname VARCHAR(20) NOT NULL
,Date_of_Birth DATE
,CourseCode CHAR(6) ,
CONSTRAINT student_pk PRIMARY KEY (Studentid));

CREATE TABLE Courses(CourseCode CHAR(6) PRIMARY KEY,CourseLevel
INT
,Fee Decimal(5,2));

INSERT INTO Students VALUES ('234349','Bill','Nomas', NULL, NULL);
INSERT INTO Students VALUES ('234351','John','Norman', '2000-11-11', 'GHR');
INSERT INTO Students VALUES ('234347','John','Sagatara', NULL, NULL);
INSERT INTO Students VALUES ('234350','Ramesh','Bartok', '1991-11-11',
NULL);
INSERT INTO Students VALUES ('234341','John','Norman', '1989-02-11', NULL);
INSERT INTO Students VALUES ('234348', 'David', 'Bulmar', NULL, NULL);
```

- a) Change the script to enforce an additional constraint that would be applied to restrict the date of birth of all students to be later than '2005-03-03'. (7 marks)
- b) Change the script to enforce an additional constraint that would ensure data integrity between data referenced in both the Students and Courses Tables. Assume that a student can only attend one course at a time and a course may have many students. (7 marks)
- c) Why is it necessary to constrain updates performed on referenced data in tables such as Courses and Students? Explain the measures available in SQL to constrain these updates. (6 marks)

Question 4 [20 marks]

- a) Explain the following two relational concepts using a sample relation of your own choice providing suitable examples.
- i) Entity Integrity
 - ii) Referential Integrity (6 Marks)
- b) Explain what is meant by a transaction and why it is an important unit of operation in a DBMS? (4 Marks)
- c) Write single sentence with a suitable example to illustrate the following relational concepts
- i. Candidate key
 - ii. Primary key
 - iii. Composite key
 - iv. Unique Key
 - v. Atomic Key (10 Marks)

Question 5 [20 marks]

The National University includes a registrar's office that maintains data about the following entities: (a) courses, including number, title, credits, syllabus, and prerequisites; (b) course offerings, including courseID, year, semester, section number, instructor(s), timings, and classroom; (c) students, including student-id, name, and program; and (d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. Mention any assumptions that you made, when you are answering the following questions.

- a) Produce an Entity Relationship Diagram (ERD) of the above scenario using the **appropriate** keywords as Entity Types. (12 Marks)
- b) State the notation you used in your Entity Relationship Diagram. (2 Marks)
- c) Indicate appropriate cardinality and primary keys in your ERD. (6 Marks)

Question 6 [20 marks]

A major objective of the ANSI-SPARC architecture is to provide data independence.

- a) Draw a diagram illustrating this architecture. (6 marks)
- b) Using examples, discuss the concepts of logical data independence and physical data independence. (6 marks)
- c) Describe four features (functions) you would expect to find in a DBMS (8 marks)

-End of the Paper-

