**THE OPEN UNIVERSITY OF SRI LANKA**
**Faculty of Engineering Technology**
**Department of Electrical & Computer Engineering**

**Bachelor of Software Engineering Honours**

Final Examination (2016/2017)
ECI4166: Data Modeling and Database Systems

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|---|---|
| Date: 5<sup>th</sup> December 2017 (Tuesday) | Time: 9:30 am – 12:30 pm |

1. *This is a **CLOSED BOOK** examination.*
2. *This question paper contains six (06) questions. (SECTION A- 1 Question and SECTION B- 5 Questions)*
3. *The **Q1 in SECTION A** is **COMPULSORY** and select any **FOUR (04)** questions from **SECTION B**.*

## SECTION A

**Q1. *(Compulsory)***

Colombo Cricket Club (CCC) is a cricket club that host **matches** against an opposing team. A database is required by the CCC to hold information to support the booking of seats to watch a match at the club's stadium.

Prior to the season start, matches are scheduled between CCC and an opposing team. Audience, who have registered with the club, watches matches. They are **Pass Holders**. Pass Holders must book seats in advance for any of the matches.

**Seat** is booked after the payment. The Pass Holder is issued with one or more **Tickets**.

A particular seat can have restricted occupancy. This is recorded as the seating types (Family, Reserved, Disabled etc.)

A Pass Holder can purchases one or more tickets for seats for each match.

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 **highlighted** 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)**

## SECTION B

### Answer any FOUR (04) questions

**Q2.**

Examine the following Entity Relationship Diagram (ERD) presented in UML notation, which is used to model the details of human resources available at the IT_Globe Company. Answer the following questions.
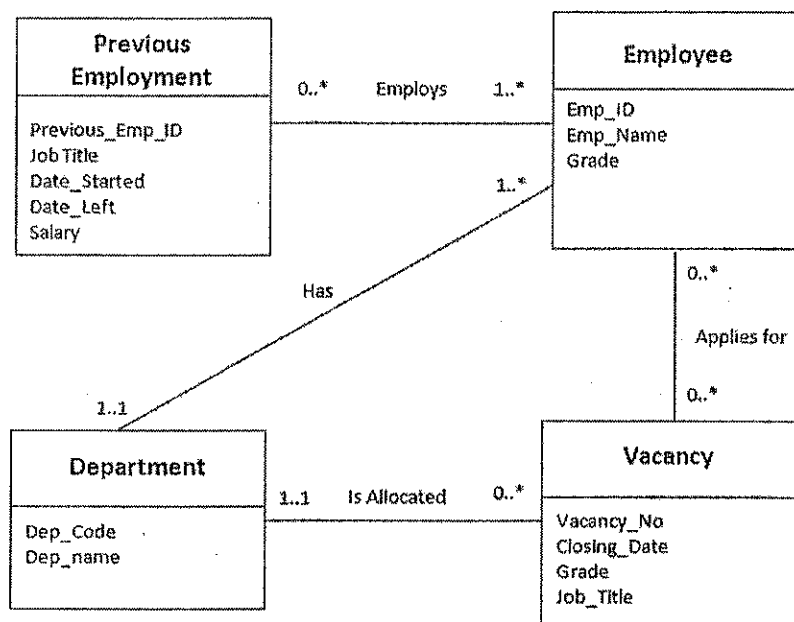
a) Explain four benefits of using ER data modelling techniques in the design of a relational database. **(6 marks)**

b) Draw and explain how you would extend the above UML diagram to represent the following requirement. *Clearly state any assumptions that you made* **(14 marks)**

According to this scenario in IT Globe the vacancies are filled from existing staff. The vacancies are filled through an interview process where senior staff employee interviews the candidates.

If the candidate is successful in the interview, he/she will be appointed to the newly applied position.

The database needs to record information about the interviews conducted for a particular vacancy. Such as who is interviewed, by whom, the outcome and the new position appointed must also be recorded.

This includes the unique attributes such as NewPositionNo, JobTitle, Salary and the AppointmentDate.

**Q3.**

a) Refer to the following Tables and answer the following questions.

```
Customer (Customer_ID, Customer_Name, C_Address, C_Postcode)
Products (Product_ID, P_Desc, Reorder_Qty, Stock, Unit_Price,
          Total_Qty_sold)
Order (Order_ID, Customer_ID, Order_Date, Promise_Date)
Line_Items (Product_ID, Order_ID, Qty_Ordered)
```

    i. Create the tables *'Customer'* and *'Order'* listed above using SQL CREATE statements. **(4 marks)**

    ii. *'Total_Qty_sold'* is a column that contains derived data. Write a SQL SELECT statement to get the value for this column for a specific product. **(4 marks)**

    iii. Write a SQL UPDATE statement that updates the column *'Total_Qty_sold'* for a given product. **(4 marks)**

b) Refer the following tables and answer the following questions.

Transaction Table

| Transaction_ID | Account_ID | Transaction_Date | Amount |
|---|---|---|---|
| 00001 | 93008 | 5/11/2017 | 367.45 |
| 00002 | 93008 | 5/11/2017 | 1299.50 |
| 00003 | 93008 | 6/11/2017 | -799.25 |
| 00004 | 334119 | 6/11/2017 | -1476.48 |
| 00005 | 93008 | 6/11/2017 | 599.20 |

Accounts Table

| Account_ID | Account_Type | Balance |
|---|---|---|
| 93008 | Direct Payment | 36274.00 |
| 334119 | Credit | 32026.00 |
| 57748 | Online Transaction | 129560.00 |
| 16227 | Direct Payment | -55090.00 |

i. Write the output and express the result of each of the following SQL queries.

**Query A:** (4 marks)

```
SELECT COUNT(*), Account_Type
FROM Accounts
WHERE Balance < 50000
GROUP BY Account_Type
HAVING COUNT(*) > 1;
```

**Query B:** (4 marks)

```
SELECT SUM(AMOUNT), T.Account_ID, Transaction_Date
FROM Transaction T
WHERE T.Account_ID IN (SELECT A.Account_ID
FROM Accounts A
WHERE Account_Type < > 'Online Transaction ')
GROUP BY T.Account_ID, Transaction_Date
ORDER BY SUM(Amount) ASC;
```

**Q4.**

a) Explain four (4) features of the file-based approach with suitable examples **(4 Marks)**

b) Explain the following two relational concepts using a sample relation of your own choice.

    i) Entity Integrity

    ii) Referential Integrity            **(6 Marks)**

c) Explain why three tier architecture more appropriate for the Web database. **(4 Marks)**

d) Write single sentence with a suitable example to illustrate the following relational concepts

    i) Candidate key

    ii) Primary key

    iii) Composite key            **(6 Marks)**

**Q5.**

a) ABC Company created a database to store personal details, branch and qualifications of their employees. 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. **(12 marks)**

| Emp_ID | Name | JobTitle | Br_Code | B_Address | Q_ID | Qualification | Level | Year Obtained |
|---|---|---|---|---|---|---|---|---|
| 001 | Kamal Perera | Web Designer | B04 | Gampaha | 1 | BSc | Undergraduate | 2012 |
| 001 | Kamal Perera | Web Designer | B04 | Gampaha | 3 | PgDip | Postgraduate | 2016 |
| 002 | Sunil Gamage | HR Manager | B01 | Nugegoda | 1 | BSc | Undergraduate | 2009 |
| 002 | Sunil Gamage | HR Manager | B01 | Nugegoda | 2 | MSc | Postgraduate | 2010 |

b) The following table shows orders placed for items.

**Orders Table**

| OrderNo | ItemNo | Item Decs | Date | Qty |
|---|---|---|---|---|
| 0011 | 100 | Screw | 06/09/2017 | 100 |
| 0011 | 200 | Bolt | 06/09/2017 | 50 |
| 0022 | 300 | Flange | 04/09/2017 | 10 |
| 0022 | 200 | Bolt | 04/09/2017 | 40 |
| 0022 | 100 | Screw | 04/09/2017 | 80 |

i. Explain why this table is not in 2NF and transform the table in to 2NF *(Show the resultant tables)*. **(4 marks)**

ii. Describe two types of anomaly that could be caused by update, insert or delete operations giving an example of each, with reference to the above table.

**(4 marks)**

**Q6.**

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. **(6 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>
```

  i.   Write a FLWOR expression that returns the *'name'* (name element) in autoloan.xml. Write the expected output of the FLWOR expression you wrote.

  **(4 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. **(4 Marks)**

  iii. Show how you going to add new element *'LoanID'* to the above xml document.

  **(4 Marks)**

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