Beijing-Dublin International College

SEMESTER II EXAMINATION - 2017/2018

School of Computer Science

COMP2004J DATABASES AND INFORMATION SYSTEMS

Professor Pádraig Cunningham
Dr. Ruihai Dong *

Time Allowed: 120 minutes

Instructions for Candidates

This paper consists of five questions, and four questions to be attempted. All questions carry equal marks. You are required to use the given Examination Book only.

BJUT Student ID: _____ **UCD Student ID:** _____

I have read and clearly understand the Examination Rules of both Beijing University of Technology and University College Dublin. I am aware of the Punishment for Violating the Rules of Beijing University of Technology and/or University College Dublin. I hereby promise to abide by the relevant rules and regulations by not giving or receiving any help during the exam. If caught violating the rules, I accept the punishment thereof.

Honesty Pledge： _____ **(Signature)**

Instructions for Invigilators

Non-programmable calculators are permitted.
No rough-work paper is to be provided for candidates.

Obtained score

Question 1:

(a) For each of the following three relational concepts, explain the key ideas behind them, using suitable examples.

- Domain Integrity
- Entity Integrity
- Referential Integrity

[10 marks]

(b) How does GROUP BY work? Describe the difference between WHERE and HAVING clause.

[10 marks]

(c) Show Cartesian product of two relations R and S described as below. Assume that R has two attributes: **A**, **B,** and S has four attributes: **C, D**, **E** and **F**.

R

A	**B**
1	2
4	5

S

C	**D**	**E**	**F**
4	4	3	3
5	6	6	6
2	4	9	1

[5 marks]

[Total 25 marks]

Obtained score

Question 2:

Study the relational schema below, and write SQL statements to answer the questions that follow.

Hotel(hotelNo, hotelName, city)
Room(roomNo, *hotelNo*, type, price)
Guest(guestNo, guestFirstName, guestLastname, guestAddress)
Booking(*hotelNo*, *guestNo*, dateFrom, dateTo, *roomNo*)

In this case, it assumes that room type can be single, double, or family.

(a) Select all the guests whose first name start with an "A".

[3 marks]

(b) List all double or family rooms with a price below $50.00 per night, in ascending order of price.

[3 marks]

(c) List the names and addresses of all guests living in London, alphabetically ordered by first name.

[3 marks]

(d) List the number of rooms in each hotel in NYC.

[3 marks]

(e) Insert a new row into "Hotel" table with the following details:

hotelNo: 12345678
hotelName: BDIC-DB-2018
city: Dublin

[3 marks]

(f) Calculate the total revenue from all double rooms per hotel.

[3 marks]

(g) Find the most commonly booked room type in London.

[3 marks]

(h) Increase the price of all double rooms by 5%.

[4 marks]

[Total 25 marks]

Obtained score

Question 3:

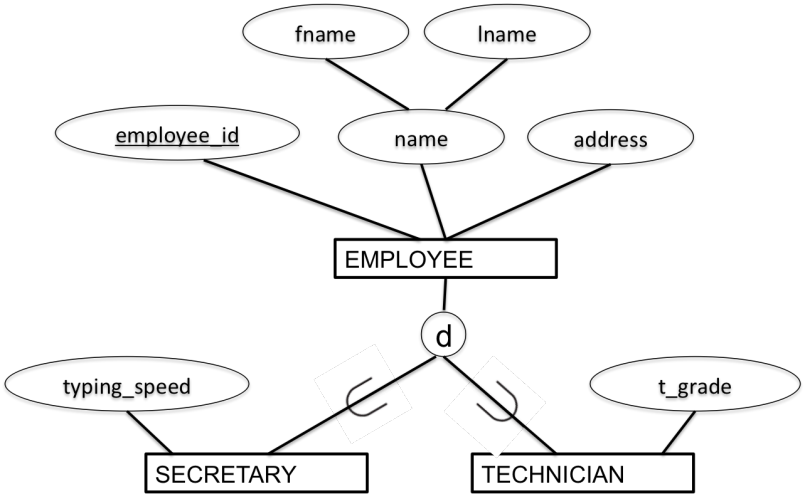
(a) What is weak entity type?

[3 marks]

(b) What is cardinality of a relationship? State the types of cardinality that are possible, and how these can be represented in an Entity Relationship diagram.

[6 marks]

(c) Transform the following entity relationship diagram into the relational model.



[5 marks]

(d) Assume you have been contracted by a university to develop a database system to keep track of student registration and accommodation records. The university courses are offered by faculties. There are no limitations to how many courses a student can enroll in. The university owns a number of hostels and each student is allocated a room after enrollment. Each room has furniture attached to it.

Draw entity relationship diagram for the above specification, and explain the process.

[11 marks]

[Total 25 marks]

Obtained score

Question 4:

Study the relational schema below, along with its functional dependencies, and answer the questions that follow.

Relation schema:
Courses(Course_Code, Course_Name, Lecturer_Code, Lecturer_Name, Student_Code, Student_Name, Lab_Time, Grade)

Functional Dependencies:

Course_Code → Course_Name, Lecturer_Code, Lecturer_Name
Lecturer_Code → Lecturer_Name
Student_Code → Student_Name
Course_Code, Student_Code → Lab_Time, Grade

(a) Use the example to show two types of anomaly that could occur with this schema.

[5 marks]

(b) Identify possible redundancies in this database.

[5 marks]

(c) Normalise this schema so that it is in Boyce Codd Normal Form (BCNF). In you answer, describe each step in detail.

[15 marks]

[Total 25 marks]

Obtained score

Question 5:

Below is the definition of a table **t_employees** and a source code to access this table by using JDBC. Examine the code and answer the questions below:

Table **t_employees**

ID	INT
Name	VARCHAR(30)
Department	VARCHAR(20)

```
public class Employee{
        private int id;
        private String name;
        private String department;
        public Employee(int eid, String n, String d){
                this.id = eid;
                this.name = n;
                this.department = d;
        }
        public int getId(){
                return this.id;
        }
        public void setId(int id){
                this.id = id
        }
        public String getName(){
                return this.name;
        }
        public void setName(String name){
                this.name=name;
        }
        public String getDepartment(){
                return this.department;
        }
        public void setDepartment(String d){
                this.department = d;
        }
}
```

```
import java.sql.*
import java.util.ArrayList;
import java.util.List;
public class DBHelper {
        public static Connection getConn() throws SQLException{
                String url = "jdbc:mysql://localhost:3306/db_employee";
                Connection conn = DriverManager.getConnection(url);
                return conn;
        }
       public static List<Employee> getAllEmployees() {
                //TODO
      }
      public static void deleteEmployee(int eid){
                //TODO
        }
        public static void updateEmployee(Employee e){
                //TODO
        }
}
```

(a) Briefly outline each of the stages that are typically included in the life cycle of an information systems

[5 marks]

(b) Complete the code above filling the method getAllEmployees() to retrieve all employees from the table.

[5 marks]

(c) Complete the code above filling the method deleteEmployee(int eid) to delete the employee with given eid from the table.

[5 marks]

(d) Complete the code above filling the method updateEmployee(Employee e) to update the employee information into the database.

[5 marks]

(e) What is SQL Injection Attack? How can it be avoided?

[5 marks]

[Total 25 marks]