



**Beijing-Dublin International College**



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**SEMESTER II EXAMINATION - 2022/2023**

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**School of Computer Science**

**COMP2013J DATABASES AND INFORMATION SYSTEMS (SE)**

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Associate Professor Neil Hurley  
Dr. Ruihai Dong \*

**Time Allowed: 120 minutes**

**Instructions for Candidates**

This paper consists of 4 questions. Answer all questions. All questions carry equal marks.

**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.

<b>Obtained score</b>

**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) Describe three phases of database design.

**[6 marks]**

(c) In relational database theory, what is the closure property? Why is this important when performing operations on relations?

**[4 marks]**

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

R

<b>A</b>	<b>B</b>
1	2
4	5

S

<b>C</b>	<b>D</b>	<b>E</b>
4	4	3
5	6	6
2	4	9

**[5 marks]****[Total 25 marks]**

<b>Obtained score</b>

**Question 2:**

(a) Write an SQL statement to create a table called “Students”, with the following details:

**Attributes:**

- **stu\_id**, which contains a student’s ID number: a number that is 8 digits long.
- **first\_name**, which is a string no longer than 30 characters.
- **last\_name**, which is a string no longer than 30 characters.
- **DOB**, which is the Date of Birth of a student.
- **major\_id**, which contains the ID of the major: an alphanumeric code that is 10 characters long.

**Other Information:**

- stu\_id is the primary key of this table.
- major\_id attribute is a foreign key that refers to an attribute named “id” in a table named “Majors”.
- If the “id” in the “Majors” table is changed (updated), the change should cause a reaction in the “Students” table to maintain the consistency between these two tables.

**[7 marks]**

(b) 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*, booking\_price)

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

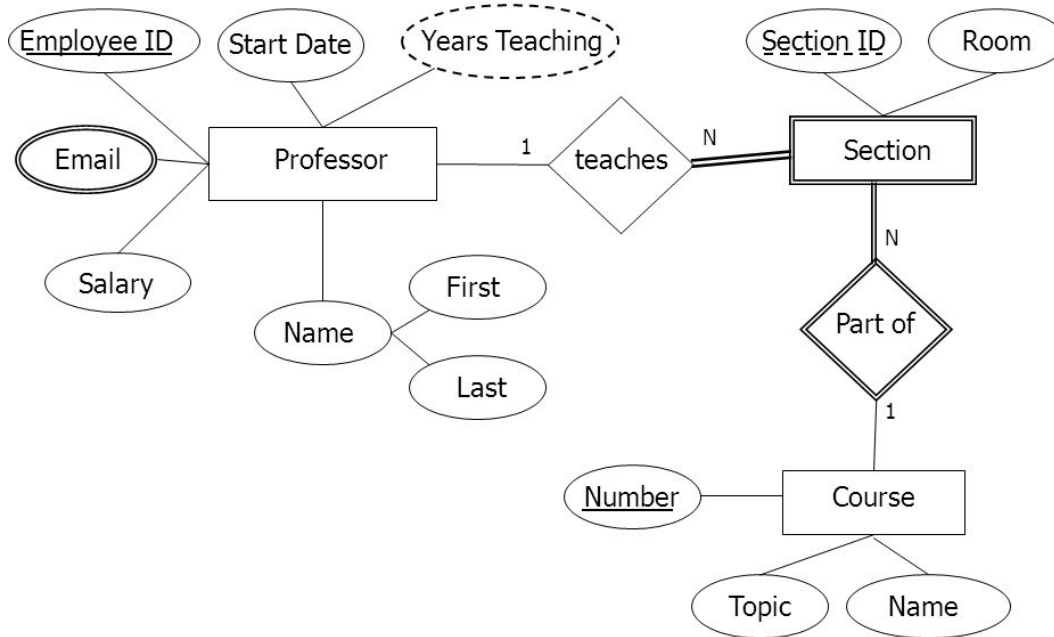
- Select all the guests whose last name start with an “D”. **[3 marks]**
- List all double or family rooms with a price above \$100.00 per night, in ascending order of price. **[3 marks]**
- List the number of rooms in each hotel in Beijing. **[4 marks]**
- Insert a new row into “Hotel” table with the following details:  
     hotelNo: 654321  
     hotelName: BDIC-2013J  
     city: Dublin **[4 marks]**
- Decrease the price of all double rooms by 10%. **[4 marks]**

**[Total 25 marks]**

<b>Obtained score</b>

**Question 3:**

Study the Entity Relationship diagram below and answer the questions that follow.



- (a) In the diagram, the “Years Teaching” attribute in the “Professor” entity type is shown with a dashed line. What is the meaning of this dashed line, and how is this different from other attributes? **[3 marks]**
- (b) In the diagram, the “Email” attribute in the “Professor” entity type is shown with a double line. What is the meaning of this double line, and how is this different from other attributes? **[3 marks]**
- (c) In the diagram, the “Section” entity type is shown with a double line. What is the meaning of this double line, and how is this different from other entities? **[4 marks]**
- (d) Map the Entity Relationship diagram to a relational model. In your answer, describe in detail the process that you use. **[15 marks]**

**[Total 25 marks]**

Obtained score

**Question 4:**

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

Table **t\_employees**

<u>ID</u>	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> getEmployeesByPageNo(int n) {
        //TODO
    }
    public static void deleteEmployee(int eid){
        //TODO
    }
    public static void updateEmployee(Employee e){
        //TODO
    }
}
```

- (a) Use an example to explain what an SQL Injection Attack is? How can it be avoided? [5 marks]
- (b) Assume that employees are displayed page by page in the system and each page displays 8 employees. Complete the code above filling the method **getEmployeesbyPageNo(int n)** to retrieve employees from the table, which are displayed on Page n. [6 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) Explain what ORM stands for and what is is used for? [4 marks]

[Total 25 marks]