Beijing-Dublin International College

SEMESTER 2 EXAMINATION - 2018/2019

School of Computer Science

COMP2013J Databases and Information Systems (Software Engineering)

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Time Allowed: 120 minutes

Instructions for Candidates

This paper contains 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

No special instructions.

Question 1:

(a) Write an SQL statement to create a table called "people", which stores data about people who have joined a tennis club. Include the following details:

Attributes:

- **id**, which contains a person's ID number: a number that is always 8 digits long.
- **name**, which contains a person's name.
- **join_date**, which is the date on which the person joined the club.
- **coach_id**, which is the ID number of another person who is this person's coach.

Other Information:

- The primary key of this table is the person's ID number.
- The "coach_id" attribute is a foreign key, as indicated in the description above.
- The "coach_id" attribute is the only one that may contain null values.

[7 marks]

(b) Study the relational schema below and write SQL statements to answer the questions that follow.

students(<u>student_id</u>, name, date_of_birth)
modules(<u>module_code</u>, name, lecturer)
assignments(<u>*student_id*</u>, <u>*module_code*</u>, <u>submission_date</u>, grade)

(i) Show all the details from the "modules" table, in alphabetical order of the module name.

[2 marks]

(ii) For each module, show the module code and the number of assignments that have been submitted for that module in the year 2016 (including only modules have assignments that have been submitted).

[3 marks]

(iii) List the names of all students who have never submitted any assignments.

[3 marks]

(iv) For the student named "Murray Head", list the names of all the modules he submitted any assignments for, and the grade he received for each assignment.

[3 marks]

(v) List the names of all modules whose module code begins with "COMP".

[3 marks]

(vi) Insert a new row into the "modules" table with the following details:

Module Code: COMP2013J
Name: Databases and Information Systems
Lecturer: David Lillis

[2 marks]

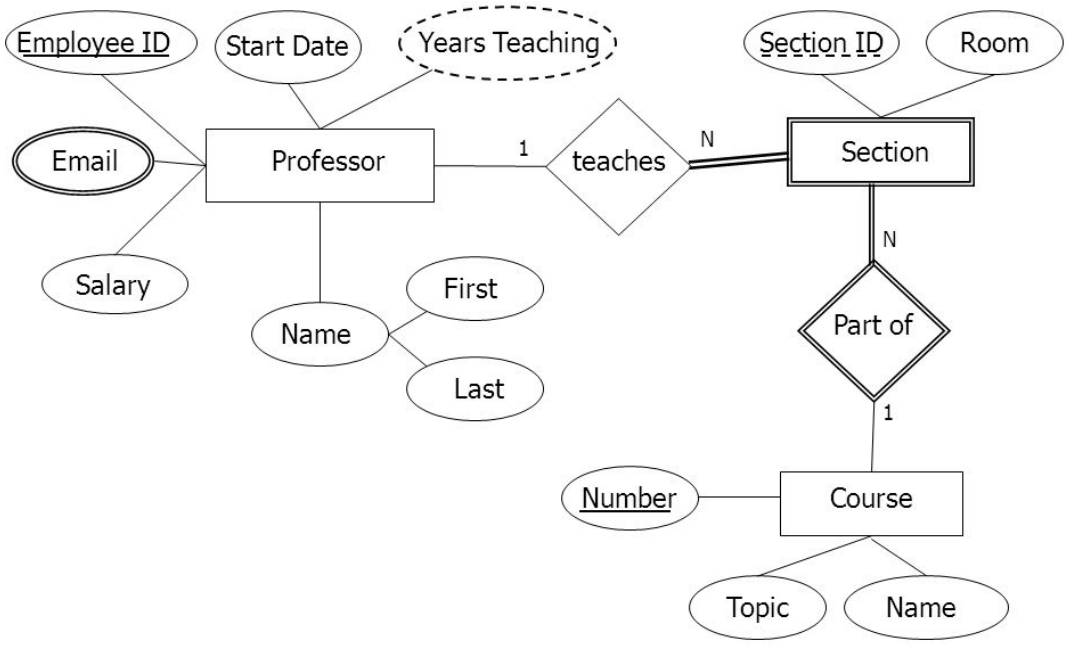
(vii) Change the details of the student with ID 1234, so that her date of birth is December 5th 2000.

[2 marks]

[Total 25 marks]

Question 2:

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



(a) For each of the following statements, state whether they are "true", "false", or "maybe". Use "maybe" when a statement is possibly true, but is not definitely true. You must explain your reasoning for **every** question.

(i) Every Professor must teach exactly 1 Section of a Course.
(ii) Every Section must be taught by some Professor and be part of a Course.
(iii) Every Course must have a different name.
(iv) Every Section must have a different Section ID.
(v) Every Course is made up of more than one Section.

[5 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?

[5 marks]

(c) 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]

Question 3:

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

Relational Schema:

books(book_title, author_id, author_name, category, shelf, copy_number)

Functional Dependencies:

author_id → author_name
book_title → category
book_title, copy_number → shelf

(a) Show two types of *anomaly* that could occur with this schema, and explain how they can occur.
[6 marks]

(b) Indicate where *redundancy* could occur in this database.
[4 marks]

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

[Total 25 marks]

Question 4

(a) Briefly describe the main differences between a *relational database* and a *NoSQL document database* such as MongoDB.

[5 marks]

(b) In relational databases, what is meant by the phrase "*relational integrity*"? How can this be enforced?

[5 marks]

(c) What is a JOIN used for? Describe the differences between the following types of JOINs: INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN.

[5 marks]

(d) Briefly outline each of the stages that are typically included in the life cycle of an information system.

[5 marks]

(e) When accessing a database using JDBC, there is an option to use a `Statement` or a `PreparedStatement`. Briefly outline the differences between these, and show any advantages that a `PreparedStatement` offers.

[5 marks]

[Total 25 marks]