Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin

Faculty of Engineering, Mathematics and Science

School of Computer Science & Statistics

Semester 2 2021-2022

Information Management II

28 April 2022 **9 :30 – 11 :30**

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Instructions to Candidates:
Attempt **three** questions in total. **Question 1 is mandatory**. Answer **any two** questions from **Question 2, Question 3 and Question 4**.

All questions carry equal marks. Each question is scored out of a total of 25 marks.

Q1. *SecondChance* is a dog shelter for rehoming stray dogs. It provides veterinary treatment for stray dogs and tries to find them new owners. It is staffed by a number of vets, veterinary nurses, assistants and administrators.

SecondChance is installing a new database to store information about the dogs in the shelter, the treatments it has performed on the dogs, the staff in the shelter and the new owners it has found for the stray dogs. For each dog, the database stores the microchip identity of that dog (either previously existing for the dog or newly given to the dog), the name(s) of the breed(s) for each particular dog (where identifiable), and a description of each dog. For each instance of a treatment for a dog, the database stores a unique identifier for that treatment instance, a description of that treatment (e.g. grooming, vaccination for parvovirus etc.,) and the date on which that treatment commenced and the date on which it completed (some treatments occur over a number of weeks). For each staff member the database records the staff member's unique ID, that staff member's role in the shelter (e.g. veterinary, veterinary nurse, etc.), and name of the staff member. The database also records which of the staff members were involved in each treatment of each dog. Finally, the database stores the names, contact addresses, date of the adoption and phone numbers of each new owner who has adopted a dog from the shelter. An owner is allowed to adopt more than one dog but a dog can only be adopted by a single owner at a time. If an owner returns a dog after adoption, the adoption of that dog is deleted.

(i) Develop an Entity Relational (ER) Model for the above database, stating any assumptions you make.

[8 Marks]

(ii) Using the appropriate mapping techniques, map the ER Model to a Relational Model giving explanation of your choices. Show the functional dependency between attributes within each table, ensuring it is in Boyce Codd Normal Form. In your answer, identify the Primary and Foreign keys for each relation.

[6 Marks]

(iii) Give the SQL command(s) for the following queries:

a. Retrieve a list of all dogs who have had the treatment "Vaccinated for Parvovirus"

[2 Marks]

b. Count the number of veterinarians involved in all treatments for the dog with microchip number '00454'

[3 Marks]

c. Suppose the dog with microchip number '00454' has been returned to the SecondChance dog shelter. Give the SQL required to update the database.

[3 Marks]

d. Suppose the database must record additional information about owners. The database must be augmented to allow the storage of whether an owner already owns any dogs. Give the SQL commands to augment the database to store this new information when available. What SQL command(s) would need to be performed to deal with the owner information previously entered but which did not have this information?

[3 Marks]

Q2. A database storing information about employees and their salaries contains the employee and remuneration relations below. Answer the questions that follow.

EMPLOYEE

Employee_ID	Firstname	Surname	Date_of_Birth	PPS_number

REMUNERATION

Employee_ID	Basic_salary	Bonus	Outside_earnings

(i) A programmer, Mary, needs to access some but not all of the data in the employee relation on a regular basis. Describe how she can be given access to all employee's id numbers, first names and surnames but not their date of birth and provide the code in SQL.

[6 Marks]

(ii) The owner of the company, Michelle, has decided to give a salary of no less than 20,000 (euro) to everyone who does not receive a bonus and is not eligible for outside earnings. How should this constraint be applied to the remuneration relation?

[7 Marks]

(iii) In the below schedule, two transactions, Course Registration and Course Transfer, are executing concurrently. Describe in detail what takes place in the case that Course Transfer fails and is rolled back on its final write operation.

[6 Marks]

time

Course Registration	Course Transfer
	read(registered_X)
	registered_X = registered_X - 1
	write(registered_X)
read(registered_X)	
registered_X = registered_X + 1	
write(registered_X)	
	read(registered_Y)
	registered_Y = registered_Y + 1
	write(registered_Y)

(iv) In the below schedule, two transactions, Course Registration and Course Transfer, are again executing concurrently. Describe in detail what takes place in terms of data consistency.

[6 Marks]

time

Course Registration	Course Transfer
	read(registered_X)
	registered_X = registered_X - 1
read(registered_X)	
registered_X = registered_X + 1	
	write(registered_X)
	read(registered_Y)
write(registered_X)	
	registered_Y = registered_Y + 1
	write(registered_Y)

Q3. A social media platform based in Ireland, *MessageMania*, is designed to allow users to publish short messages online and has become popular in recent years as it encourages users to provide information in a concise way that other users can quickly digest before moving on to the next message posted. *MessageMania* currently has over 2 million users worldwide. The platform allows two different levels of access for messages posted by users. Firstly, in the default case, messages on the platform are *public* and published to everyone with an account on the platform, in addition to any internet user who comes across the message while using the general *MessageMedia* website or search engine. Secondly, messages can be published as *protected*, only shown to users who are registered *followers* of that posting user, i.e. a follower is another user who has voluntarily signed up to receive your messages with a list of your followers also being available to you.

However, a bug in the design of *MessageMania* means that if in the case of an Android user changing their email address (the one linked to their *MessageMania* account), *protected* messages are automatically switched to *public*.

Jessica, a programmer working for *MessageMania*, became aware of the issue on December 26th 2018 and realised that users would not be informed of this, since, to the best of her knowledge, the company itself was unaware of it.

(i) Describe in detail all issues related to GDPR that the above scenario raises.

[10 Marks]

(ii) Who should Jessica inform in *MessageMania* about the potential issue she discovered and following on from that, who should that individual inform about the situation?

[8 Marks]

(iii) What is likely to be the impact of the issue Jessica discovered for the *MessageMania* company?

[7 Marks]

Q4. In Enhanced ER modelling, new notations are introduced to support inheritance of attributes and relationships. Suppose the entertainment talent management company called IrelandTalentProductions seeks to setup a database for the entertainers and broadcasters which it manages. The database needs to store information about entertainers such as date of birth, name, contact address and phone number. USING INHERITANCE, the database must model different kinds of entertainers and their associated information. The first kind of entertainer is of are Comedians, with attributes KindOfComedian (e.g. Standup Comedian, Comic Actor, Circus Clown etc.) and preferred types of work venues (e.g. physical events, TV, Radio, Film). Note a Comedian can perform as several kinds of comedian and can have several preferred types of work venues. For Musicians the database can store the (possibly multiple) types of instruments they can play, the age ranges of the augiences for which they are most suited and the genre(s) of music they can perform. For Broadcasters, the database stores the kind of radio or TV show for which they are suitable. IrelandTalentProductions focuses on only five kinds of broadcasting programmes namely current affairs, day time casual, news, documentary and sports.

(i) Using the EER notations given in this course, develop an Enhanced Entity Relational (ER) Model for the above database, stating any assumptions you make.

[8 Marks]

(ii) Develop an Relational Model giving table definitions for this database and explaining your choice of tables, primary keys and foreign keys for this database.

[8 Marks]

(iii) MyAssistant is a virtual assistant (conversational bot) which can carry out specific actions (or what are termed MyAssistant Skills). For example, one skill that MyAssistant has is the ability to make room bookings for meetings. If a user makes a request for a meeting in a particular room, MyAssistant will try and make a room booking for that meeting. If MyAssistant succeeds, it will

email all attendees (identified as part of original meeting request) to confirm the time and room number for the meeting. Thus for each booking MyAssistant stores the room number (unique) for the booking, the start and stop time and the date of the booked meeting, the email address of the requesting person who booked the room and the email addresses of those who are attending the meeting. A second skill for MyAssistant is a reminder service. A user can request a reminder email to be sent to him/her (or if required, to a set of users) about a particular event. The reminder can only be set to occur on a particular requested time and date.

Suppose the resultant database is modelled as the following tables :

Booking (BookingID, RoomNum, MeetingRequestor, StartDateAndTime, StopDateAndTime, *ReminderID*)
BookingAttendees (*BookingID*, MeetingAttendees)
Reminder (ReminderID, ReminderMessage, ReminderDateAndTime)
ReminderRecipients (*ReminderID*, ReminderRecipients)

Give the SQL commands for the following operations

a. Suppose a constraint was made whereby no meeting rooms can be booked before 7am or after 9pm. Give the SQL command to ensure that this constraint is met from the time when the database was first created.

[2 Marks]

b. Create a view of all the room bookings for room '101', their StartDateAndTime and the attendees who were invited to attend those room bookings

[3 Marks]

c. Suppose a MeetingAdmin table is created which consists of two attributes, BookingID and MeetingAttendeeNumbers. Write a trigger command to insert a row into the MeetingAdmin table when any meeting booking has been inserted with or updated with more than 20 Meeting Attendees

[4 Marks]