SCHOOL OF MATHEMATICAL AND COMPUTER SCIENCES

Department of Computer Science

F28DM

DATABASE MANAGEMENT SYSTEMS

Semester 2 2017/18

Duration: Two Hours

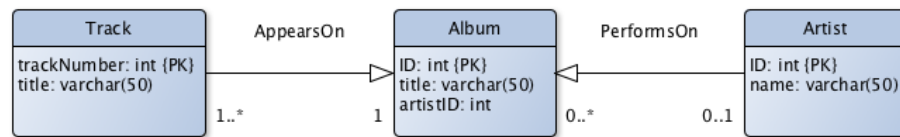ANSWER THREE QUESTIONS

Q1

(a)   Explain what is meant by each of the following terms, and give an example of each:

    (i)   Database

(2 marks)

    (ii)   Database Management System

(2 marks)

    (iii)   Database application

(2 marks)

(b)   What are the different user roles associated with a database system? For each role state the typical types of operations they can perform on the database.

(9 marks)

(c)   Consider the following Java statements.

```
String username = myTextField.getText();
String query = "SELECT * FROM Users WHERE "
    + "username = '" + username + "'";
```

    (i)   Describe a malicious attack that could be used to gain access to the database.

(2 marks)

    (ii)   Describe the mechanism that would prevent the attack? (You are not required to provide the Java, but may do so.)

(3 marks)

Q2

(a)   Consider the following snippet of an ER diagram capturing music albums, the tracks that appear on them, and the performers.

Track	AppearsOn	Album	PerformsOn	Artist
trackNumber: int {PK} title: varchar(50)		ID: int {PK} title: varchar(50) artistID: int		ID: int {PK} name: varchar(50)
1..*		1	0..*	0..1

(i)   Identify the mistake in the diagram and explain why it is not needed.

(2 marks)

(ii)   What is a weak entity and identify one in the ER diagram?

(2 marks)

(iii) What is the primary key of a weak entity when it is translated to a table? Give an example based on the above ER diagram.

(2 marks)

(iv) What is a chasm trap and where does it appear in the ER diagram?

(4 marks)

(b)

(i)   Explain what an index is and the pros and cons of creating one.

(4 marks)

(ii)   What if any indexes does MySQL create when a table is created? Use the Album table generated corresponding to the above ER diagram to give an example.

(2 marks)

(iii) What index would you create to support queries that search for a specific album by title?

(1 mark)

(c)

(i)   How is data stored in a sequential file?

(1 mark)

(ii)   Give one advantage of using a sequential file

(1 mark)

(iii) Give one disadvantage of using a sequential file

(1 mark)

Q3
(a)
    (i)   What is a transaction?

(2 marks)

    (ii)   What properties does the Transaction Manager maintain?

(4 marks)

    (iii) Outline how two phase locking enables multiple concurrent transactions.

(6 marks)

(b)   Consider the following relational schema:
```
Country(name, continent, area, population, gdp,
capital)
  capital is a foreign key referencing City.name
City(name, area, population)
```

    (i)   Write an SQL query to list the names of all the continents at most once.

(2 marks)

    (ii)   Write an SQL query to list the population of each continent with more than 1 billion inhabitants

(3 marks)

    (iii) Write an SQL query to find any countries where the population of the capital city is the same as the population of the country.

(3 marks)

Q4

(a)

(i) Provide a definition for third normal form (3NF).

(2 marks)

(ii) What is a functional dependency and how is it used to check that a table is in 3NF?

(3 marks)

(iii) Convert the following table into 3NF. First state the functional dependencies that you use for this conversion and then provide the 3NF version.

courseCode	title	lecturer	email
F28DM-Ed	Database Systems	Alasdair Gray	A.J.G.Gray@ hw.ac.uk
F20BD-Ed	Big Data Management	Alasdair Gray	A.J.G.Gray@ hw.ac.uk
F28DM-Dub	Database Systems	Talal Shaikh	T.A.G.Shaikh @hw.ac.uk

(7 marks)

(b)

(i) How are missing values dealt with in an XML document

(1 mark)

(ii) How are multiple values of the same type dealt with in an XML document, e.g. storing more than one telephone number for a person?

(1 mark)

QUESTION CONTINUES ON NEXT PAGE

(iii) Explain why the following XML document is not well formed. (Line number are given to allow you to refer to them in your answer. They should not be considered as part of the XML document.)

```
1.  <?xml version="1.0" encoding="UTF-8"?>
2.  <course code=F28DM-Ed>
3.    <title>Database Management Systems<title>
4.    <lecturer>Alasdair Gray</lecturer>
5.    <email>A.J.G.Gray@hw.ac.uk</email>
6.  </course>
7.  <course code="F28DM-Dub">
8.    <Title>Database Management Systems</title>
9.    <lecturer>Talal Shaikh</lecturer>
10.   <email>T.A.G.Shaikh@hw.ac.uj</email>
11. </course>
```

(4 marks)

(iv) What would be the result of the following XPath query over a corrected version of the XML document in part (iii)

```
//lecturer/text()
```

(2 marks)

END OF PAPER