

UNIVERSITY OF CENTRAL LANCASHIRE

FACULTY OF SCIENCE AND TECHNOLOGY

SCHOOL OF COMPUTING, ENGINEERING AND PHYSICAL SCIENCES

MARKSCHEME

MODULE CODE: CO2755

MODULE TITLE: Database Systems

SEMESTER 2, 2012

Instructions to Candidates:

Answer ALL questions from Section A (25% of the marks)

Answer THREE questions from Section B (75% of the marks)

Additional materials: None

Time Allowed: 2 hours + 10 minutes reading time

Date:

Time:

Venue:

Section A

Answer all the questions in this section

1. Define the terms **primary key** and **composite key** (also known as compound or complex or concatenated key). For each term give an example of their use in a table (4 marks)

Primary key is the attribute(s) that uniquely identifies the instance of the entity (2 marks)

Composite key is a primary key that is made up of more than 1 attribute (2marks)

2. Explain the purpose of prototyping and distinguish between requirements prototyping and evolutionary prototyping. (4 marks)

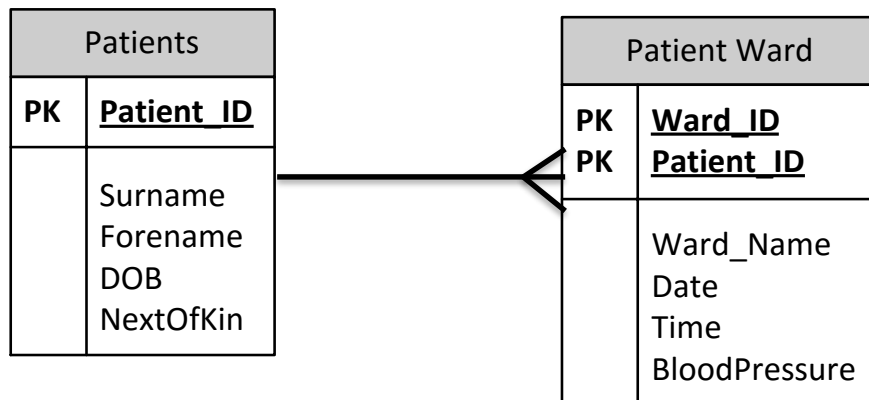
Prototyping is used to model the required system to ensure that the developer and the user understand what is wanted and what will be produced (2 marks)

Requirements prototyping – prototype used to check requirements have been understood – then system developed in different software (1 mark)

Evolutionary prototype is continued to be developed and becomes the final product (1 mark)

3. a. Give a definition of second normal form. (2 marks)
2NF – No partial key dependency (2 marks)

- b. The following entities relate to a Patients Records System at a hospital. Given that the entities shown are in 1NF, put them into 2NF and justify your actions.



(5 marks)

Patients table should be left untouched as it has a simple key (1 mark)

Ward Name depends only on Ward ID so there is partial key dependency (2 marks)

PATIENTS (Patient ID, Surname, Forename, Dob, Next of Kin)

PATIENT WARD (Ward ID, Patient ID, Date, Time, BloodPressure)

WARD(Ward ID, Ward Name)

(2 marks)

(Question total 7 marks)

4. With any computer system there are many issues of security that need to be considered.

- a. Discuss what do you understand by the term **security** in relation to computer systems? (2 marks)

Accidental, or malicious, loss damage or disclosure of data & systems (2 marks)

- b. Discuss 4 different security measures which could be considered for any multiuser computer system. (8 marks)

(Question total 10 marks)

4 x 2 marks per measure – must be different measures

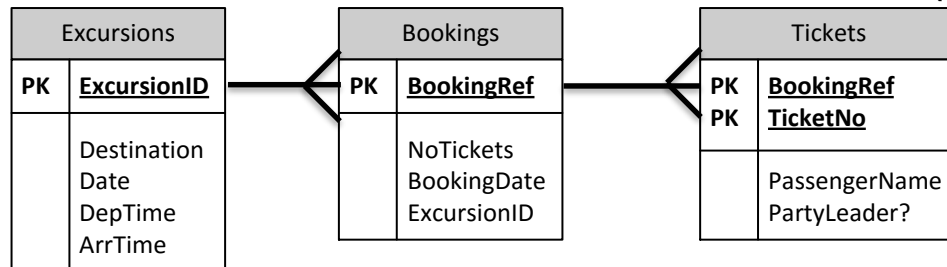
Section B

Answer 3 out of 4 questions in this section.

5. McLaren Excursions is a small company offering coach excursions to places of interest throughout the region. The company stores data about its excursions such as the destination, date, departure and arrival times. It also keeps information about bookings such as the date an excursion is booked, the number of tickets sold per booking. In addition the name of the passenger and whether or not the passenger is the party leader is recorded against each ticket allocation

- a) Draw an entity relationship diagram (logical data model) representing the data in above the system. State any assumptions which you make.

(9 marks)



Or any variation that it acceptable - 9 marks

- b) Relationships have **cardinality** and **optionality**. Explain what you understand by the terms in italics (4 marks)

Cardinality is the degree of the relationship – 1:1, 1:m, m:n - 2 marks

Optionality identifies whether every occurrence of the entity must be (or may be) related to occurrences of the entity at the other end of the relationship - 2 marks

- c) List 5 different data types that could be used in a database system, giving examples of where you would use each of the data types identified in the ERD you created in part a). (5 marks)

Any valid data type may vary depending if the database system being taught is Oracle

Eg Text, Char, Varchar, Number, Date/time, Autonumber, Boolean, yes/no etc. 1 mark per data type listed with an appropriate attribute(up to 5). (No marks for data type without appropriate attribute)

- d) Explain what is meant by the term **validation**. Using 3 different validation methods, explain the validation that could be performed on 3 of the attributes identified in part a (7 marks)

Validation is checking that data entered is reasonable (1 mark)

(2 marks for each method, 1 mark for method 1 mark for link to attribute)

Eg Range check – arrival time must be > departure time

Automatically generated number – for unique tickets nos

Existence check – Excursion ID in Booking must exist in Excursion table

(Question total 25 marks)

6. Relational databases are well established and used in a variety of business environments. However, users are now demanding more sophisticated database systems driven by advances in technology such as Geographical Information Systems (GIS), mobile databases, object oriented, multi-media and intelligent databases.

- a. Describe an advanced database system you have studied, justifying the use of the term 'advanced'

(10 marks)

This will vary from college to college depending on which advanced database system has been studied. Justification of term advanced could be expected to include how the particular application overcomes the problems that could arise from problems with the relational model i.e
representation of real world entities
semantic overloading
integrity constraints and enterprise constraints
homogeneous data
limited operations
recursive queries
impedance mismatch
short lived transactions
difficulty in changing schema
poor navigational access

- b. Discuss the tasks users typically undertake when using the system and describe the features the system provides to support the user.

(15 marks)

Will vary form college to college, allocate marks for sensible suggestions for tasks that the application can be used for and for describing sensible support features of the application

(Total 25 marks)

7. A database system for a modern gym holds details of members' activities on aerobic equipment (e.g. Treadmill, Cross-trainer, Rowing Machine etc.) Members scan their membership cards on card readers on the gym equipment type. Information about the activity type and duration along with the equipment settings is captured and recorded against the member. The database consists of the following 2 tables:

Members

Member_id	Primary key, integer
Forename	Text
Surname	Text
Address1	Text
Address2	Text
Address3	Text
Post_code	Text – with input mask
Telephone	Text – with input mask
Email	Text
Renewal_Date	Date

Activities

Activity_ID	Primary key, integer
Member_id	Foreign key, integer
Activity_date	Date
Start_Time	Date/Time
End_time	Date/Time
Activity_Name	Text
Activity_Details	Text

The relationship between the tables is described as:

Each Member may partake in any activity more than once per visit
Each activity must relate to one and only one Member

Write appropriate SQL commands to generate results for the following queries:

- a) A complete list of all activities in reverse date sequence. (Most recent first)

(3 marks)

```
SELECT * FROM Activities  
ORDER BY Activity_date DESC
```

- b) An email list of Members showing Membership id, forename, surname, and email address only, in alphabetical order of customer surname.

(3 marks)

```
SELECT Member_ID, Forename, Surname, Email  
FROM Members  
ORDER BY Surname
```

- c) A list showing Membership id, surname, forename, activity date, start time, end time, activity name and activity details for the member whose id is 100184002.

(5 marks)

```
SELECT Activities.Member-id, Members.Surname, Members.Forename,
Activities.Activity_date, Activities.Start_Time, Activities.End_time,
Activities.Activity_Name, Activities.Activity_Details
FROM Members, Activities
WHERE Activities.Member_id = Members.Member_id
AND Activities.Member_id = '100184002'
```

- d) A list showing all the details of all the activities on the Rowing Machines only

(3 marks)

```
SELECT * FROM Activities
WHERE Activity_Name = 'Rowing Machine'
```

- e) A list showing the membership id, forename and surname of all those whose membership renewal date is in June 2012 the list should be in alphabetical order of surname

(6 marks)

```
SELECT Member-id, Forename, Surname
FROM Members
WHERE Renewal_Date BETWEEN '31/5/2012' AND '1/7/2012'
ORDER BY Surname
```

- f) A new member is to be added to the system with the following partial details

Member id	100212399
Forename	John
Surname	Smith

(5 marks)

```
INSERT INTO Members (Member_id, Forename, Surname)
VALUES (100212399, John, Smith);
```

(Total 25 marks)

- 8 a. A multi-user database must guard against problems of concurrency and will use data locks in order to resolve these issues.
- (i) Explain what is meant by the term **concurrency** in this context, using an example to aid your explanation. **(5 marks)**

Concurrency is when 2 users are attempting to update the same record at the same time – resulting in the loss of data.(2 marks)
See example below – record 1 has £500 at the start

Time→	User 1 opens record 1(balance £500) and begins update by adding £300	
		User 2 opens records 1(balance £500) and begins update by subtracting £200
	User 1 saves update .. record 1 balance £800	
		User 2 saves update record 1 balance £300

The concurrency problem has meant that the first update has been lost! (3 marks for example)

- (ii) How can data locks be used to resolve these concurrency issues, include in this explanation your understanding of the term granularity **(5 marks)**

Data locks can be applied to the database to stop 2 users being able to update the same record at the same time(2 mark)
Granularity refers to the fineness of the data lock.....(2 marks)
Some discussion of the level of data locks that can be applied (eg database, table, record, field).....(1 mark)

- (iii) In this context explain what is meant by a **dirty read** **(2 marks)**
A dirty read is a data lock which locks a record for update but which allows another user to access the data to read only.....(2 marks)

- b. In the context of databases what is a transaction and what is its importance when updating a database? **(3 marks)**

A transaction is a unit of activity in the database which cannot be interrupted 2 marks
the whole transaction must take place or non of it. – 1 mark

- c. As a result of applying data locks, deadlock or deadly embrace can become an issue.
- (i) What is meant by the term **deadlock** or **deadly embrace**? Use an example to illustrate your answer (5 marks)
Deadlock occurs when 2 users are trying to access each others locked records in order to complete a transaction (2 marks)
A further 3 marks for the discussion of a suitable example or allow up to 5 marks for the discussion of a suitable example which explains the term deadlock clear. Max 5 marks
- (ii) Describe the method of two phase locking which could be used to overcome deadlock.
Phase 1 – collect and lock resources(1 mark), release all if not all resources available(1 mark), try again to collect until successful (1 mark)
Phase 2 – perform update (1 mark) & release resources (1 mark)
Total 5 marks