

BCS THE CHARTERED INSTITUTE FOR IT
BCS HIGHER EDUCATION QUALIFICATIONS

BCS Level 5 Diploma in IT

DATABASE SYSTEMS

Friday 4th April 2014 - Morning

Answer **any** FOUR questions out of SIX. All questions carry equal marks
Time: TWO hours

Answer any **Section A** questions you attempt in **Answer Book A**
Answer any **Section B** questions you attempt in **Answer Book B**

The marks given in brackets are **indicative** of the weight given to each part of the question.

Calculators are **NOT** allowed in this examination

Section A

Answer Section A questions in Answer Book A

A1

- (a) A tennis club uses the following table to record details of players and their coaches.

Players

PlayerID	Name	Ranking	CoachID	CoachName
P001	Little	12	C003	Spode
P002	Widgeon	03	C013	Glossop
P003	Prosser	17	C003	Spode
P004	Twistleton	09	C006	Travers

- (i) Explain why the above table is not in 3rd normal form.

(2 Marks)

- (ii) Transform the table into 3rd normal form.

(4 Marks)

- (b) The table below records orders for items. Each order is placed on a given date, and may include a variety of items in different quantities.

Orders

<u>OrderNo</u>	<u>ItemNo</u>	Description	Date	Quantity
1	12	Screw	Jan 6th	100
1	15	Bolt	Jan 6th	50
2	7	Flange	Feb 2nd	10
2	15	Bolt	Feb 2nd	40
2	12	Screw	Feb 2nd	80

- (i) Give an example of an insertion anomaly and an example of modification (update) anomaly that might occur in the above table.

(4 Marks)

- (ii) Explain why this table is not in 2nd Normal Form.

(3 Marks)

- (iii) Transform the table into 2nd Normal Form

(6 Marks)

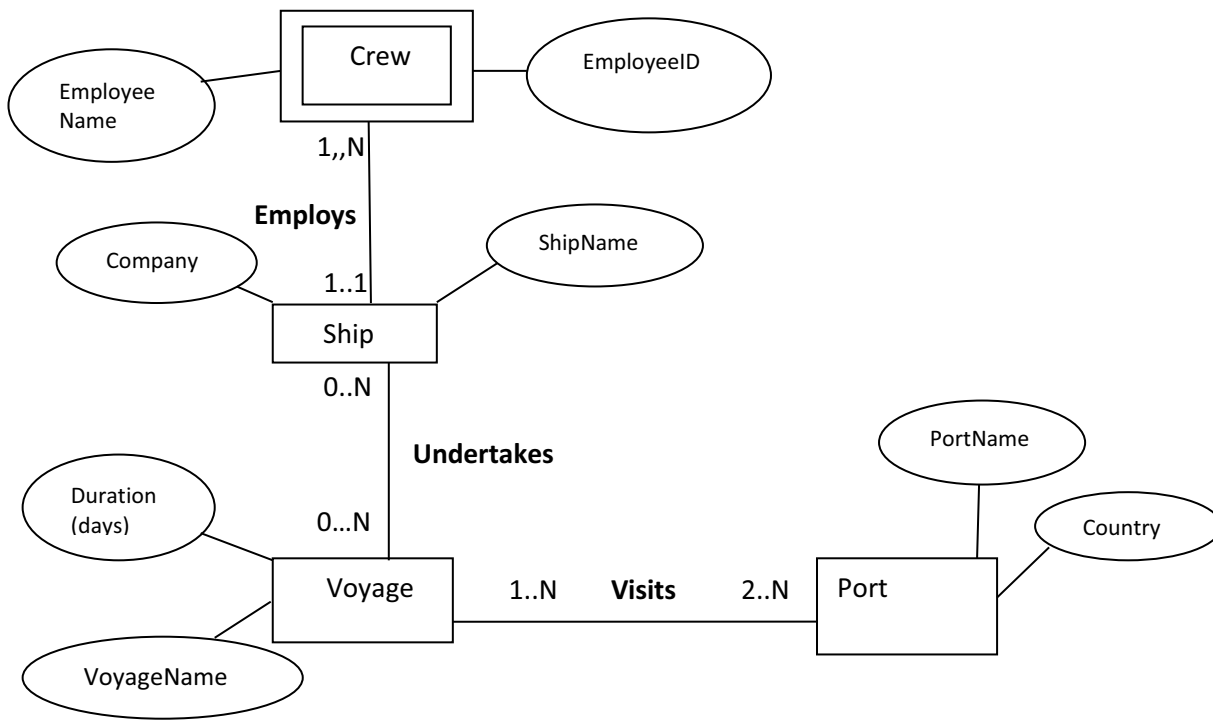
- (c) Given the table below, where A, B, C, D and E represent the attributes of the table. $A \rightarrow D$ is one example of a functional dependency in this table. Find two other dependencies.

A	B	C	D	E
a1	b1	c1	d1	e1
a1	b2	c2	d1	e2
a1	b3	c1	d1	e3
a2	b1	c1	d2	e4
a2	b2	c2	d2	e5

(6 Marks)

A2

Examine the following ERD (using UML notation) which is used to model the voyages of ships and their movement during a voyage from port to port. Then answer the question parts that follow.



- a) With reference to the ER model above, explain the concept of relationship participation involving the Visits relationship and the Employs relationship. (Hint your answer should include a diagram of entity occurrences)

(6 Marks)

- b) Identify and explain the difference between a weak entity type and a strong entity type.

(5 Marks)

- c) Explain how you would assign the following attributes to the appropriate relationships in the ER model

- (i) DestinationPort,
- (ii) VisitStartDate
- (iii) VisitEndDate
- (iv) VoyageStartDate

(4 Marks)

d) Explain how you would translate the ERD above to an equivalent relational model. Identify the primary keys and foreign keys for each relation. (hint remember to reconcile the many to many relationships and assign attributes to appropriate relations)

(10 Marks)

A3

- a) Write out the output and express in English the result of running each of the following queries against the following tables –

Loan

LoanID	BorrowerID	LoanDate	DueDate	ReturnDate
123	874	12-23-2013	01-24-2014	01-24-2014
124	874	12-23-2013	01-24-2014	NULL
125	876	12-29-2013	01-28-2014	NULL
123	874	01-25-2014	02-21-2014	NULL

Borrower

BorrowerID	BorrowerFname	BorrowerLname
874	Leon	Small
875	Gary	Lowe
876	Mark	Sanchez
877	Clywd	Morgan

Query 1:

```
SELECT Count(*) , BorrowerLname
FROM Loan, Borrower
WHERE Loan.BorrowerID = Borrower.BorrowerID
GROUP BY BorrowerLname
HAVING Count(*) >2
```

Query2:

```
SELECT DISTINCT BorrowerID
FROM Loan
WHERE ReturnDate IS NULL
AND DueDate < getDate()
```

Note GETDATE returns the current date which you should assume is = 01-27-2014

Query3:

```
SELECT BorrowerID
FROM Borrower
WHERE BorrowerID NOT IN (SELECT BorrowerID FROM Loan);
```

(9 Marks)

- b) SQL allows the database developer to create indexes. Describe using example SQL code the range of indexing techniques that could be used to improve the performance of each of the above queries.

(9 Marks)

- c) Describe the use of various DBMS software tools that allow the performance of queries to be monitored.

(7 Marks)

Section B

Answer Section B questions in Answer Book B

B4

This question uses the 'Electricals' relation below...

Electricals

Code	Description	Supplier	Price	Stock
1	DVD	Sunshine Electricals	99.99	24
2	Netbook	Electro-Pro	149.99	65
3	HDTV	Sunshine Electricals	499.99	24
4	Speakers	Pro-Sound	129.99	58
5	MP3 Player	Pro-Sound	29.99	350
6	Smart Phone	Talk2Go	149.99	125
7	Tablet Computer	Electro-Pro	199.99	134

- (a) For each of the following descriptions *name the correct relational concept* and give an *example* based on the 'Electricals' relation...

(i) Provides a mechanism for identifying each row in the relation (2 Marks)

(ii) Describes the number of rows in the relation (2 Marks)

(iii) Describes the number of columns in the relation (2 Marks)

(iv) Describes the permitted values in any given column (2 Marks)

(v) Provides a mechanism for linking to another relation (2 Marks)

- (b) For each of the following relational concepts, explain the key ideas behind it and use the 'Electricals' relation to provide suitable examples...

- Entity Integrity
- Referential Integrity

(6 Marks)

(c) Write a *single sentence* with a *simple example* (based on *any* relation) to illustrate the following relational concepts...

- Candidate Key
- Alternate Key
- Atomic Key
- Composite Key
- Primary Key

(9 Marks)

B5

(a) Explain the phrase ‘three-tier architecture’ with respect to the following two distinct systems:

(i) Databases and the ANSI-SPARC model

(5 Marks)

(ii) Databases and the Web

(5 Marks)

Good diagrams are essential in each case.

(b) Explain, using your own examples, how the following database concepts are implemented and how they relate to each other:

(i) Data integrity

(5 Marks)

(ii) Data validation

(5 Marks)

(iii) Data security

(5 Marks)

B6

(a) Describe four possible benefits of “Views” in databases.

(8 Marks)

(b) Describe the role, and content, of the system catalog in a DBMS

(6 Marks)

(c) Discuss what is meant by “Integrity” in a database, and describe two possible mechanisms for achieving data integrity.

(6 marks)

(d) Describe five advantages of using a database system over the use of spreadsheets.

(5 marks)