

BCS THE CHARTERED INSTITUTE FOR IT
BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

DATABASE SYSTEMS

Tuesday 31st March 2015 – 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

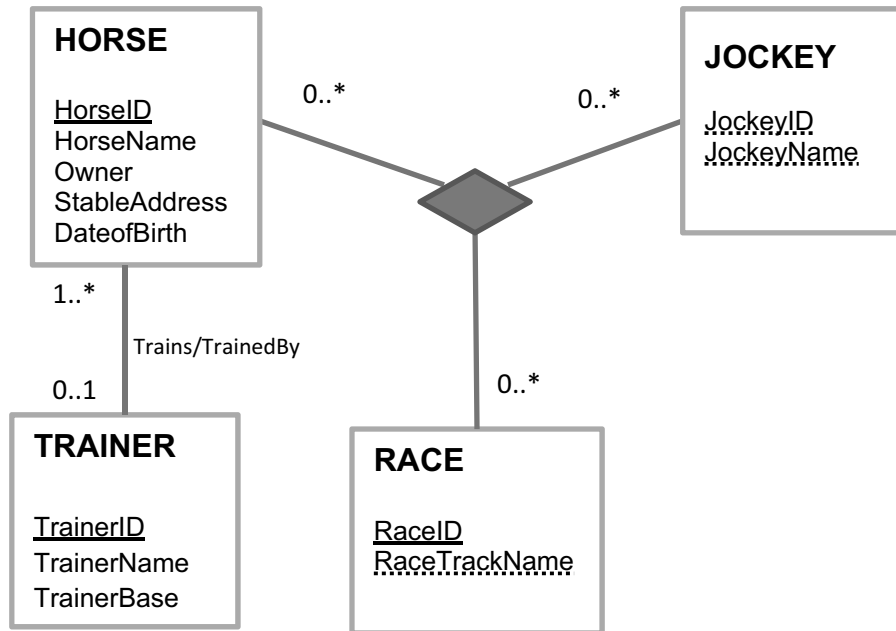
A1

Refer to the ER model given in Figure A1. Assume that :-

A Trainer trains one or many horses and a horse is trained by no more than one Trainer.

A given horse competes in a particular race ridden by a particular jockey on a specific date and the position (ie 1st, 2nd etc) in which a horse finishes is recorded.

Figure A1 ER model (UML Class diagram notation) for use in question A1



- In the context of database design give a precise definition of an Entity Type. **(2 marks)**
- Outline why an ER model assists in database design. **(5 marks)**
- Explain using examples from the ER model (figure A1) the difference between a *ternary* relationship and a *binary* relationship. **(5 marks)**
- State why many to many relationships need to be resolved into one to many relationships in an ER model. **(2 marks)**
- Explain how you would modify the ER model given in Figure A1 in order to resolve many to many relationships. **(6 marks)**
- Explain how you would translate your modified ER model (in part d) as a set of Tables, giving table names, column names and an indication of primary and foreign keys. **(5 marks)**

A2

Refer to the following tables then answer the questions that follow.

Table1 Publisher

pub_ID	pub_name	address	city	state
736	New Age Books	4 1st Ave.	Boston	MA
877	Binnet&Barney	23 34rd St.	Washington	DC
1389	AlgoDumini	47 9th Ave.	Berkeley	CA

Table2 Titles

title_ID	title	cat	pub_ID	price
2091	is anger the enemy?	psychology	0736	10.00
2106	life without fear	psychology	0736	7.00
1035	alien	sci-fi	1389	19.99

a) Show the data output produced when each of the following SQL queries are executed.

SQL query 1:

```
SELECT pub_ID, pub_name
FROM publisher
WHERE state NOT IN ('MA', 'IL')
AND pub_name NOT LIKE 'A%'
```

SQL query 2:

```
SELECT cat ,
AVG(price) AS AveragePrice,
SUM(price + price*0.2) AS TotalPrice
FROM titles
GROUP BY cat;
```

(8 marks)

- b) What is the purpose of the HAVING keyword? Use a HAVING clause in query 2 above to show how it can be used to limit the rows in the output :- **(4 marks)**
- c) Discuss the advantages of using stored procedures as a way of implementing database queries. **(7 marks)**
- d) Write SQL code to convert SQL query 1 into a View and explain the advantages of using Views as a way of implementing database queries. **(6 marks)**

A3

a) The table shown below stores details of students and the overall grade each student obtained in different modules. The Primary Key is (StudentID, ModuleID).

Results

<u>StudentID</u>	StudentName	<u>ModuleID</u>	ModuleName	Grade
S001	Smith	M01	Java	A
S001	Smith	M02	Databases	B
S002	Ford	M01	Java	B

- (i) Which Normal Form does the above table violate and why? **(3 marks)**
- (ii) Give an example of an update anomaly and an example of a delete anomaly that may occur if the table is left un-normalised. Explain the problems that are caused. **(4 marks)**
- (iii) Show how you would normalise the table. **(5 marks)**

b) An important concept in the theory of relational databases is that of a *functional dependency*.

- (i) Explain what is meant by a functional dependency and give an example. **(2 marks)**
- (ii) Identify two functional dependencies in the following table (A, B and C are the attributes):

A	B	C
a1	b1	c1
a1	b1	c3
a1	b2	c1

(4 marks)

- c) A company uses the table below to record details of staff. Each staff has up to three qualifications:

<u>StaffID</u>	StaffName	Qualifications
S01	Ibanga	BSc, MSc, PhD
S02	Kumar	BSc, MSc
S03	Grant	BSc, PhD

- (i) Explain why this table is not in "First Normal Form" (1NF). **(1 mark)**
- (ii) Show how this table can be transformed into 1NF tables. **(6 marks)**
Give **two** possible solutions.

Section B

Answer Section B questions in Answer Book B

B4

- (a) With reference to a sample relation of your own choosing, explain and discuss the following relational model terminology, including its function and any related concepts. *A good diagram showing your sample relation is strongly suggested.*

- Tuple
- Attribute
- Domain
- Degree
- Cardinality

Each item is equally weighted.

(15 marks)

- (b) *Using your own simple examples*, explain how the four SET operations work within Relational Algebra and what limitations the concept of UNION COMPATIBILITY places upon these sets being processed. Suitable Venn diagrams and sample relations will gain bonus marks.

(10 marks)

B5

- (a) Describe the various interfaces that a user may employ when interacting with a database, taking care to highlight the features, strengths and limitations of each. Your discussion should encompass all types of database user – from technical developers & administrators to non-technical end-users.
- (10 marks)**
- (b) Explain what the term *data validation* means. *Using your own examples*, describe the various data validation techniques that may be embedded into a forms-based interface to a database.
- (10 marks)**
- (c) Describe the *form components* that may be used to implement these data validation techniques.
- (5 marks)**

B6

- (a) Explain what is meant by a transaction and why it is an important unit of operation in a DBMS?
- (3 marks)**
- (b) Discuss the "ACID" properties of transactions. Give examples to illustrate your answer.
- (12 marks)**
- (c) Describe, with an example, one type of problem that can occur in a multi-user environment when concurrent access to the database is allowed.
- (6 marks)**
- (d) Discuss how the log file is a fundamental feature in any database recovery mechanism.
- (4 marks)**

