BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

DATABASE SYSTEMS

Monday 26th September 2011 - Afternoon
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. The normalised relations (table) below represent a bookstore database system.

Normalised relations:

```
Publisher       (PublisherID, PublisherName, City)
Book            (BookID, Title, Price, PublishedDate, PublisherID)
Author          (AuthorID, AuthorName)
Writing         (BookID, AuthorID)
Inventory       (BookID, BranchID, OnHand)
Branch          (BranchID, BranchName, BranchAddress)
Staff           (StaffID, StaffName, PhoneNo, BranchID)
```

a) Identify the foreign keys and list them in each relation; list the name of the table it is in and the name of the table it references.

(10 marks)

b) Use the information you have derived above to convert the normalised relations into an Entity-Relationship model. Label each relationship with a meaningful name. State any assumptions you make.

(10 marks)

c) For each relationship in your model, explain the choice of optionality in each direction.

(5 marks)

A2. Concerning a database design, helpful information can be obtained from an existing flat file. The following is an invoice from a company named Summer Distributors. Determine the tables and attributes that would be required from this document.

a) Explain what is the normalisation and why needs to do normalisation in DBMS.

(5 marks)

b) Represent each attribute as an unnormalised relation and identify the candidate keys and primary key by underlining it.

(10 marks)

c) Normalise each of the unnormalised relations in (b) above, showing the results of each stage of the normalisation. State the assumptions you make.

(10 marks)

BONo	PubCode	PubName	PubAdd	PubDate	ISBNno	Desc	Qty	Price
B001	**P120**	**PublisherA**	**…….**	**3/2/11**	**012345678-9**	**Fiction**	**3**	**20.00**
					012345678-10	**Fashion**	**6**	**25.00**
B002	**P121**	**PublisherB**	**…….**	**3/2/11**	**012345678-11**	**sports**	**15**	**30.00**
etc.								

The attributes used in the form are:
BONo stands for book order number
PubCode stands for publisher code
PubName stands for publisher name
PubAdd stands for publisher address
PubDate stands for publishing date
ISBNno stands for book ISBN number
Desc stands for book description
Qty stands for quantity
Price stands for price of the book(s)

A3. Consider the following database scenario:

A part manufacturing company has one engineering department in Manchester and two manufacturing plants, one in London and one in Hong Kong. Each type of part is produced at only one manufacturing plant. Currently, the company has one database located in the engineering department in Manchester. Applications at the manufacturing plants access this database via a communication network.

One of the relations in this centralised database system is the PART relation, where data about the manufactured parts are kept. The attributes of the PART relation are; the part's number (Part#), part's name (Name), part's manufacturing cost (Cost), the part's drawing number that specifies its design (Drawing#), the name of the plant where the part is manufactured (Plant), and the quantity available (Qty).

An instance of the PART relation is the following:

PART					
Part#	**Name**	**Cost**	**Drawing#**	**Plant**	**Qty**
p2	Widget	200	123-7	London	500
p7	Gizmo	600	501-9	Hong Kong	1000
p3	Thing	100	238-2	Hong Kong	2000
p1	Gadget	1000	310-0	Hong Kong	40
p8	Acme	150	400-6	London	3000

The company has decided to move to a distributed database system where each of the sites has its own database.

a) Propose a fragmentation design of the PART relation that reflects the distribution of the company's sites and their functionality.

(8 marks)

b) Write an SQL statement that shows how relation is fragmented in your design.

(9 marks)

c) Justify your proposed fragmentation design for the PART relation.

(9 marks)

Section B

Answer Section B questions in Answer Book B

B4. Refer to the tables and discourse in Appendix A.

a) Write SQL statements to **create** the Bookings, Performance and Production Tables given below. DO NOT include foreign key references and check constraints.

(9 marks)

b) Write SQL statements to **add** foreign key references between the Performance and Production Tables assuming these Tables were created in (a) above.

(6 marks)

c) Explain the techniques you would use to prevent the following database operations from compromising data consistency and data integrity of the application:-

- Cancel all bookings made by a customer with name = P.Smith.
- Cancel all bookings for the next performance of 12th Night.
- Change the date of a performance of a production of 12th Night from 3rd January 2011 to 4th January 2011.

(10 marks)

B5. Refer to the discourse in Appendix A.

Assume that at peak times the theatre database server processes up to 100 transactions submitted concurrently by customers accessing the theatre bookings website.

a) List a range of CRUD (create/read/update/delete) transactions that a particular user would submit to the theatre tables. Your list should include transaction description or name, transaction type (either create/read/update/delete), table(s).

(5 marks)

b) List two CRUD transactions that would conflict with transactions being processed concurrently from another user/connection. Explain how a DBMS server handles these conflicts.

(12 marks)

c) Explain how a DBMS might be tuned to maximise high transaction throughput given the volume of concurrent transactions in the theatre booking application.

(8 marks)

B6. Refer to the discourse in Appendix A.

a) Draft out the layout of a forms based user interface that will handle all aspects of customer booking as outlined in the discourse. Include a menu structure to navigate to the required forms.

(6 marks)

b) Explain how your forms map to the underlying relational model and how they support the processing requirements mentioned in the discourse. State any recommendations or assumptions you made.

(9 marks)

c) Explain illustrated by example code, the programming techniques you would need to use when implementing your ‘Forms based interface’ for the theatre application.

(10 marks)

APPENDIX A: Theatre Booking Database

Discourse: The following tables represent the data tier of a client-server database application that customers access to make bookings over the WWW. The database supports the booking of seats by customers for a performance of a particular production that take place at a particular theatre. Customers can either reserve a seat or pay for a seat in full at the time of booking. Reservations must be fully paid (and hence confirmed) within 7 days of the booking if the performance is more than 14 days ahead. Following a successful booking a 'printable' ticket is generated for the customer to print off and present at the theatre when they attend the performance or if they request a refund.

Seats are organised into areas with the most expensive in the circle with individual seats identified by a seat number (e.g. H3) and given a seat code, such as Reserved for sponsors (code R) ; reserved for Disabled customers (code D) otherwise the seat code is NULL. Seats are also given a seat status where 'C' indicates a booking for a seat has been confirmed and paid for otherwise the seat status is NULL if the seat is reserved. When a performances is cancelled and customers are refunded the cost of their tickets in full subject to the customer producing a printed ticket (this acts as a proof of purchase). Alternatively customers can re-book for another performance of the same production on a different date. They must re-book or request a refund within 14 days after the date of the performance.

Relational Tables

Figure A1 Bookings Table

TicketNo	IssueDate	CustNo	PerfNo	SeatNo	SeatStatus
079231	13-Dec-2010	10032	8320	H3	C
309232	13-Dec-2010	10032	8320	H4	C
309998	15-Dec-2010	3424	869321	MM3	C
306298	15-Mar-2011	3424	9767	MM3	C
736228	15-Oct-2010	3420	9770	C11	C
079232	13-Dec-2010	10035	8320	H5	
079233	13-Dec-2010	10035	8320	H6	

Figure A2: Performance Table

PerfNo	PerfDate	Production No	Theatre
8320	2-Jan-2011	1	Welldon
8321	3-Jan-2011	1	Byron
869321	15-Dec-2010	2	Byron
9767	15-Mar-2011	2	Welldon
9770	15-Oct-2010	3	Byron

Figure A3: Production Table

ProductionNo	ProductionTitle	Production	Company	Sponsor
1	12th Night	RSC		Teesside Polymers
2	Chopped Carrot	Shaw-Taylor		The Vegan Society
3	12th Night	Shaw-Taylor		Gardeners World

Figure A4 Customer Table

Customer No	Customer Name	Customer Address
10032	R. Sayers	'Tess' Ilkley Moor
7243	P. Smith	**'**Homeblest', Preston Capes
10035	V. Singh	23 Belle Vue St, Odiham
3420	P.Smith	Dove Cottage Stratford

Figure A5: Seats Table

SeatNo	Seat Area	Seat Code	**Theatre**
C11	Balcony	F	Byron
MM3	Circle	D	Welldon
MM3	Stalls	D	Byron
H2	Front Stalls		Welldon
H3	Front Stalls		Welldon
H4	Front Stalls		Welldon
H5	Front Stalls		Welldon

**** END OF EXAM ****