BCS HIGHER EDUCATION QUALIFICATIONS
Level 5 Diploma in IT

March 2012

EXAMINERS' REPORT

Systems Analysis & Design

General Comments

Part A – Analysis: Question 1 was attempted by most candidates, while questions 2 and 3 were attempted by 35% and 68% respectively. Generally speaking, the marks for question 1 suggest that candidates are learning the DFD modelling notation but are not as good at applying it to represent a case study. The answers to questions 1b and 2 imply that candidates are focussing on learning traditional modelling techniques rather than those in UML (Unified Modelling Language).

Question A1

Learning Outcomes:

3. Evaluate the tools and techniques of systems analysis and design that may be used in a given context.
4. Use appropriate methods and techniques to produce an analysis of a given scenario
6. Provide suitable documentation for systems analysis and design activities.

Question

a) Produce a top level data flow diagram for the **current** system of the scenario above.

17 marks

b) Compare the use of a data flow model with an activity diagram for modelling business processes. Your comparison should include an explanation of both notations. There is no need to model the scenario again.

8 marks

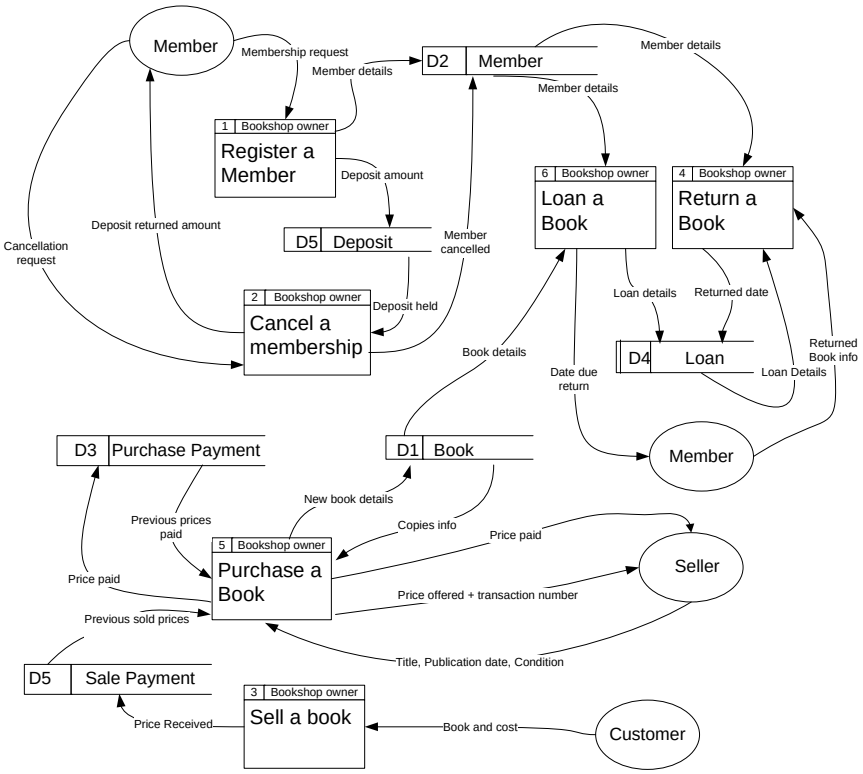
Answer Pointers/Model answer

a) Marks were given for a good representation of the scenario as follows:

Correct external entities	1
Correct data stores	3
Correct processes and dataflows, including completeness	10
Correct notation	3

1a) maximum 17 marks

Note that a solution showing only 4 top level processes (e.g. Handle Membership, Loaning Books, Purchasing Books, and Selling Books) would also have been correct.



b) 1 mark for each correct point. For example:

DFD represents Processes – Activity diagram shows activities

DFD represents data flow – Activity diagram shows flow from one activity to the next

DFD can represent the location/actor for a process – Activity diagram uses swim lanes to show where/who is performing an activity

External entities represent sources and sinks of data flows on DFD – not explicit on an activity diagram

Conditions and alternative paths not shown on a DFD – they are shown on an activity diagram

1b) maximum 8 marks

Question 1 total 25 marks

Examiners' Guidance Notes

a) A re-occurring error with data flow diagrams each year is that many candidates either do not name data flows or label them as actions e.g. update accounts. Candidates should be clear that data flows are flows of information and should be labelled as such e.g. amount paid.

The majority of candidates only represented one or two of the aspects of the book shop's business. There are 3 areas of business: Loaning books, selling books and buying books. Other common mistakes were to name John Smith as an external entity, and to include reference to the web (not relevant for a **current** DFD of the bookshop).

b) Some candidates did not seem to know what an activity diagram is, so either did not answer part b, or made a comparison between the DFD and an entity relationship diagram. Candidates that did correctly compare a DFD with an activity diagram

tended to focus their comparison on the notation (e.g. rectangle v ellipse) rather than on what the two diagrams could represent.

Question A2
Learning Outcomes:

2. Discuss various approaches to systems analysis and design and explain their strengths and weaknesses.
4. Use appropriate methods and techniques to produce an analysis of a given scenario

Question
This question is based on the required new system for the case study above.

a) A requirement of the new website is that members of the public can offer a book for sale to John. This requirement has been documented as the use case 'Offer a book for sale'. Produce a system use case description for the normal scenario of this use case.

2a) maximum 10 marks

b) Explain what an alternative scenario is, and why it may occur?

2b) maximum 5 marks

c) Write the alternative scenarios for the use case description in part a.

2c) maximum 10 marks

Answer Pointers/Model answer

a) Actor 'Public Book Seller' or similar
   1. The Public Book Seller enters the title of the book, the publication date and the condition
   2. The system checks that the book is already in the catalogue
   3. The system calculates the price of the book
   4. The system requests acceptance of the price
   5. The Public Book Seller accepts the price
   6. The system displays a transaction number
   7. The use case ends

   I mark for the actor and each correct step
   2 marks for the clarity of actor and system responsibilities

2a) maximum 10 marks

b) An alternative scenario is an alternative path through a use case starting from any step. It can occur because of actor choice, invalid entry, or a system constraint or condition not met.

2b) maximum 5 marks

c) In step 2 the book is not in the catalogue
   The system requests a contact phone number or e-mail
   The Public Book Seller enters the details
   The system issues an e-mail to the shop owner

In step 5 the Public Book Seller rejects the price
The use case ends

2c) maximum 10 marks

Question 2 total 25 marks

Examiners' Guidance Notes

A number of candidates produced use case diagrams in answer to this part of the question; however a textual description of the use case was required. There are many templates for writing system use case descriptions (specifications), so any textual format would have been accepted if it identified the actor and if the steps in the use case were clear and correct. It should be noted that actors are roles played by people or external systems when interacting with the required system; an actor cannot be a named individual. Many candidates attempting this question were unclear about the scope of a use case; a use case achieves a useful goal for the actor and is temporally cohesive (is completed in a finite and continuous period of time). Therefore, for example, the book shop owner responding to an e-mail is outside the scope of the given use case.

Question A3

Learning Outcomes:

1. Evaluate the tools and techniques of systems analysis and design that may be used in a given context.
6. Provide suitable documentation for systems analysis and design activities.

Question

a) Explain when in the system development life cycle a requirements document would be produced, and describe the contents of a requirements document.

3a) maximum 18 marks

b) Explain the difference between a functional and non functional requirement. Identify **three** types of non functional requirement.

3b) maximum 7 marks

Answer Pointers/Model answer

a) A requirements document would be produced in the requirements analysis phase of the SDLC but it would be a working document to be updated throughout the project.

3 marks

Example Contents:

- Background information and the purpose of the project
- The stakeholders and the users of the product
- Definition of project scope
- Constraints
- Facts and assumptions
- Functional and data requirements

- Non functional requirements
- Issues

1 mark for each point + up to 2 with explanation - **max 15 marks**

3a) maximum 18 marks

b) Functional requirement is what the system must do, the processing it must carry out and the data it must hold or update. A non functional requirement describes how well the system must perform the functional requirements.
Non functional requirements may refer to a particular functional requirement or the system as a whole.

4 marks

1 mark for each type of non functional requirement.

For example Reliability, Availability, Capacity

max 3 marks

3b) maximum 7 marks

Question 3 total 25 marks

Examiners' Guidance Notes

a) This question was based solely on theory with no application to the case study. Candidates need to be careful when answering this type of question to ensure they understand what is required in the answer. Some candidates wrote long answers where the content was not relevant to the question. For example, some answers described the system development life cycle in detail, while others described requirement gathering techniques.

b) There appears to be some confusion about the difference between a functional and a non functional requirement. Perhaps considering the non functional requirements to be quality requirements would help to distinguish between the two types. Some of the examples of non functional requirements were taken from other disciplines such as engineering; these were not appropriate to this question.

General Comments

Part B – Design: 73% of candidates attempted Question 4. 58% of candidates attempted Question 5, while Question 6 was attempted by less than 40% of candidates. Most candidates attempting Questions 4 and 5 gave reasonable and satisfactory answers, but Question 6 caused more problems.

Question B4

Learning outcomes:

5. Use appropriate methods and techniques to produce a design for a given scenario
6. Provide suitable documentation for systems analysis and design activities

Question

a) This question refers to the case study described above. John Smith owns a second hand book shop and a small private library of rare books. The table below shows an example of a list of rare books which were on loan.

Book code: S127	Book title: Origin of Species	Book details: Oxford Press, 1899	Seller name: A Brown	Seller tel. no.: 02087654321
	Loan code: L2010/23	Loan details: 2 weeks	Borrower name: P Palmer	Borrower address: 12 Elm Rd, SW12
	Loan code: L2010/27	Loan details: 1 week	Borrower name: A Green	Borrower address: 1 Prince Rd, SE8
	.....	.....	.....	....
Book code: P287	Book title: Pride and Prejudice	Book details: Webster's , 1902	Seller name: G Holmes	Seller tel no: 02071234567
	Loan code: L2010/12	Loan details: 2 weeks	Borrower name: P Daniels	Borrower address: 45 Elm Rd, SW12
	....	.....	....	....
Book code: A123	Book title: The Art of Italy	Book details: Pergamon Press, 1912	Seller name: A Blake	Seller tel .no: 02085674321
	Loan code: L2011/5	Loan details: 1 week	Borrower name: S Short	Borrower address: 11 Eton Square, SW1
	.....	.....	.....	.....

Normalise the table to produce a set of relations in the Third Normal Form. You must show all of your working explaining each step.

18 marks

b) Draw an entity relationship diagram (ERD) based on the relations produced in part a).

7 marks

Answer Pointers/Model answer

a) The steps of normalisation are shown below.

UNF	1NF	2NF	3NF	Relations
Book code Book title Book details Seller name Seller tel. no.	<u>Book code</u> Book title Book details Seller name Seller tel. no.	<u>Book code</u> Book title Book details Seller name Seller tel. no.	<u>Book code</u> Book title Book details Seller name* <u>Seller name</u> Seller tel. no.	Book Seller
Loan code Loan details Borrower name Borrower address	<u>Book code</u> <u>Loan code</u> Loan details Borrower name Borrower address	<u>Book code</u> <u>Loan code</u> <u>Loan code</u> Loan details Borrower name Borrower address	<u>Book code</u> <u>Loan code</u> <u>Loan code</u> Loan details Borrower name* <u>Borrower name</u> Borrower address	Loan/Book Loan Borrower

For correct 1NF with explanation (remove repeating groups) **5 marks**

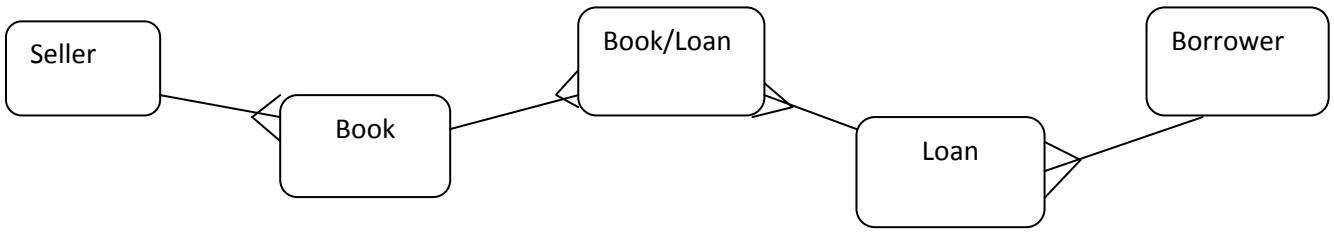
For correct 2NF with explanation (remove part key dependencies) **5 marks**

For correct 3NF with explanation (remove non-key dependencies) **5 marks**

For correct relations **3 marks**

4a) maximum 18 marks

b)



For correct relationships and their multiplicities **5 marks**
For correct entities **2 marks**

4b) maximum 7 marks

Question 4 total 25 marks

Examiners' Guidance Notes

a) Only a small number of candidates produced excellent answers i.e. a full and correct explanation of each step. Many candidates identified correct relations/tables. A small group of candidates produced completely wrong answers.
b) Most candidates were able to identify correct entities. Relationships (multiplicities of relationships in particular) caused more problems.

Question B5

Learning outcomes:

3. Evaluate the tools and techniques of systems analysis and design that may be used in a given context.
5. Use appropriate methods and techniques to produce a design for a given scenario
6. Provide suitable documentation for systems analysis and design activities

Question

a) Consider the following extra information about the book shop and the small library owned by John Smith described above:
"John Smith plans to introduce two types of borrowers: individual borrowers and companies. The following data should be stored about each individual borrower: *Borrower No, First name, Surname, Address, Tel. no*. The attributes of each company are: *Borrower No, Company name, Address, Tel. no., Email address.*
An object of class Book consists of an Introduction, a number of Chapters, an Index"

Explain the following relationships between classes using examples from John Smith's system to illustrate your answers:
(i) Association,
(ii) Aggregation or Composition, and
(iii)Generalisation/Inheritance.
The examples should show relevant fragments of a class diagram.

15 marks

b) Provide a brief explanation of the following characteristics/attributes of a good software design:
Efficient, Flexible, General, Usable.
Which characteristic is particularly important for web applications design? Explain why.

10 marks

Answer Pointers/Model answer

Question 5 solution

a) Explanation of association **2 marks**
Example of association (e.g. between Book and Seller) **3 marks**

Explanation of aggregation **2 marks**
Example of aggregation (e.g. object of class Book 'consists' of Introduction, iteration of Chapter, Index) **3 marks**

Explanation of inheritance/generalization **2 marks**
Example of inheritance/generalization (e.g. Borrower – superclass with two subclasses: Individual and Company) **3 marks**

5a) maximum 15 marks

b)

Explanations of characteristics **(2 marks * 4)**

Efficient – the software executes quickly and does not make unnecessary use of computing resources
Flexible – the software is easy to change
General – the software relates to a wide range of conditions and circumstances
Usable – easy to learn and to use

Usability is very important for web applications where members of the public interact directly with the computer system **2 marks**

5b) maximum 10 marks

Question 5 total 25 marks

Examiners' Guidance Notes

a) Many candidates provided reasonable explanations of relationships between classes. Examples however caused some problems. Some candidates confused different types of relationships (aggregation and generalisation in particular).
b) Many candidates did not provide proper definitions of the above characteristics/attributes of a good software design. Only a small number of candidates suggested usability as an important characteristic of web application design.

Question B6
Learning outcomes:

5. Use appropriate methods and techniques to produce a design for a given scenario
6. Provide suitable documentation for systems analysis and design activities

Question

a) Give a brief explanation of 'object interaction and collaboration' in object-oriented systems.
Discuss the similarities and differences between sequence and communication/ collaboration diagrams.

6 marks

b)

(i) Give a brief explanation of the role sequence diagrams play in systems modelling with the emphasis on designing the interaction between the user and the system.

6 marks

(ii) Produce a sequence diagram for the use case 'Borrow a book' in the book shop and the small library system described above. A brief description of this use case is given below.
"The corresponding *Book code* and *Borrower number* are entered by a Librarian. The system checks the status of the borrower. If the status is ok then a loan is created and the system prompts for the book to be stamped with the return date".

13 marks

Answer Pointers/Model answer

a) Proper and brief explanation of the meaning of object interaction and collaboration. **2 marks**

At least two similarities should be identified. **2 marks**
Examples of similarities:

- Both diagrams show object interactions and collaborations (i.e. they show objects/classes and messages).
- Both diagrams show interactions between actors and the system.

At least two differences should be identified. **2 marks**
Examples of differences:

- Sequence diagrams focus more on a time sequence while communication diagrams focus more on a structure represented by a fragment of a class diagram.

- Objects/classes are represented by:
  'lifelines' in sequence diagrams,
  rectangles in communication diagrams.

6a) maximum 6 marks

b)

(i) Sequence diagrams are used to model :

- interactions between objects (during the realisation of a use case), and
- interactions between the user and the system ('represented' by e.g. the boundary object)

Sequence diagrams can be used as Analysis technique (more general 'model' of interactions) or as a Design technique (more detailed 'model' of interactions). When modelling user-system interactions they focus on messages exchanged between the user and the system/the boundary object.

6bi) maximum 6 marks

(ii) A sequence diagram should have the following elements:

Actor – Librarian **2 marks**

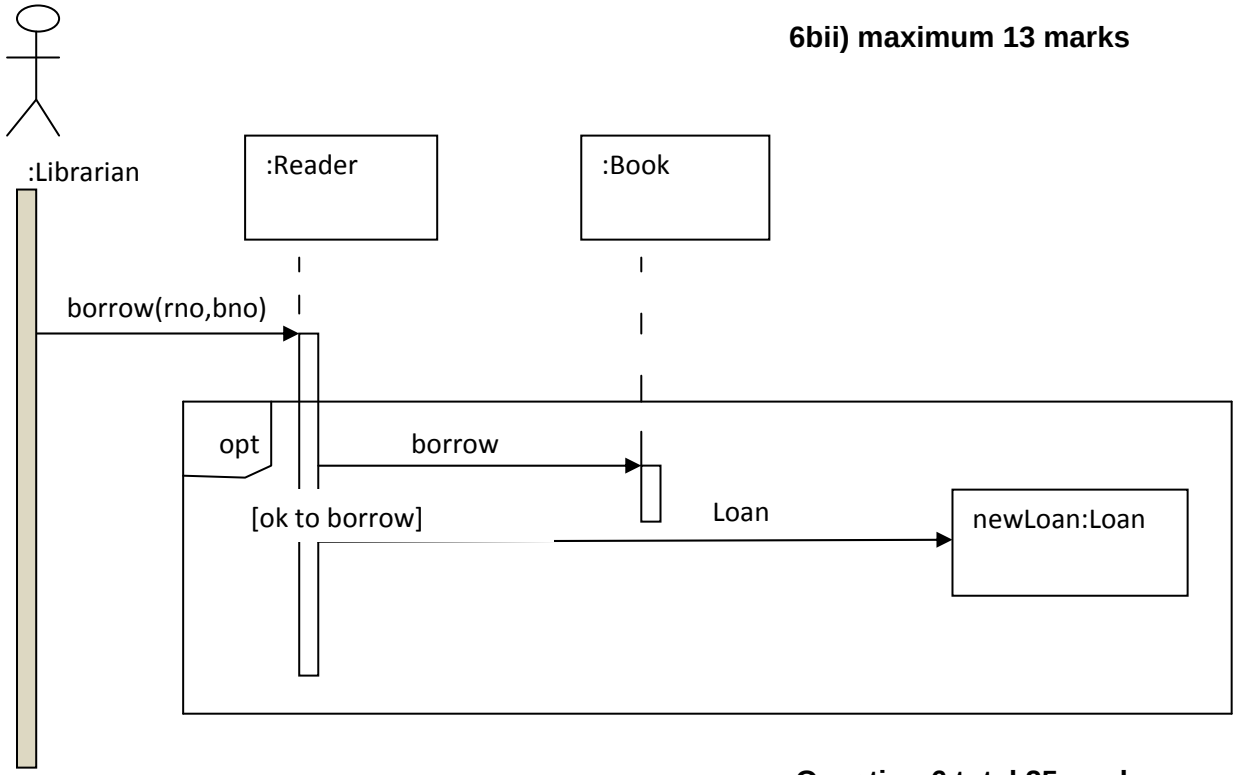
Classes/Objects: Borrower (updated), Loan (new object is created), Book (updated) **5 marks**

Right messages/operations **4 marks**

Branching/optionality (to show two alternative execution pathways) **2 marks**

An example of the sequence diagram is given below.

6bii) maximum 13 marks



Question 6 total 25 marks

Examiners' Guidance Notes

This question caused more problems than questions 4 and 5.

a) A few candidates were able to properly explain the meaning of object interaction and collaboration.
The discussion of the similarities and differences between sequence and communication diagrams was rather disappointing.

b)
(i) Many candidates provided reasonable answers.
(ii) Only a few candidates produced satisfactory sequence diagrams.