

**BCS Higher Education Qualifications
Level 5 Diploma in IT**

September 2011

EXAMINERS' REPORT

Systems Analysis and Design

General Comments

Part A - Analysis

In general candidates need to read questions carefully to make sure they are actually answering the question. There is a tendency to write long, repetitive but irrelevant answers to some questions. This wastes time for candidate that could otherwise be spent improving other answers.

Question 1 was the most popular question, being answered by 93% of the candidates. The majority of candidates answering question 1 achieved a pass in that question. Question 3 was the least popular analysis question being attempted by only 37% of candidates. Only a small number of candidates achieved a pass mark in this question (see the examiner's comments for the question below)

Part B - Design

80% of candidates attempted Question 4. 70% of candidates attempted Question 5, while Question 6 was attempted by less than 30% of candidates. Most candidates attempting Question 5 gave reasonable and satisfactory answers. Question 4 caused some problems. Question 6 was answered satisfactorily by a few candidates only.

Question Number 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 of the Compu-Fix company.

20 marks

- b) Compare a data flow model with another process model of your choice (for example a business activity model). There is no need to model the Compu-Fix scenario again but you should describe the notation of the process model you have chosen as part of your comparison.

5 marks

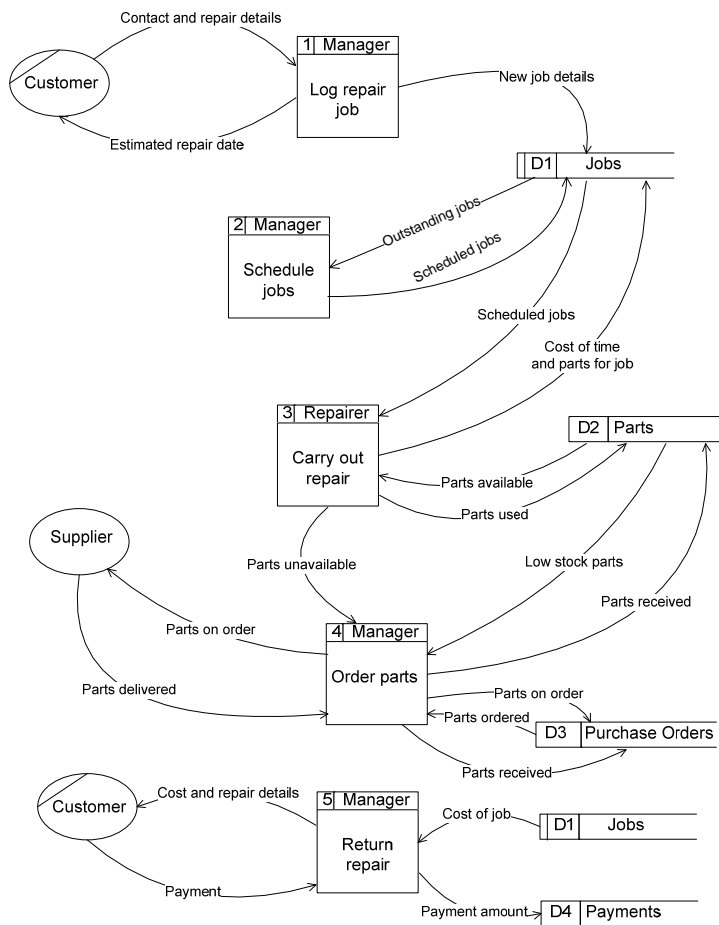
Question 1 total 25 marks

Answer Pointers/Model answer

- a) For good representation of scenario:

| | |
|---------------------------|---|
| Correct external entities | 4 |
| Correct data stores | 4 |
| Correct processes | 5 |
| Correct notation | 5 |
| Completeness | 2 |

1a) maximum 20 marks



Note that there is no data flow from the Payments datastore on this diagram. This is because no process to use the payment information is included in the Compu-Fix scenario.

b) For each correct comparison – 1 mark

e.g.

Arrows on a BAM represent dependency between activities; on a DFD they represent data flows.

Notation for DFM is more formal than for BAM.

A BAM shows activities; a DFD shows processes.

A BAM does not show data in any way.

Both models support decomposition.

1b) maximum 5 marks

Examiners' Guidance Notes

1a) The most common weakness in the DFDs is failure to represent and name data flows correctly. A number of candidates still label data flows as actions giving rise to a misunderstanding as to what a process should represent. Other candidates do not label data flows at all making the diagram difficult to understand. In general though most candidates had some understanding of what a DFD is, and modelled the scenario with a measure of success.

1b) The error made by many candidates in answering this part of the question was to compare the DFD with an Entity Relationship Diagram. An ERD is not a process model so these answers would not have gained any marks. Suitable models for comparison would have been for example, a Business Activity Model (given as an example in the question), an Activity Diagram or a Use Case Model.

Question Number A2

Learning Outcomes:

1. Evaluate the tools and techniques of systems analysis and design that may be used in a given context.
2. Discuss various approaches to systems analysis and design and explain their strengths and weaknesses.

Question

- a) Describe the Waterfall system development model and discuss the disadvantages of developing a system using this approach.

(10 marks)

- b) Compare the life cycle of an agile method with the Waterfall life cycle you described in part (a). You should answer this question using an agile method of your choosing (for example: DSDM, eXtreme Programming, Scrum). Explain how the agile method you have chosen addresses the disadvantages you identified in part (a).

(15 marks)

Answer Pointers/Model answer

- a) The answer should list phases such as:

Feasibility study

Requirements gathering

Analysis

Design

Build

Test

Implementation

Maintenance

1 mark for each up to a **maximum of 6**

Disadvantages:

Inflexible – requirements may change

Long period before delivery of product

Mistakes made in requirements expensive to rectify

Lack of user involvement in the development process

Each step 'signed off' so fixed before next step can be started

Assumes a 'green field' development

1 mark for each up to a **maximum of 4**

2a) maximum 10 marks

- b) Sample answer based on DSDM

DSDM life cycle has 5 phases: feasibility study; business study; functional model iteration; design and build iteration; implementation. Unlike the SDLC the last three phases are iterative and you can go back to any previous iterative phase. The life cycle delivers products incrementally and to a fixed deadline. The method is intended for projects where the requirements are unclear or volatile, and the prototyping approach helps to clarify requirements during the functional model iteration. Users are involved in the development during the whole life cycle. Each iteration and phase is finished when good enough for purpose rather than 100% complete. The MoSCoW approach to requirements prioritisation along with timeboxing means not all requirements will necessarily be met but the most important requirements will be. Incremental approach means customers have a useable product early on.

2b) maximum 15 marks

Examiners' Guidance Notes

Most candidates focussed on answering part (a) of this question yet it attracted less marks than part (b). Candidates should check carefully the number of marks awarded for each part of the question.

2a) In general candidates answering this part of the question produced good answers. There was a tendency to write long, descriptive and sometimes repetitive answers when a concise description of the phases and the disadvantages would have been sufficient to gain the marks.

2b) A number of answers were based on RAD and/or prototyping, which are techniques rather than actual Agile methods. Few answers were specific to a particular Agile method, rather the tendency was to discuss generic Agile approaches such as iteration, incremental deliver and user involvement. Only candidates that used an actual Agile method such as Scrum had enough basis for their comparison to achieve high marks for this question.

Question Number A3

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

Question

- a) Identify the functional requirements of a new system for Compu-Fix (described in question 1) representing them in a use case diagram. You must also identify the actor for each use case.

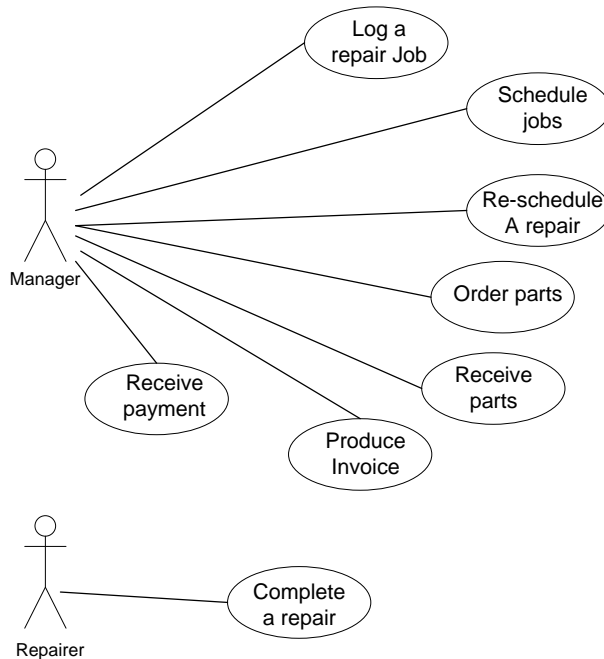
3a) maximum 11 marks

- b) Explain how a CRUD (create, read, update, delete) matrix can help the analyst ensure all the functional requirements (or use cases) have been identified. You should illustrate your answer by constructing a CRUD matrix to include the use cases identified in part (a) and two entity types from the scenario. You do not need to produce an entity-relationship diagram.

3b) maximum 14 marks

Answer Pointers/Model answer

- a) For correct use case notation – 2 marks
 For correct actors (not Lee) – 2 marks
 For correct use cases – maximum 7 marks.



3a) maximum 11 marks

- b) The analyst can ensure completeness of the use case model by checking that there are use cases to create, read, update and delete every entity type on the data model.

4 marks

There is no use case to delete a job. The use case 'Complete a Repair' could be considered to delete a job but then any audit trail or record of a job would be lost. There is likely to be an archive use case that removes completed jobs after a fixed period of time.

A Payment can be created but there are no use cases to Update, Read or Delete. You would not expect a Payment to be updated or deleted once it has been recorded. Again there would be an archive event to remove payment records after a period of time. One would expect a use case that reads Payment; this would probably be a reporting use case such as 'Report Jobs and Payments Received'.

| Entity type Use case | Job | Payment |
|----------------------------|-----|---------|
| Log a repair job | C | |
| View outstanding jobs | R | |
| Complete a repair | U | |
| Produce an Invoice | R | |
| Receive Payment | | C |
| Order Parts | R | |
| Receive Parts | U | |

Answers are likely to have different use cases and entities. 5 marks for each illustration and explanation using a CRUD matrix. Up to maximum of 10 marks

3b) maximum 14 marks

Examiners' Guidance Notes

3a) Most candidates attempting this question knew the notation to represent a use case, but many were unclear as to the scope of a use case model, and the purpose of actors. The use case model represents the requirements of the new computer system, and the actors represent roles users will play when using the computer system. Therefore an actor will directly interact with the computer system. So a Customer is not an actor in this use case model.

3b) Very few candidates answered this part of the question correctly. There seemed to be considerable confusion as to what a CRUD matrix is and how it can be useful to an analyst. Section 12.7 of Avison and Fitzgerald, Information Systems Development has an example of a CRUD matrix.

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

The table below shows an example of a list of repair jobs in the Comp-Fix company described in Question A1.

| | | | | |
|--------------------------|---------------------------|--|------------------------------|-------------------------------|
| Job code: C28 | Start date: 15/10/2009 | End date: 19/10/2009 | Customer name: A Smith | Customer tel. no.: 6071213 |
| | Part code: CPUInt | Part details: INTEL Dual Core E7600 | Supplier name: CompParts | Supplier tel. no.: 6224546 |
| | Part code: RAM | Part details: 2GB Samsung DDR3 | Supplier name: Electronix | Supplier tel. no.: 5121314 |
| | | | | |
| Job code: M13 | Start date: 20/10/2009 | End date: 23/10/2009 | Customer name: P Jones | Customer tel .no.: 5081214 |

| | | | | |
|--|---------------------|---------------------------|------------------------------|-------------------------------|
| | Part code: FuseM | Part details: Fuse FX3 | Supplier name: Electronix | Supplier tel. no.: 5121314 |
|--|---------------------|---------------------------|------------------------------|-------------------------------|

- a) 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)

- a) Explain briefly how you would map an inheritance hierarchy in a class diagram to relational database tables. Consider two possible approaches.

(7 marks)

Answer pointers/Model answer

- a) The steps of normalisation are shown below:

| UNF | 1NF | 2NF | 3NF | Relations |
|---|--|--|--|--|
| Job code Start date End date Customer name Customer tel.no. | <u>Job code</u> Start date End date Customer name Customer tel.no. | <u>Job code</u> Start date End date Customer name Customer tel.no. | <u>Job code</u> Start date End date Customer name* <u>Customer name</u> Customer tel.no. | Job Customer |
| Part code Part details Supplier name Supplier tel.no. | <u>Job code</u> <u>Part code</u> Part details Supplier name Supplier tel.no. | <u>Job code</u> <u>Part code</u> <u>Part code</u> Part details Supplier name Supplier tel.no. | <u>Job code</u> <u>Part code</u> <u>Part code</u> Part details Supplier name * <u>Supplier name</u> Supplier tel.no. | Job/Custom er Part Supplier |

- b)

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

c) There are three approaches to mapping:

- Only the superclass is implemented as a table. Attributes of subclasses become attributes of the superclass table and have null values when they are not used. This approach is in particular useful when subclasses differ from their superclass more in behaviour (operations) than in attributes.
- Only the subclasses are implemented as tables. The attributes of the superclass are kept in the subclass tables. This works if the superclass is *abstract* (i.e. there are no instances of it).
- All the classes (both the subclasses and the superclass) are implemented as separate tables. To retrieve the data for a subclass, both its own table and the table of its superclass must be accessed.

Any two approaches should be sufficiently discussed.

4b) – maximum 7 marks

Examiners' Guidance Notes

- a) Only a small number of candidates provided a full and correct explanation of each step and identified correct relations/tables. Many candidates however managed to identify some correct relations/tables.
- b) The candidates were unable to answer this part properly. Many tried to explain e.g. inheritance instead.

Question Number 5

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 Compu-Fix system described in Question A1:

"Compu-Fix plan to introduce two types of customers: individual customers and companies. This will allow Compu-Fix to carry out regular computer servicing jobs for various companies. The following data should be stored about each customer: *Customer number, Address, Tel number*. For individual customers *First name* and *Surname* are also stored, while for companies *Company name* and *Number of computers* are stored.

An object of class Computer consists of a System unit, a Keyboard, and a Monitor."

Explain the following relationships between classes using examples from the Compu-Fix company system to illustrate your answers:

- (i) Association,
- (ii) Aggregation or Composition, and
- (iii) Generalisation/Inheritance.

(15 marks)

- b) There are many characteristics/attributes of a good software design. List FIVE of them and provide a brief explanation of each.

(10 marks)

Answer pointers/Model answer

- a) Explanation of Association **2 marks**
Example of association (e.g. between classes Customer and Job) **3 marks**

Explanation of Composition (it seems to be more suitable than Aggregation in this case)

2 marks

Example of composition (an object of class Computer 'consists of' System unit, Keyboard, Monitor)

3 marks

Explanation of Inheritance/Generalization

2 marks

Example of inheritance/generalization (e.g. Customer – superclass with two subclasses: Individual and Company)

3 marks

5a) maximum 15 marks

- b) Possible characteristics of a good software design are: Functional, Efficient, Economical, Reliable, Secure, Flexible, General, Manageable, Maintainable, Usable, Reusable.

Five of these should be briefly explained

(2marks * 5)

5b) maximum 10 marks

Examiners' Guidance Notes

- a) Many candidates produced reasonable explanations and examples of relationships between classes. Some candidates gave however wrong examples or confused relationships (aggregation and generalisation in particular).
- b) Many candidates listed proper characteristics/attributes of a good software design. Explanation of characteristics caused however some problems.

Question Number 6

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) What is the difference between the dialogue and direct manipulation metaphors that are widely used to represent the user interface?

(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 'Create a new repair job' in the Compu-Fix system described in Question A1. A brief description of this use case is given below.
"The details of a customer and a computer's fault are entered by a manager. When the customer is 'new' then his/her record is created, otherwise the existing customer's record is updated. The system responds with an estimated end date of the job".

(13 marks)

Answer pointers/Model answer

- a) The candidates are expected to briefly explain both metaphors and next to emphasise the difference between both.

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.

6b(i) maximum 6 marks

- (ii) The sequence diagram should have the following elements:

Actor – Manager

2 marks

Classes/Objects: Customer (new object is created or an existing object is updated), Job (new object is created)

5 marks

Right messages/operations

4 marks

Branching (to show two alternative execution pathways)

2 marks

6b(ii) maximum 13 marks

Examiners' Guidance Notes

This question caused more problems than questions 4 and 5.

- a) Most candidates did not provide (or provided wrong) answers.

b)

- (i) Most candidates were unable to properly explain the role sequence diagrams play in systems modelling.

(ii) Only a few candidates produced reasonable sequence diagrams. Some candidates drew activity diagrams instead. A few candidates produced a 'sequence diagram' for the whole system.