THE BCS PROFESSIONAL EXAMINATION
Diploma

April 2015

EXAMINERS' REPORT
Systems Analysis and Design

Section A

General Comments

Questions 2 and 3 were answered by more than half the candidates, possibly because they required written answers rather than knowledge of a particular diagram notation. However, there was a tendency for candidates to write everything they knew about the topics rather than directly answering the questions. Answers should be focussed on the question to make sure time is not wasted in the examination.
In general candidates seem to learn theory that they can reproduce in the examination but are less able to apply the theory in practice.

Question Number 1
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) Explain the differences between a physical and a logical data flow diagram (DFD).

9 marks

b) List the processes and the external entities that you would include on a LOGICAL top level data flow diagram (DFD) of the Compu-Fix company. (You do not need to draw the DFD).

7 marks

c) Produce a Use Case diagram for the Compu-Fix system. (Hint – correct <<include>> or <extend>> relationships will attract additional marks).

9 marks

Answer Pointers/Model answer
a) A physical DFD represents a system with all its constraints and practices.
This may include: physical data stores; transient data stores; duplication of data and processes; person or department carrying out a process; processes that re-arrange information e.g. sorting; reporting data; checking or decision-making processes.

A logical DFD shows the underlying business functions and data.
Each data store id only shown once and people/departments become external entities.

1a) 9 marks

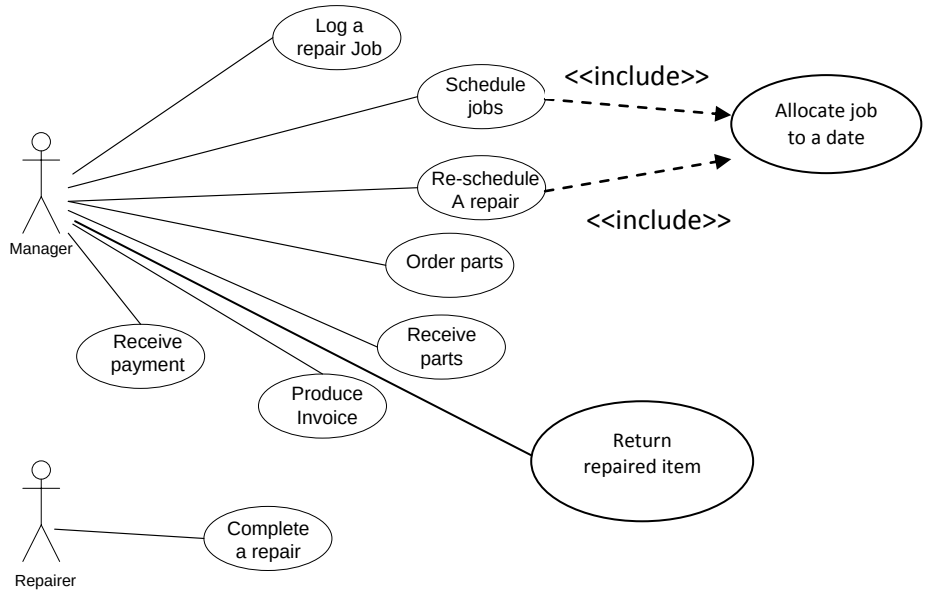
b) For example –

Processes: Schedule Jobs,
Log Repair Job,
Record Completed Repair,
Order Parts,
Return a Repair (this would include invoicing and payment)

External entities: Customer ½ mark,
Supplier ½ mark,
Manager 1 mark,
Repairer 1 mark

1b) 7 marks

c) Use Cases:



1 mark for each use case with the correct actor if not given a mark in part b. 5 marks
Correct use of <<include>> 2 marks
Correct notation 2 marks

1c) 9 marks

Question 1 - 25 marks

Examiners' Guidance Notes

This question was attempted by 45% of candidates, but only just over half achieved a pass mark for their answer. Most answers for part (a) did not demonstrate an understanding of the difference between a physical and a logical DFD. Part (b) had better answers but some candidates seemed to just take sentences from the case study rather than thinking through what the processes would be. The answers to part (c) showed that most candidates knew the use case diagram notation, but identifying use cases correctly seemed to present more difficulty. There was little understanding of the correct use of <<include>> and <<extend>>.

Question Number 2

Learning Outcomes:

2. Discuss various approaches to systems analysis and design and explain their strengths and weaknesses.

Question

a) List **seven** techniques for eliciting requirements.

7 marks

b) Explain **two** of these techniques in detail including the advantages and disadvantages of each technique.

18 marks

Answer Pointers/Model answer

a) These might have included:

- Interviews
- Brainstorming workshops
- Observation
- Scenarios
- Prototyping
- Questionnaires
- Document analysis
- Joint application development

  1 mark for each up to a maximum of 7

2a) 7 marks

b) Maximum 9 marks for each chosen technique – 5 for explanation + 4 for advantages and disadvantages.

e.g. points made about interviews could include

- interview key stakeholders
- can identify personal issues and problems as well as requirements
- preparation required – arrange where and when in advance
- questions covering who, what, why, when, how and where
- follow up to confirm understanding
- take notes or record interview
- Advantages
  - can form good relationship between stakeholder and analyst
  - gives various viewpoints from different stakeholders
- Disdvantages
  - time consuming for analyst and stakeholders
  - all key stakeholders must be interviewed or requirements may be incomplete

2b) 18 marks

Question 2 - 25 marks

Examiners' Guidance Notes

Nearly 70% of candidates attempted this question, and the majority of them achieved a pass mark for their answer. The most popular techniques described were interviews and questionnaires.

Question Number 3

Learning Outcomes:

1. Describe different life cycle models and explain the contribution of the systems analysis and design within them.
6. Provide suitable documentation for systems analysis and design activities.

Question

a) Describe a system development method of your choice. You should include a description of the stages/phases of your method as well as the interim products produced at each stage. A diagram of the method should be produced if appropriate.

15 marks

b) Discuss whether your chosen method would be suitable for developing a new computer system to support Compu-Fix as described in the case study.

10 marks

Answer Pointers/Model answer

a) Candidates could choose any method here. Maximum 10 marks awarded if the answer was generic, i.e. waterfall, agile.

3a) 15 marks

b) Answers here would depend on the method chosen in part a. Discussion should have considered aspects such as: size of company/system; skill of users; availability of IT skills; whether incremental delivery was suitable; involvement of users in development; criticality of system; complexity of requirements; timescale for completion. A heavy weight, prescriptive method was unlikely to be an appropriate method

3b) 10 marks

Question 3 - 25 marks

Examiners' Guidance Notes

This was the most popular question in section A with nearly 75% of candidates attempting it. The majority of candidates achieved a pass mark for their answer. By far the majority of candidates answering this question described 'Waterfall' as their choice of method. The Waterfall life cycle is a generic model of system development rather than a specific methodology (such as SSADM). It was disappointing that very few candidates choose a more current method such as an Agile method (e.g. eXtreme Programming, Scrum). Part (b) of this question was answered less well. The tendency was for answers to make rather generic points rather than points directly relating to the case study.

Section B

General Comments

Questions 4 and 5 were much more popular than Question 6. The best results were achieved for Question 4, followed by Question 5 results. The Question 6 results were substantially worse.

Question Number 4

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 Compu-Fix Computer Repairs company described in the case study:

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Jobcode: **C28**	**Start date:** **15/10/2014**	**End date:** **19/10/2014**	**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:** **20/10/2014**	**End date:** **23/10/2014**	**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

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
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/Part Part Supplier

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

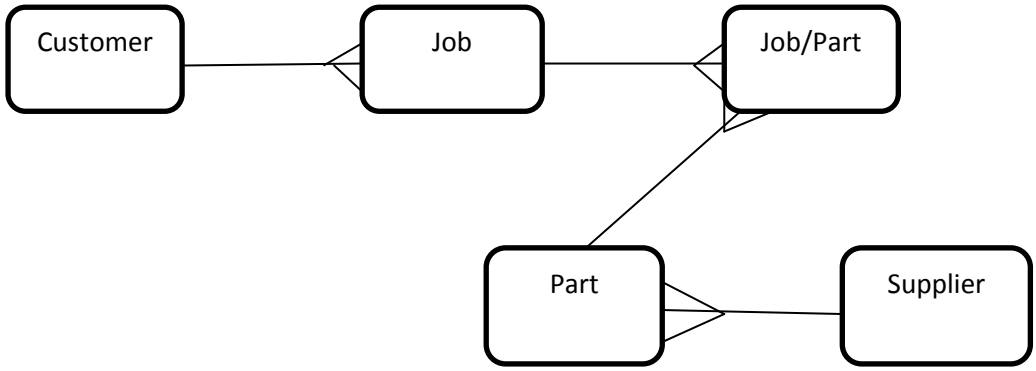
For correct 2NF with explanation (remove part key dependencies) **5 marks**

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

For correct relations **3 marks**

4a) 18 marks

b)



For correct entities **2 marks**
For correct relationships **5 marks**

4b) 7 marks

Question 4 -25 marks

Examiners' Guidance Notes

Nearly 95% of candidates attempted this question and the majority of them achieved a pass mark for their answers. Many answers for part (a) were good and the majority of candidates were able to practically demonstrate the normalisation process. Some candidates however did not provide proper explanations. Part (b) was answered generally well. Some candidates had problems with relationships (with cardinalities of relationships in particular).

Question Number 5

Learning outcomes:

2. Discuss various approaches to systems analysis and design and explain their strengths and weaknesses.
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 the case study:

"Compu-Fix plan to employ two types of engineers: full time engineers and part time engineers. The following data should be stored about each engineer: *Engineer number, Engineer name, Address, Tel number.* For full time engineers *Annual salary* is also stored, while for part time *Hourly rate* and *Hours worked* 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,

iii) Generalisation/Inheritance.

15 marks

b) Discuss at least TWO similarities and TWO differences between class diagrams and entity relationship diagrams.

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. Engineer – superclass with two subclasses: Full time, Part time) **3 marks**

5a) 15 marks

b) At least 2 similarities and 2 differences should be briefly discussed.

For reasonable similarities **5 marks**
For reasonable differences **5 marks**

For example:

Similarities:

- Both diagrams show the structure of data in the system i.e. 'things' (entities, objects) about which data should be stored
- Both diagrams show the relationships between these 'things'

Differences:

- In Class Diagrams there are three types of relationships: associations, aggregations and inheritance while in ERDs relationships correspond to associations
- Classes of course are semantically 'richer' than entities – as they encapsulate both the attributes and operations (entities encapsulate attributes only)

5b) 10 marks

Question 5 -25 marks

Examiners' Guidance Notes

This question was attempted by approximately 97% of candidates. Part (a) was answered reasonably well. Some candidates however were unable to give proper and correct examples of relationships between classes. A small number of candidates also had problems with definitions/explanations of relationships between classes (associations in particular). Most candidates answered part (b) reasonably well, but some did not clearly distinguish between similarities and differences.

Question Number 6

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) Explain how the following UML diagrams relate to each other:
   (i) class diagrams,
   (ii) sequence diagrams,
   (iii) state machines/statecharts.

7 marks

b)

(i) Give a brief explanation of the role state machines/statecharts play in systems modelling.

4 marks

(ii) Produce a state machine/statechart for the class Job in the Compu-Fix system described in the case study. You may assume that objects of this class are affected by the following 'events' (listed in alphabetical order):

cancel job, completion of job, create job, delete job, reschedule job, schedule job.

Please note that jobs are deleted automatically 6 months after their completion or cancellation.

14 marks

Answer Pointers/Model answer

a)

A class diagram shows *classes of objects* (with their attributes and operations). The *interactions between these objects* for a particular use case are shown in a sequence diagram. The sequence diagram shows relevant *operations/messages*. Objects progress through states and these can be identified from the sequence diagrams. The collection of all these states and the transitions between them are shown on a state machine/ state chart. The transitions are usually caused by operations.

For all 'main points' (underlined) **7 marks**

6a) 7 marks

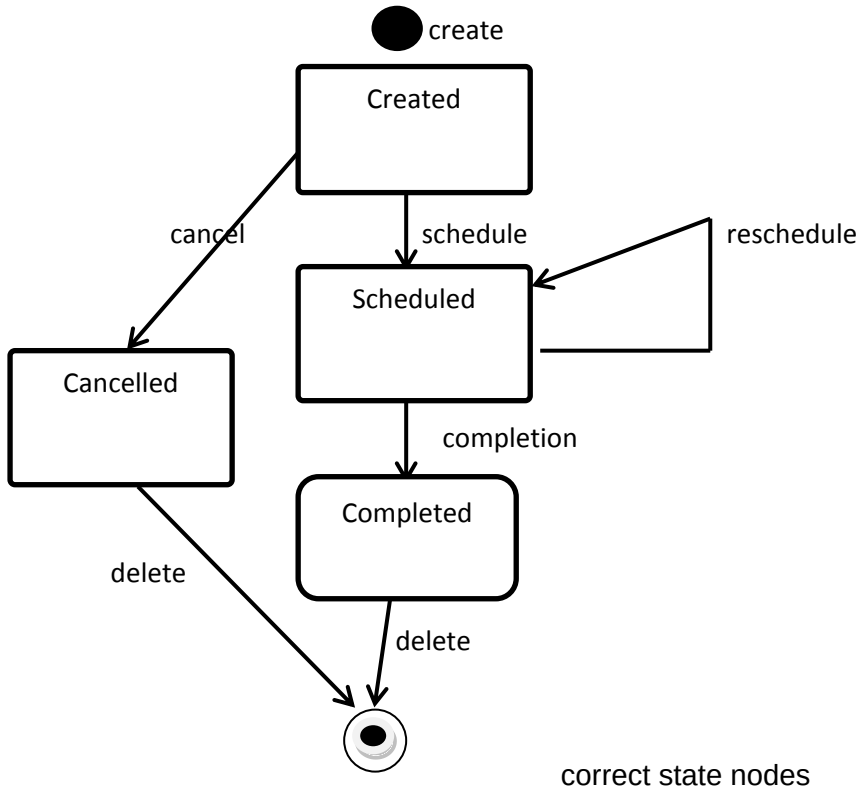
b)

(i) State machines/state charts model *states and state-dependent behaviour* for a modelling element (*typically a class,* but we can also produce state machines for subsystems, interfaces, etc). They model the *'dynamic' aspect* of the modelled element (typically a class). For a specific class, its state machine captures *the impact of events on that class and it shows the resulting state changes with their limitations on behaviour.*

For all 'main points' (underlined) **4 marks**

6b(i) 4 marks

(ii)



correct state nodes	**4 marks**
initial and final states	**2 marks**
correct transitions	**8 marks**

6b(ii) 14 marks
Question 6 – 25 marks

Examiners' Guidance Notes

Only a small number of candidates (less than 30%) attempted this question, and the results are worse than the results of questions 4 and 5. Parts a) and b(i) caused some problems and the corresponding results are below expectation. The answers to part b(ii) however were slightly better than expected. A few candidates produced good state machines/state charts, but some drew activity diagrams instead.