THE BCS PROFESSIONAL EXAMINATION
Professional Graduate Diploma

April 2004

EXAMINERS' REPORT

System Design Methods

Question 1

a) Explain with the aid of diagrams the differences between the waterfall and prototyping approaches to systems development. (8 marks)

b) Discuss the appropriateness of the waterfall and prototyping approaches for developing:
   i) A user interface
   ii) A complex payroll calculation module
   iii) A back-end database for a website (9 marks)

c) A systems development method includes the following stages: Feasibility, Analysis, Prototype, Plan increments to deliver, Design and build increment, User acceptance of an increment, Roll out an increment. Draw a diagram which shows the process of this method i.e. stages and 'paths' between stages. Use 'one way' arrows to denote paths. (8 marks)

Answer Pointers

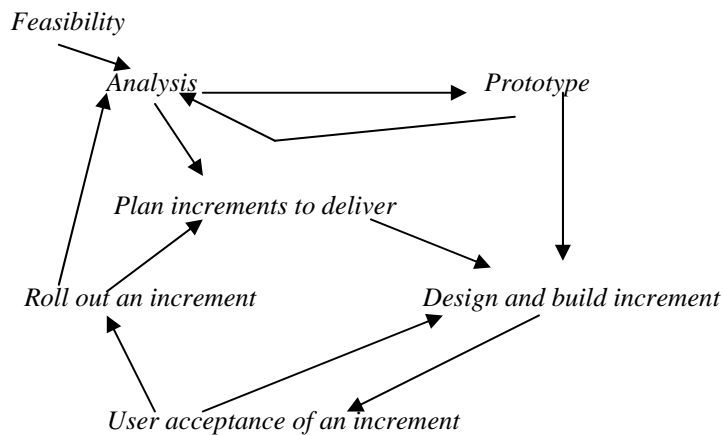a) The following (or suitable alternatives) would be expected:

The waterfall approach to systems development involves the completion of a series of activities in a sequential manner. Each activity such as analysis or design needs to be completed (and typically signed off by the client) before the next activity in the sequence begins.
{A diagram to be included} (4 marks)

The prototyping approach to systems development typically incorporates the view that a system is developed by incremental improvements in a model of the system, starting with design models and then progressing to code models. There is typically far greater user involvement in prototyping approaches than in the waterfall approach.
{A diagram to be included} (4 marks)

(b)
  i)   The prototyping approach can be particularly beneficial for developing user interfaces since the more that users are involved in the development of a user interface, the more likely it is to be suited to their needs. The waterfall approach is less appropriate since it can be difficult to completely specify exactly how a user interface should work with only limited user involvement. (3 marks)

  ii)   The waterfall approach might be more appropriate for developing a complex payroll calculation module, since it should be possible to specify exactly what the calculations need to achieve. A prototyping approach might be more likely to 'miss' or confuse requirements. (3 marks)

  iii) A back end database for a website could potentially be developed using either a waterfall or prototyping approach depending upon the extent to which the data elements and structure of the database could be defined or need to be established. (3 marks)

(c)

The following (or suitable alternatives) would be expected:

Feasibility

Analysis → *Prototype*

Plan increments to deliver

Roll out an increment   *Design and build increment*

User acceptance of an increment

Small' iterations/loops: Analysis-Prototype, Design-Acceptance   (4 marks)
'Main loop', right order of steps   (4 marks)

Examiner's Guidance Notes
For part (a): Generally no serious problems. Some answers were too long as many candidates discussed various stages/steps in detail (which was not required). More emphasis on the differences was expected.
For part (b): No serious problems with (i) and (ii), but many vague answers were given for (iii). Also a few candidates discussed the suitability of both approaches for all three situations (and did not make any recommendations).
For part (c): This part caused many problems. Most candidates did not manage to identify 'loops' in the process. Some candidates also specified stages in wrong order.

Question 2
a) Discuss why systems design methods commonly include techniques to model the structural, procedural/functional, and temporal/dynamic aspects of an IT system. Give an example of the techniques that model these systems aspects in a systems design method of your choice.   (15 marks)

b) Explain how you would cross-check the three models discussed above (in 2a).   (10 marks)

Answer Pointers
a) Systems design methods commonly include structural modelling techniques since only the simplest of IT systems will not require some kind of structure, e.g. data structures for holding system data. Examples: Entity relationship diagrams, Logical data models, class diagrams   (5 marks)

Systems design methods commonly include procedural modelling techniques since these ultimately describe the actual activity to be performed, e.g. calculations and data input and output. Examples: Data flow diagrams, Use cases   (5 marks)

Systems design methods commonly include temporal modelling techniques since data will change over time and therefore the state of the data needs to be specified in order to ensure that it is processed correctly. Examples: Entity life histories, State transition diagrams

(5 marks)

b) Structural vs Procedural/functional (SSADM example): Each data store should hold/represent a whole number of entities i.e. a data store is related to one or more entities and an entity may not appear in more than one data store. (4 marks)

Structural vs Temporal/dynamic (SSADM example): Each ELH corresponds to an entity

(3 marks)

Procedural/functional vs Temporal (SSADM example): Each bottom-level process that updates a main data store will be triggered by one or more events that appear on the ELH

(3 marks)

Examiner's Guidance Notes
For part (a) most candidates gave examples of structural, procedural and temporal modelling techniques, however fewer candidates discussed why such modelling techniques are commonly found in systems design methods.

For part (b) most candidates could explain how the different models were cross-checked.

Question 3
a) You are the IT director in a software house that has grown in size significantly in the past few years. Previously your staff did not use a systems design method. Discuss what 'practical' factors you would consider when selecting a systems design method for use in your software house. (12 marks)

b) What is an integrated CASE tool? Identify and discuss briefly three potential advantages and three disadvantages of integrated CASE tools. (13 marks)

Answer Pointers
a) Skills of the IT staff and business users. Systems design methods can require significant skills in order to be used effectively by IT staff and business users. (3 marks)

Complexity. Some systems design methods are complex as they are intended for large projects. In addition some systems design methods may be difficult to learn. (3 marks)

Tool support. For some systems design methods software tools may not be available or may be difficult to use / expensive to purchase. (3 marks)

Supports languages used. It would be practical to select a systems design method that supports the languages used for systems development (3 marks)

b) An integrated CASE tool (toolset) is a software system designed to support a significant part of the systems development process and the management of this process. (1 mark)

Examples of advantages:
Improvements in systems quality
Automated checking for consistency
Improvements in productivity (6 marks)

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Examples of disadvantages:
Staff education and training costs
Integration of the new tool
Customisation of the tool   (6 marks)

Examiner's Guidance Notes
For part (a) most candidates discussed relevant practical factors relating to the selection of a
systems design method.

For part (b) most candidates could describe an integrated CASE tool, and discuss the potential
advantages. Fewer candidates could discuss the potential disadvantages.

Question 4
a) You are the IT personnel manager in a large insurance company. You have been asked to provide training in an
     object oriented design method for the 30 graduates that will be joining the IT department shortly.
     Outline the different training approaches that might be used to train the graduate entrants in the object oriented
     design method.   (15 marks)

b) You are the IT manager in a manufacturing company. You have decided to introduce object oriented development
     techniques into your IT department. Discuss which approach to implementing object oriented development you
     would use: training staff in an object oriented design method first and then an object oriented programming
     language, training staff in an object oriented programming language first and then an object oriented design
     method, or training in both at the same time. Explain the reasons for your choice.   (10 marks)

Answer Pointers
a)   Training course for the object oriented design method.   (5 marks)

     Hands-on training approach, whereby the graduate entrants will learn how to use the object
     oriented design method while they are working on IT projects.   (5 marks)

     Computer based training (CBT) package to train the graduate entrants in the object oriented
     design method.   (5 marks)

b)   Is it more appropriate to learn object oriented concepts first (for example, encapsulation,
     polymorphism, and inheritance) or to learn practical examples first (for example classes,
     method overloading and method overriding) or can the two be done together.   (5 marks)

     Is it more appropriate to learn how to code first or how to design first, or can both be done
     together.   (5 marks)

Examiner's Guidance Notes
For part (a) most candidates provided appropriate training approaches.

For part (b) candidates generally found difficulty in justifying which approach to adopt.

Question 5

a) Avison and Fitzgerald provide a number of 'ideal – type' criteria that might be considered in assessing systems development methods. Some of these criteria are: life cycle coverage; effective communication; inter-stage communication; separation of analysis and design; visibility of product; designing for change; 'extendability'. Give an explanation of the meaning of each criterion. (7 marks)

b) Discuss the reasons why systems design methods may not be used by IT practitioners. (9 marks)

c) Discuss the reasons why systems design methods have been used by IT practitioners. (9 marks)

Answer Pointers

a) Explanation:
- A method should ideally cover the entire systems development process (including maintenance)
- A method should provide an effective communication medium between analysts and users
- The full extent of work carried out must be communicable to other stages
- The analysis of the user requirements is not influenced by design considerations
- The product at different stages of its development (analysis, design, etc) should be specified
- The logical and physical designs should be easily modified
- It should be possible to add new techniques and tools to the method, but still maintain consistency and framework of the method (7 marks)

(b) Systems design methods may not be used by IT practitioners due to:

Time constraints. A systems design method requires time to go through the particular techniques involved in the method, and to produce the required documentation. Sufficient time may not be available to undertake such activities in all IT projects, especially in maintenance projects. (3 marks)

Cost constraints. Using a systems design methods can add costs to an IT project in the short term, since the IT staff costs required to produce the documentation required for the systems design method will add to the overall IT project cost. If IT project costs need to be reduced, documentation and the use of systems design methods might typically be the first activities to be abandoned. (3 marks)

Reluctance of IT practitioners. IT practitioners may perceive little benefit in using a systems design method especially if they have developed / maintained IT systems successfully without using a systems design method in the past. Some aspects of systems design methods may appear overly bureaucratic to IT practitioners, particularly large amounts of documentation. (3 marks)

The three main reasons (benefits) are:
- A better end product. Improved quality attributes such as reliability, maintainability, etc. (3 marks)
- A better development process. Improved management and project control (3 marks)
- A standardized process. A common approach throughout an organization. (3 marks)

Examiner's Guidance Notes
For part (a): No serious problems. Most candidates provided reasonable explanations.
For parts (b) and (c) most candidates identified proper reasons for and against the use of design methods.