

**BCS THE CHARTERED INSTITUTE FOR IT**  
**BCS HIGHER EDUCATION QUALIFICATIONS**  
**BCS Level 6 Professional Graduate Diploma in IT**

**SYSTEM DESIGN METHODS**

**Section A**

**A1**

**Basic Elements of System Design Methods**

a) Give THREE arguments for using systems modelling. **(6 marks)**

b) What are State Transition Diagrams (STDs) and what aspect of information systems do they model?

Produce a STD for entity X whose instances are created by event Ev1, updated by event Ev2, and deleted by event Ev3. Please note that Ev2 can affect an instance of X several times. **(10 marks)**

c) There are different approaches to software prototyping. Explain, with the aid of diagrams the differences between throw away prototyping and evolutionary prototyping. Which approach to prototyping can be 'merged' with the waterfall software life cycle model and how? **(9 marks)**

**Answer pointers**

1. a)

Some arguments for systems modelling:

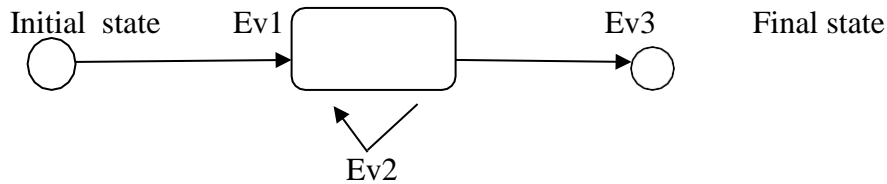
- Graphical models are more precise than text
- Graphical models are more succinct than text
- Models (of requirements) are good communication tools between developers and users
- Models (of requirements) are good communication tools between analysts and designers
- Design models are good communication tools between designers and programmers

Three arguments should be briefly discussed. **(6 marks)**

1. b)

STD – a diagram which shows the various states (of a system, object, entity) and transitions between states. Usually events that cause transitions are also shown (and initial and final states).

STDs model temporal/dynamic aspects of information systems. (4 marks)



STD (6 marks)

1. c)

The diagram showing throw away prototyping (3 marks)

The diagram showing evolutionary prototyping (3 marks)

Throw away prototyping can be ‘merged’ with the waterfall life cycle model. Typically, it is used as ‘a requirements gathering tool’ therefore it constitutes a part of the Requirements Analysis stage.

(3 marks)

### **Examiner’s Guidance Notes**

Part a) was answered reasonably well. Some candidates discussed such topics as prototyping, life cycle models, which are unrelated. Many candidates discussed very ‘general’ arguments, such as e.g. time efficiency, but did not properly explained them.

There is evidence that part b) caused some problems. In particular, many candidates produced completely wrong diagrams.

Part c). This part was answered reasonably well.

## A2

### Construction of a Method

- a) A smartphone app designer intends to develop a system design method for smartphone apps. Discuss what design techniques could be used to design the following aspects of smartphone apps:
- i) The user interaction with the smartphone app; **(5 marks)**
  - ii) The layout of the screens for the smartphone app; **(5 marks)**
  - iii) The detailed logic of the smartphone app. **(5 marks)**
- b) Consider a web developer who develops interactive educational websites for young children. Discuss what types of design techniques would be appropriate for developing interactive educational websites. **(10 marks)**

### Answer pointers

2. a)

The following or appropriate alternatives would be expected:

- i) The user interaction with the smartphone app could be designed using sequence diagrams. Sequence diagrams could indicate how the smartphone user would interact with the functions (use cases) provided by the applications.
- ii) The layout of the screens for the smartphone app could be designed using storyboards. Storyboards could graphically illustrate the layout of the screens within the smartphone app and describe how the different screen elements would operate.
- iii) The detailed logic of the smartphone apps could be designed using an activity diagram. An activity diagram could graphically represent the logic contained within the smartphone app in terms of sequence, iteration and selection.

(15 marks)

2. b)

The following or appropriate alternatives would be expected:

Websites for educational purposes could be developed using storyboards. The storyboards could graphically represent the interactive educational web pages. The storyboards could also show the stages in the progress through the learning materials and how movement between stages occurs. The storyboards could also describe how the user would interact with web page elements such as menus and buttons.

Decision trees or activity diagrams could be used to design the interaction to be provided by the educational website. Decision trees show the different paths that users can take through an application whilst activity diagrams show not just selection, but also iteration and sequence.

(10 marks)

### **Examiner's Guidance Notes**

There is evidence that this question caused many problems. Many answers were irrelevant or incorrect.

Part a). Many candidates discussed software life cycle models and design methods (such as waterfall, prototyping, Agile) instead of design techniques. Only a small number of candidates managed to identify proper modelling techniques.

Part b). Many candidates discussed software life cycle models and design methods (such as prototyping, Agile, etc.) instead of design techniques. Also, a substantial number of candidates discussed various features of interactive educational websites instead of design techniques.

A3

### Selecting a Method

- a) Compare the advantages and disadvantages of using object oriented and structured methods for administrative systems such as payroll. **(10 marks)**
- b) Discuss the criteria that would support the selection of a formal systems development method for an organisation. **(15 marks)**

### Answer pointers

3. a)

The following (or appropriate alternatives) would be expected:

Object oriented system design methods could model the data requirements of administrative system such as payroll using class diagrams, these are richer than ERD diagrams as they show both data and processes and therefore could be viewed as providing a fuller model of the system. The user interaction with an administrative system such as payroll could be modelled using use case diagrams and sequence diagrams (for more details), which clearly show which users interact with which functions. Object oriented systems design methods should allow for more re-use of components in an administrative system such as payroll than structured design methods.

Structured methods could model the data requirements of an administrative system such as payroll using entity relationship diagrams, although these are not as rich as class diagrams, they can be easier to understand conceptually. Dataflow diagrams could be used to show the overall set of processes involved in an administrative system such as payroll at different levels of detail, which object oriented methods do not so readily provide.

However, the events in an administrative system such as payroll modelled by entity life histories, could possibly be more clearly modelled by state machines (state transition diagrams).

(10 marks)

3. b)

The following or appropriate alternatives would be expected:

The criteria that would support the selection of a formal systems development method for an organization might include:

The development of systems that include a high level of complex mathematical modelling which would be supported by the mathematical approach found in formal methods for example flight simulators and missile guidance.

The development of safety critical systems such as nuclear power plant and air traffic control systems which require a high degree of precision in terms of design, in order to attempt to ensure that the system operates in a specified manner.

For mathematical model-based systems and safety critical systems formal mathematical based systems design approaches would be a suitable choice as such design methods can define requirements in an unambiguous manner.

(15 marks)

### **Examiner's Guidance Notes**

Part a). Only a small group of candidates identified proper advantages and disadvantages and carried out a direct comparison. Many 'advantages' and 'disadvantages' identified by the candidates were general and not properly justified.

Part b). There is evidence that this part caused candidates some problems. There were many irrelevant answers  
e.g. overview of structured and object-oriented methods, NIMSAD, etc. A substantial group of candidates discussed various general criteria for method selection e.g. quality of a product, end user involvement, etc. instead of specific criteria for the selection of a formal method.

## Section B

### B4

#### Introducing a Method

- a) An IT organisation has decided to introduce a new system development method for use in various projects.

Identify possible problems and risks which may affect the introduction of the new method and the measures that could be adopted to avoid these problems and risks. **(15 marks)**

- b) A large company has used a traditional structured method for many years. This method is to be 'replaced' by DSDM (an agile method). Produce a plan of action for introducing DSDM. Discuss briefly at least FIVE actions which should be included in the plan. **(10 marks)**

#### Answer pointers

4. a)

The introduction of a new systems development method might fail because the staff using the method might not have been trained sufficiently in the method. In order to attempt to avoid this situation appropriate training techniques could be used such as short courses, computer based training packages (where available) or 'a train the trainers approach' whereby a small group of staff are trained and then train the other staff.

The implementation might also fail because there is insufficient on-going support for the use of the systems development method. This can potentially be avoided by having readily available documentation and training materials, and / or designated members of staff who will answer any queries regarding the use of the systems design method.

The implementation of the systems design method might fail due to staff being unwilling to use the method or using it inappropriately. This can potentially be avoided by encouraging the staff to use the method and incorporating the use of the method into quality control measures used within the organisation such as inspections and reviews. It is also important to involve the staff in the process of selecting a method (the staff should be consulted).

Insufficient commitment to the new method by top management. The initiative of the introducing should be fully supported by top managers.

Underestimation of costs associated with the new method. All the costs should be taken into account: documentation, training, tools, etc.

The new method might be unsuitable for applications developed by your IT organisation. It is very important (when selecting a method) to make sure that the method is suitable

for your organisation.

(15 marks)

4. b)

Five (or more) actions should be specified. The actions are as follows:

- The reasons for introducing DSDM must be understood and the business case for DSDM should be developed – to justify its use.
- Philosophy and concepts of DSDM should be communicated to all concerned (initial training courses, etc.)
- The current development practices and procedures should be examined and compared with the DSDM approach
- Using the same comparison, the areas that will need to be changed should be identified
- Gain support and commitment for all the activities in the plan
- The first suitable project should be identified
- The project team should be trained (technical courses)
- The development environment should be set up

(10 marks)

### **Examiner's Guidance Notes**

Most candidates answered part (a) reasonably well and appropriately discussed the problems and risks that might occur, and the measures that could be adopted to avoid or reduce such.

Most candidates answered part (b) reasonably well and appropriately discussed an appropriate action plan.



## B5

### Evaluation and tuning of a method

- a) Give TWO (or more) reasons for comparing and evaluating systems design methods. **(4 marks)**
- b) Outline how an organisation could attempt to assess the benefits obtained through introducing a new systems design method. **(10 marks)**
- c) Consider the following criteria that might be used in assessing systems development methods:  
life cycle coverage, project management support techniques, documentation standards, improved quality of products, design for change, visibility of product, code generation facility.

Discuss, giving appropriate arguments, which criteria are suitable, and which are not suitable for the above purpose. **(11 marks)**

### Answer pointers

5. a)

An academic reason – to better understand the nature of methods in order to perform classifications and to improve future information systems development

A practical reason – to choose a method, part of one, or a number of methods for a practical application, a group of applications, or for an organisation as a whole. **(4 marks)**

5. b)

One approach to assessing the benefits obtained through introducing a new systems design method might be to compare the overall cost of developing a system using the new method with the cost of developing a similar system using the old method (or no method).

Another approach might be to compare the cost of maintaining a system developed using the new systems design method with the cost of maintaining a similar system developed using the old method (or no method).

Another approach might be to compare the number and frequency of implementation and post implementation problems encountered in systems developed with and without the new systems design method.

**(10 marks)**

5. c)

Explanations of the suitability of:

Life cycle coverage  
Documentation standards  
Improved quality of product  
Design for change  
Visibility of product

for assessing a method. (8 marks)

Code generation facility. This is not really a proper criterion to assess a method. It is more suitable for the assessment of a CASE tool.

Project management support techniques. This is more suitable for the assessment of a software project management 'method'.

(3 marks)

### **Examiner's Guidance Notes**

Most candidates answered part (a) reasonably well and provided reasons for comparing and evaluating systems design methods.

Some candidates answered part (b) reasonably well and appropriately discussed how to assess the benefits from adopting a new systems design method. However, some candidates discussed potential benefits, rather than how to assess such benefits.

Most candidates answered part (c) reasonably well and appropriately identified the suitable and unsuitable criteria for assessing a systems design method.