

**THE BCS PROFESSIONAL EXAMINATIONS  
BCS Level 5 Diploma in IT**

**April 2008**

**EXAMINERS' REPORT**

**Principles of User Interface Design**

**General Comments**

Candidates should ensure they give sufficient detail in their answers and use the number of marks allocated to the section as a guide to the depth of answer required for the question. Candidates should also answer questions in the context of the scenario presented and avoid repeating lists and theories recalled directly from text books.

**Question 1**

1As an HCI expert, you have been asked to carry out an expert evaluation of a small website selling designer sunglasses and tee-shirts. You choose to use a *structured walkthrough* in your evaluation.

- (a) Describe what is meant by the term *structured walkthrough*. **(4 marks)**
  
- (b) Design a *structured walkthrough* to evaluate each of the following aspects of the website:
  - (i) consistency; **(7 marks)**
  - (ii) navigation; and **(7 marks)**
  - (iii) functionality. **(7 marks)**

**Examiner's Comments**

This question requires candidates to have read about and understood the use of basic, standard evaluation methodologies. For candidates to achieve good marks, the answers must reflect the context of the scenario of the question, demonstrating their ability to appropriately adapt and apply a standard interactive system evaluation methodology for use in the setting of a website evaluation. A common problem with answers to this question was that candidates described the process of performing a structured walkthrough, rather than producing an actual design for an appropriate evaluation using this methodology, as asked for in the question.

- (a) A structured walkthrough is a formalised way of anticipating and testing users' actions as they interact with a system. Realistic task scenarios with identifiable outcomes are designed and used to test the ability of the system to support completing the desired task and identify and document any errors or issues encountered. **(4 marks)**
  
- (b) This is an open-ended question, and candidates' answers will vary. The following are some of the points that should be addressed by their answers. Marks are allocated for

covering the main points addressed by the question and presenting a coherent evaluation strategy.

Note that the question specifies “expert evaluation” so students should not include user selection/user groups/user testing in their answer.

When designing a structured walkthrough, specific objectives and outcomes should be identified as part of the design. The outcomes should be consistent with the goals of the website and be measurable.

The structured walkthrough differs from a heuristic walkthrough in that it follows scenarios constructed by the evaluator comprising tasks that will test the objectives of the system.

The following points may be addressed by students:

- As many elements of the website as possible should be evaluated
- Scenarios and tasks should be worded in a simple and straight-forward fashion
- Compliance with basic interface principles should be evaluated, e.g. use of colour, use of menus, chunking of information, use of icons, consistency and size of fonts
- Use of proforma/s to record the results of the scenario walkthroughs, e.g. time taken, errors made and recovery strategies used
- Technical performance of the website should be evaluated e.g. browser/platform compatibility, download times, search/filtering performance
- In the example cited in the question, the expert evaluator would be expected to be flexible and expand scenarios/tasks on the fly if indicated

In each of the case scenarios the evaluation would typically test the following:

- (i) that all the pages are consistent in terms of design, look and feel and menus;  
(7 marks)
- (ii) the navigation is consistent, allows access to all areas of the site, there are no broken links, it is easy to tell where the user is in the site and it is easy to backtrack; and  
(7 marks)
- (iii) functionality, e.g. buying of a pair of sunglasses and a tee-shirt, including browsing, search and filtering facilities and basket/checkout system.  
(7 marks)

## Question 2

Designers of user interfaces need to use their knowledge of the characteristics and limitations of human memory to ensure that interfaces avoid or overcome problems arising from human memory characteristics or limitations.

- (a) Describe the main reasons why *short-term* or *working* component of human memory is often referred to as the “great bottleneck”. **(5 marks)**
- (b) Give **three** general design guidelines an interface designer could apply when designing menus to help overcome the short-term/working human memory bottleneck. **(6 marks)**
- (c) Classifying human memory (or knowledge) as either *declarative* or *procedural* is useful when considering user interface design.
- (i) Describe the differences between declarative and procedural memory and give an example of each. **(8 marks)**
- (ii) Discuss why the differences between the two types are important in terms of human memory bottlenecks. **(6 marks)**

## Examiner's Comments

This question required candidates to have a theoretical knowledge of human memory and apply it in a particular area of user interface design. In general, candidates did not address the actual question asked in section (a), and knowledge of the theories of human memory was not well demonstrated.

- (a) The student's response would be expected to reflect the following:

Working memory has limited capacity and duration which is not absolute. The capacity seems to be 7+/- 2 CHUNKS and duration approximately 2-3 minutes.. CHUNKS are semantically coherent collections of data which are based on highly active processing and the contents of a single CHUNK can change depending on training and experience. Chunks appear to be more or less equivalent to “meaningful concept”, i.e. information with a single meaning. Users actively create chunks from data although the organisation of information in a user interface can assist in the creation of meaningful CHUNKS.

- (b) Designers have developed a number of strategies, which have been shown to control and encourage CHUNKING. The student could state any three of the following:

- Tasks should be decomposed (each = 1 chunk?).
- Menu titles should be used as options/items on subsequent menus. This forms links which encourages CHUNKING.
- Similar items should be grouped to aid CHUNKING.
- Sequencing should be meaningful to encourage grouping and hence CHUNKING.
- Items should be kept brief and consistent. Encourages linking, grouping and CHUNKING.

- (c) (i) The question is open ended and answers should include:  
Declarative memory refers facts or information about things, concepts, etc.  
Declarative memories that are consciously available and are often divided into:  
i. episodic memory referring to memory of events, times, places, associated emotions, and other conception-based knowledge, and

ii. semantic memory referring to the memory of meanings, definitions, understandings, and other concept-based knowledge. e.g. Edinburgh is the capital of Scotland, a dog is an animal, birds fly in the air. Users normally find it easy to describe their declarative knowledge.

Procedural memory refers to the way to achieve a task, to doing things, use of objects or movements of the body, such as how exactly to write and send an email, use a pencil or ride a bicycle. Once users have acquired procedural knowledge they find it very hard to describe how they do things – they just do them.

- (ii) Processing of declarative information such as in an interface, requires processing capacity which appears to cause the working memory bottleneck. Procedural knowledge possessed by users appears to require little processing by working memory. This is often referred to as “overlearning”. It should be noted that if users are trying to acquire procedural knowledge, then that it is declarative until “mastery” is achieved.

### Question 3

You are hired as an HCI expert to oversee the design of a computer program which will integrate three existing programs that are used for different functions in a company. In such cases *tasks analysis* becomes an important focus. The original design documents for the three programs have been lost so you will have to work directly with existing users.

- (a) Describe **two** suitable methods you could use to capture the tasks being performed using the three existing programs and discuss the advantages and disadvantages of each method. **(12 marks)**
- (b) Describe **three** important objectives of the *task identification* you will undertake. **(6 marks)**
- (c) Describe **two** suitable methods you could use for *task analysis* and discuss the differences between them. **(7 marks)**

### Examiner's Comments

This question required the candidate to apply their knowledge of task analysis, as part of user-centred design, to a specific scenario such as would be encountered in industry. Candidates did not give an appropriate level of detail on their answers to score high marks, and there was some deficit in the technical knowledge of the standard formal task analysis methodologies covered by the question.

- (a) The students could typically describe and discuss the following methods:
- (i) Direct observation;  
Advantages:  
- direct expert observation - no user opinion/interpretation;  
- can include classification of tasks.  
Disadvantages:  
- requires expertise/experience;  
- resource intensive;  
- can be time consuming.
- (ii) User questionnaires;  
Advantages:  
- can be very efficient;  
- can be administered by non-expert;  
- can capture from many users.  
Disadvantages:  
- need expert design;  
- prone to user subjectivity;  
- can not follow up on "interesting" answers.
- (iii) User interviews.  
Advantages:  
- expert can maximise information gained from user;  
- flexible form of information collection;  
- gives users a closer stake in the process.  
Disadvantages:  
- resource intensive;  
- takes up user time;  
- requires expertise/experience;  
- time consuming.

(2 marks for naming each method and 4 marks for each discussion)

- (b) The answer could include any three of the following:
- to understand the user's starting state and goal state
  - to understand the user's activities or how they move between the start and goal states
  - to understand the tools used by users to move between the start and goal states
  - to understand the environment and context users work in.
- (2 marks each)

(c) Answers would most likely be the following methods:

- (i) hierarchical task analysis (HTA) (also known as a prerequisite task analysis);
  - is a decomposition of the overall task that breaks to show the hierarchical relationship amongst the sub-tasks with each sub-task shown relative to others in the overall task.
- (ii) procedural task analysis (also known as an information-processing analysis).
  - a procedural analysis breaks down the steps, including decisions, a user must go through so the task can be successfully achieved. The steps are arranged linearly and sequentially from beginning to end in a flowchart or outline form.
- (iii) Knowledge Based Task Analysis;
  - builds upon HTA but focuses on the knowledge users need to carry out a specific task. Uses formal logic and grammars to represent the knowledge and these are computationally executable.
- (iv) Entity Relation Based Task Analysis;
  - borrows from Db design and uses a formal set of constructs such as Agents, Actors, Patients, Instruments, etc. to build a model of task components and inter-relationships. Resembles OO design and in particular UML. Uses HTA for final representations.
- (v) Scenario Based Task Analysis;
  - scenarios are used to describe tasks and to place these into context, e.g. stakeholders and environment. Uses HTA and Use Cases to formalise scenarios.

(1 mark for naming and 2 for discussion each + bonus mark for good discussion)

### Question 5

- (a) Describe **four** criteria which might be used to define any system as usable. (12 marks)
- (b) Accepted models of user-centred design comprise four main components.
- (i) Describe these components. **(8 marks)**
- (ii) Describe how they relate to each other. **(5 marks)**

### Examiner's Comment

The level of detail in the answers given by candidates for this question limited the marks that could be scored.

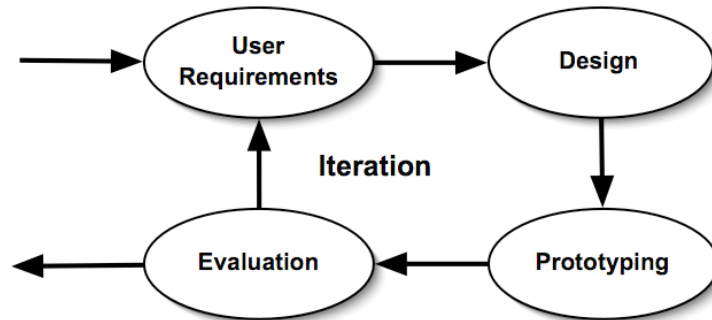
- (a) This is an open-ended question and students' answers will vary. The following points should be covered:
- (i) Effectiveness:
- whether the software does the job it is intended to do
  - the software supports the tasks that the user needs to do to carry out a specific job
  - usually achieved through detailed task analysis relating, e.g. to writing, careful design and subsequent evaluation of the software to ensure that the software supports the users' tasks.
- (3 marks)
- (ii) Learnability:
- any usable system should be easy to learn and also easy for a user to come back to
  - intermittent but regular users would benefit from learnability, enabling them to come back to the system with a minimum amount of effort.
- (3 marks)
- (iii) Flexibility:
- usable software needs to enable each and every user to work in slightly different ways
  - also should allow some degree of customisation
  - software should be designed in such a way as to cope with changing demands (e.g. tasks) from the user.
- (3 marks)
- (iv) Attitude:
- usable software should generate a positive attitude from the users
  - users should feel satisfied that the tool they are using supports their work and enable their tasks
  - it should result in a minimum amount of frustration.
- (3 marks)
- (b) (i) User requirements:
- studying user characteristics
  - task analysis
  - situational analysis
  - acceptance criteria.
- (2 marks)
- Design:
- conceptual design
  - functional design
  - dialogue design
- (2 marks)

Prototyping (2 marks)

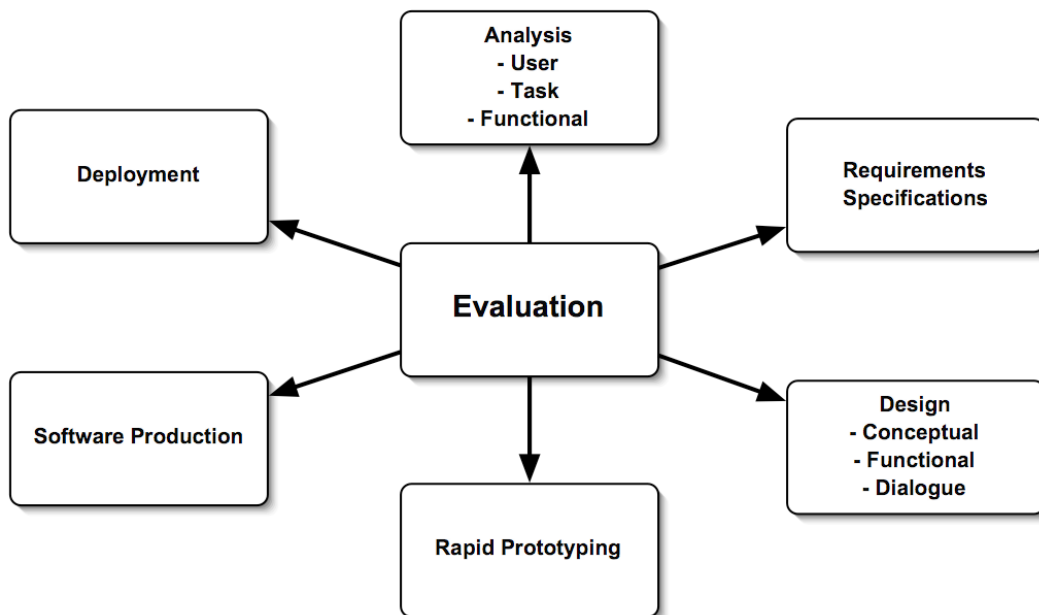
Evaluation and iteration (2 marks)

(ii) Either of the following schema could be described:

Interaction between components can be shown by the following diagram:



or the Star Model also acceptable



(5 marks)



### Question 5

Ethnographic approaches are often used in Usability Engineering to collect formative evaluation data to improve user interface design.

(a) What are the main characteristics of ethnographic approaches? **(5 marks)**

(b) What are the main strengths and weaknesses of ethnographic approaches to collecting evaluation data? **(10 marks)**

(c) Design an outline ethnographic study for collecting evaluation data for a new user interface that is intended for software programmers.

Your answer should address data collection, analysis and the role of the evaluator.

**(10 marks)**

### Examiner's Comments

No candidate attempted question 5.

(a) Ethnographic approaches originate in anthropology where they are characterised by "participation", e.g. living and working with people being studied.

In Usability Engineering the essential characteristic of ethnographic methods is contextualisation (often through participative observation). Evaluators try to take into account the context of users and try and build that into their evaluations. Methods used here include, interviews, questionnaires and focus groups, also direct observation and user feedback.

**(5 marks)**

(b) The strengths of ethnographic approaches are that they are more "natural" as compared to e.g. laboratory experiments. "Ecological validity" is potentially high as regards tasks and these approaches are more able to take into account "working environments" and "special situations".

The weaknesses of ethnographic approaches are they require a great of expertise and experience to be used effectively. Informal and loose approaches are often labelled ethnographic to give them a more credible label – not good and misleading.

Approaches can be time consuming and data analysis can be problematic if not formally planned. Data analysis can also be very time-consuming. Can therefore be expensive.

**(5 marks for strengths and 5 marks for weaknesses)**

(c) Open ended, unseen problem solving. Any reasonable attempt will be judged on merit. Answers

should acknowledge the "participative" and "contextual" nature of the study. This may mean that the evaluators work with the programmers and of course may him or herself be a programmer. The answer should suggest a method for collecting data, e.g. interviews, observations, workshops, focus groups, etc. Videos could be used. Data analysis could take the form of "reflective analysis" (e.g. as in Action Research), coding schemes from videos and statistics, scalings, ratings, etc.

**(10 marks based on the answer indicating a realistic and "doable" study)**

## Question 6

Most modern Graphical User Interfaces (GUIs) are based on the *desktop metaphor* seen with operating systems such as Windows® and Mac OS®.

- (a) What is meant by *desktop metaphor* in the context of user interfaces?  
(5 marks)
- (b) Describe the generally accepted rationale for the widespread use and success of the desktop metaphor in GUI operating systems.  
(10 marks)
- (c) Describe **two** limitations of the desktop metaphor for users of today's interactive systems.  
(4 marks)
- (d) Describe **two** similar metaphors in common use that extend beyond the desktop metaphor to address these limitations.  
(6 marks)

## Examiner's Comments

The question requires general knowledge of modern user interface design and an understanding of the commonly used desktop metaphor, e.g. as seen in Windows. An understanding of the strengths and weaknesses of the desktop metaphor is required. This is general user interface design material linked to material on human cognitive characteristics.

Answers lacked detail and little evidence of a systematic approach to answering the question was present. Candidates should ensure that basic material is covered when preparing for the paper. It is important to read the question and subcomponents carefully.

- (a) The Desktop Metaphor is an abstraction of the desktop or workspace. Sometimes referred to as the "paper paradigm", which is a more literal interpretation of a software version of the desk. Files are windows, wastebaskets are trashcans, and filing cabinets are disks. Modern GUIs are less literal and more abstracted in terms of icons and objects represented.  
(5 marks)
- (b) A core feature that makes the Desktop Metaphor usable and therefore popular and widespread is the human cognitive characteristic that "recognition" is far superior to "recall". GUIs based on the Desktop Metaphor are easy to learn and this further aids recognition. The similarity and overlap between different GUIs that use the Desktop Metaphor (e.g. Apple, Microsoft, Linux) facilitates the transfer of learning and further supports recognition and usability. A second feature is "action" rather than language, i.e. the reliance on object manipulation rather than command language. A third feature is the hierarchical structure, value added in modern systems with "hypertextual navigation" (i.e. non linear), a feature that maps onto and supports human associative memory structures.  
(10 marks)
- (c) Open ended problem solving.  
Here candidates are being given an opportunity to speculate but within a certain framework of current thinking and known trends. Key issues to be addressed should be that current Desktop Metaphors do not take account the "social context of work" that should influence the "organisation of work" and tasks in GUIs. A core issue in these developments is to facilitate access to information in a world where the amount of information available to users grows steadily.  
(4 marks)

- (d) Open ended problem solving.  
Good answers could mention a number of current developments that could be said to be going beyond the Desktop Metaphor, e.g. Lifestreams, Haystack, Task Gallery, GroupBar, and Scalable Fabric. (6 marks)