

THE BCS PROFESSIONAL EXAMINATION
Professional Graduate Diploma

April 2005

EXAMINER'S REPORT

User Interface Design

General

Candidates produced a range of answers to the questions set in the paper and overall the standard was quite good. A number of candidates produced very good answers indeed. The main problems observed were that some candidates were not well-prepared for the paper and again it was noted that a number of candidates did not address the questions but chose to write about general issues relating to user interface design. Candidates are advised to read the questions carefully and focus their answers only on material required by the question. It is also worth pointing out that the length of answers is not an important issue. A number of candidates produced very long answers that went beyond the scope of the questions. This does not result in extra marks. On the other hand, many candidates provided shorter, to the point answers that yielded high marks.

Question 1

1. Your company is developing a mobile multimedia handheld computer with wireless networking. The computer will have a colour screen of approximately 15cm x 10cm. Although details have not yet been finalised, the computer will run some form of Microsoft Windows® operating system.

Provide a set of general guidelines for how the user interface and user interaction should be designed. The guidelines should address both software and hardware issues, e.g. use of stylus and buttons to aid interaction. You may use diagrams to illustrate your proposed guidelines.

(25 marks)

Answer Pointers

There are a number of issues that need to be addressed such as:

1. Visual Interface – Limitations imposed by small screen size:
 - Fonts
 - Icons
 - Other graphics
 - Layout
 - Special issues arising from multimedia.
 - Data eyes and other possible alternative wearable visual interfaces
2. Input – Absence of a keyboard
 - Co-design issues relating to software and hardware limitations
 - Use of stylus – implications for textual and graphical input
 - Use of buttons – ergonomic issues and relationship to stylus.
 - Voice command control

A key issue here is for candidates to demonstrate knowledge of general user interface design guidelines and show an understanding of how these would have to be modified and adapted for a hand held computer.

Examiner's Comments

Although there were a number of good answers to this question, most tended to regurgitate standard textbook interface design guidelines (generally from Schneiderman) with little or no attempt to apply them to the hand-held device in question. Candidates who demonstrate that they are able to recall large sections of the standard texts are generally credited with some marks for their answers. On the other hand, candidates who show that they are able to filter and apply given wisdom whilst augmenting it with reference to contemporary technologies (thereby demonstrating something other than textbook knowledge) are rewarded with the highest marks.

Question 2

2. It is well documented that the characteristics of human memory place limitations on human-computer interaction and must be taken into account when designing user interfaces.
- a) What are the main memory limitations and problems experienced by users when interacting with computers?
- b) Provide recommendations for how you can take account of human memory limitations when designing user interfaces.

(25 marks)

Answer Pointers

Part (a)

Common sources of memory problems associated with human computer interaction are mostly to do with the limitations and characteristics of human short-term memory although problems relating to long-term memory may also occur. The main problems associated with short-term memory include:

- Duration of stimuli may be too short for selection of "relevant" data.
- Sensitivity to secondary input that displaces current content
- Limitations imposed by the CHUNKING limit of $5-7 \pm 2$ – overloading causes displacement.
- Sensitivity to interpolated tasks (displaces, prevents rehearsal and re-coding).

As regards long-term memory the main problems are an over-reliance in interface tasks on recalling information rather than recognition. Studies have shown that human recognition is far superior to the recall of information.

Part (b)

1. Modern graphical user interfaces exploit a very important characteristic of human memory, namely that human recognition is far superior to recall. Therefore, an important recommendation is to provide users with "mnemonic" clues in the forms of icons and texts.
2. Human ability to Chunk information according to meaning is an important characteristic that should form part of design guidelines:
 - Measure and ensure that no information in a user interface exceeds the general guideline of $5-7 \pm 2$.
 - Design information to allow Chunking – this can be done through associations and learning models.
3. Dialogue should be designed to be a series of tasks – this avoids short-term memory overloads.
4. Aid selection of visual information with graphical cues – helps prevent problems with short-term sensory memory.
5. Apply "minimalist" rules to dialogue.

Examiner's Comments

This question addresses fundamental cognitive science issues relevant to user interface design and a large number of candidates chose to answer the question. The quality of answers had a wide range. Some candidates produced outstanding answers showing a good grasp of the material and its implications while some were poor. A large number of answers were good but could have been improved through greater detail and a more systematic approach. Poor answers seemed to be reflection of a lack of preparation. On a general note it is important that candidates read the question carefully and understand what is required of them before answering. Some answers were quite long due to the inclusion of material not relevant to the question.

Question 3

3. In modern times, user interfaces are designed and implemented with User Centred Approaches - often referred to as Usability Engineering.

- a) What are the main characteristics of Usability Engineering and what are the main phases of development and implementation?
- b) What are the main advantages and disadvantages of Usability Engineering?

(25 marks)

Answer Pointers

Part (a)

Main characteristics of Usability Engineering are:

- 1. Early and often intense involvement of users.
- 2. Prototyping.
- 3. Evaluation
- 4. Iteration.

Prototypes are produced early, as these are an expression of the requirements. Users find it hard to specify requirements but can work with prototypes. Evaluation plays a central role – all aspects are evaluated to obtain formative guidance. Iteration is a key feature.

Main phases:

- 1. Requirements, analysis of user needs.
- 2. Design:
 - i. Conceptual
 - ii. Functional
 - iii. Dialogue
- 3. Prototyping
- 4. Iteration of prototypes through evaluation
- 5. Deployment/maintenance

A good answer would summarise the main characteristics and phases through a diagrammatic model such as the Star Model. Further, good answers would describe how the process of Usability Engineering works, e.g. user centred design gives the impression of being linear, this is not so as the phases are usually done in parallel and this approach is increasingly common. The whole process is about capturing requirements through knowledge elicitation using formative evaluation methods and prototypes.

Part (b)

Main advantages include:

1. Products are more efficient, effective and safe.
2. Usability Engineering assists in managing users' expectations and levels of satisfaction with the product.
3. Users develop a sense of ownership for the product.
4. Products require less redesign and integrate into the environment more quickly.
5. The collaborative process generates more creative design solutions to problems.

Main disadvantages include:

1. Usability Engineering can be more costly as compared to conventional methods.
2. Usability Engineering can be more time consuming as compared to conventional methods.
3. Usability Engineering may require the involvement of additional design team members (i.e. psychologists, ethnographers, etc.) and wide range of stakeholders.
4. On occasion it may be difficult to translate some types of data into design.
5. The product may be too specific for more general use, thus not readily transferable to other clients; thus more costly.

Examiner's Comments

A relatively small number of candidates chose this question although the material covered is fundamental to user interface design. Perhaps this was a reflection of the second part of the question requiring synthesis. Most answers were good while some were less so. Overall, the main problem with a number of answers was a lack of detail. These answers provided an overview and some discussion but lacked depth and detail. It is important that when candidates prepare for an examination they should be expecting to answer questions in detail if they wish to be awarded high marks. Some answers were quite long due to the inclusion of material not relevant to the question.

Question 4

4. You work as an independent web design consultant and a large commercial company has approached you for help. The company hosts a number of websites and have received negative feedback from both staff and customers. The company asks you to address the following:

- a) How would you go about setting usability criteria for a website?
- b) Evaluations of websites frequently focus on the look and feel of web pages rather than structure. How can you design an evaluation study that focuses on the structure and organisation of a website?
(Note: structure and organisation in this context refer to how web pages and other elements, e.g. graphics, are linked together to form logical meaningful navigation.)

(25 marks)

Answer Pointers

Part (a)

Generally many web sites try to offer good advice on usability criteria but most are quite vague and general. None are operationalised, i.e. tell you how to implement the criteria in practice. Many are unrealistic in terms of being converted into measures that would be important for evaluation.

Usability criteria provide the baseline for most evaluation studies. There is no agreed way of setting usability criteria but these tend to be set out in broad terms and are then operationalised so that measurements can be made to establish if the criteria are being met or not. Common approaches include:

1. Brainstorming by design team.
2. Analysis of published literature.
3. Analysis of original criteria set for a site.
4. Use of general heuristics.
5. Consultation (elicitation) with management.
6. Requirements studies with users.

Part (b)

Most common approaches involve capturing data that allows a comparison of a Website's structure to users' conceptual or mental models of the knowledge domain. Generically this usually involves some form of classification system, e.g. Card Sorting. Here users are provided with cards, each one representing a web page or other "structure". Cards are then sorted into named piles, which can then be linked. The results are then compared with the actual structure. Various statistical techniques can be used on the results, e.g. cluster analysis.

Examiner's Comments

In general, this was a poorly answered question. The vast majority of candidates who attempted this question appear to have reacted to the word 'usability', rather than reading the whole question and identifying the actual requirement. Part (a) of the question required candidates to discuss how usability criteria can be identified and set. Most answers simply regurgitated standard textbook guidelines on usability (mainly from Schneiderman). Part (b) of the question required candidates to demonstrate an understanding of the process by which the information architecture of a web site can be evaluated as appropriate and fit for purpose. In a similar fashion to part (a), most answers focused on describing ideal types of information architecture (again, straight from the text book) rather than dealing with the actual requirement of the question.

Question 5

5. You are a member of a software development team designing the graphical user interface to a software package that will be used in schools to teach interactive system design. The user interface will employ a mixture of text and graphics but a special emphasis will be placed on the use of high quality icons.

Write a set of guidelines and recommendations for the team on how to design the icons for the graphical user interface.

(25 marks)

Answer Pointers

There are available a number of general guidelines for the design of icons. Shneiderman has provided a set of guidelines that can be summarised as:

1. Represent the object or action in a familiar or recognisable manner.
2. Limit the number of different icons.
3. Make icons stand out from background.
4. Consider 3D icons (Good but can be distracting).
5. Make sure that a selected icon is clearly visible when compared to non-selected icons.
6. Ensure that each icon is distinctive as compared to other icons.
7. Ensure the harmoniousness of each icon that belongs to a group or family of icons.
8. Design the movement animation: When dragging an icon, the use might move the whole icon, just frame, possibly a greyed-out or transparent version, or a black box.
9. Add detailed information, e.g. shadow for size, thickness for breadth of folder, colour for age, etc.

10. Explore the possibility of combining icons to create new objects or actions.

Answers should typically address the issues listed above and elaborate on these and place them in context.

Examiner's Comments

This proved a popular question and many candidates provided good answers while other answers could have been improved in terms of depth and detail. It appears that some candidates chose this question as they felt they had things to say about icon design without having studied relevant material in detail. Some candidates provided general material on user interface design, e.g. design guidelines. Not many marks are awarded for such answers unless the material is related and linked to the design of icons. It is worth emphasising that candidates should spend time reading and understanding the question and focus on answering the question and only the question. Long answers that provide peripheral information do not attract good marks. It is better to answer the question precisely and concisely as this results in high marks, even if the answer is relatively short.