BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

PRINCIPLES OF USER INTERFACE DESIGN

April 2015
Answer any FOUR questions out of SIX. All questions carry equal marks.
Time: TWO hours.

Answer any Section A questions you attempt in Answer Book A
Answer any Section B questions you attempt in Answer Book B

The marks given in brackets are indicative of the weight given to each part of the question.

Calculators are NOT allowed in this examination.

General Comments

Some candidates gave good answers demonstrating knowledge of the theory and basic practice of User Interface Design, but a number of answers showed no understanding of the basics.
Candidates must answer the questions asked. Marks cannot be given for answers that do not address the question.
Do not waste time and effort re-writing or summarising the question at the start of the answer, the examiner knows what the question is.
Look at the number of marks allocated to each question or part of a question and use that as a guide to how much detail is required in the answer. One or two marks for a question or part of question indicates a single point or sentence is required. Do not waste time and effort giving long, detailed answers as they cannot earn more than the one or two marks.
Do not waste time giving your opinion on the suitability, or not, of a method or technique where a question has asked for a description of how to use it, unless you have been specifically asked to do so.
Section A
Answer Section A questions in Answer Book A

A1. In the context of user interface design and evaluation, briefly describe how you would carry out the following briefs.

Your descriptions must relate specifically to the scenario outlined.

a) Use a card-sort exercise to decide the structure and layout of the navigation menu for a website promoting tourism in a small city.

   (8 marks)

b) Use storyboards to evaluate the proposed toolbar for an tablet micro-blogging social network app with a small group of users.

   (8 marks)

c) Do a cognitive walkthrough of a bank automated teller machine (ATM) that customers have reported difficulties withdrawing cash from.

   (9 marks)

Answer Pointers (A1)

The questions are open ended, so answers will vary, but they should cover at least the majority of the points below.

a) In this scenario, the page structure would already be determined, so it is a matter of arranging the pages in a suitable order, perhaps with groupings/sub-groupings. A number of users would be used for the card sort exercise, preferably potential website users, but probably more likely various representatives of the stakeholders. Ideally they should all work together as a group and reach a consensus, but if this is not practical, they could do it individually and you would have to collate and rationalise the results.

   There are also a number of tools that allow card sorts to be done collaboratively online.

   Create a list of all the pages in the site that will be the menus and place each item on a card, keeping some blank cards for group headers etc.

   Have copies of the pages available for users to look at/read.

   Have the users sort the cards into groups of similar or related topics i.e. logically associated.

   Each pile would then represent a sub group in the navigation menu.

   They should also consider whether piles should be further subdivided.

   Users should then come up with a name for each “pile” and that becomes the menu or sub-menu heading.

   Some pages may not fit into groups or may be stand-alone.

   The users should consider the stand-alone pages and determine if they should be individual items at the top level or get lumped into an “other” group.
The users should then sort the piles into a logical structure to give the order of the menu.
It is usually useful to ask users to further sort the piles and indicate relations between them to give alternate structures which can even be evaluated against each other. (8 marks)

b) The storyboards should act as prototypes for the dialogues and actions associated with the items on the toolbar. The storyboards should accurately show the proposed icons and other interactive elements, allowing you to see if they accurately represent the actions to the users e.g new micro-blog etc. Use a sequence of scenarios to represent the tasks/actions users would perform using the toolbar. Each dialog/subsequent screen in a scenario should be represented by a board that can be presented to the users as the “result” of their interaction with the toolbar. Both specific prepared questions and open ended invitations to comment should be given to the users regarding how they perceive and experience the interface and the interactions. Users should be prompted to comment on all aspects of the interface and interaction from icon representation, layout, size, colour, fonts, feedback/instruction, readability etc. (8 marks)

c) A cognitive walkthrough is a formalised way of anticipating a user’s thoughts and actions when using an interface. A detailed design description or a simulation/example of the cash machine software is required. Information about the users who had problems would be ideal, but otherwise obtain information on the bank customers in general. The task to be investigated is determined: cash withdrawal. Walk through each step a user has to take to do the task, attempting to anticipate the customer’s actions, taking into account what you know of the customers in terms of age, experience with ATMs, computer literacy etc. Note the prompts and feedback provided by the interface and any problems that are encountered. Anticipate and make errors that the customers might, and note how errors are handled, help is given and whether any error recovery support is effective. Particular attention should be paid to any interactions that have the potential for short-term memory overload, interpolated tasks, distraction/loss of attention, or other common cognitive related usability issues. The walkthrough should allow identification and documentation of where and how customers are likely to be making errors and identify potential solutions. (9 marks)
Examiners’ Guidance Notes (A1)

Some candidates showed a good understanding of how to undertake the techniques required in these scenarios, but many failed to adequately describe how to do them, but rather gave a theoretical descriptions of what the techniques are. Despite the emphasis in the question, a number of candidates totally ignored the scenarios and generalised their description. Any theoretical knowledge or background to the techniques were not relevant to this question unless candidates related this to the scenarios as described.

A2. As an HCI expert you have been asked to evaluate the usability of a website that sells different models of tablet covers. You decide to do a direct observation user evaluation of the site using twenty tablet owners.

You decide to recruit a user-group for the evaluation from people using tablets in a public library.

a) Describe FIVE user profile metrics you would collect from the evaluation group.
   (5 marks)

b) Briefly describe ONE suitable scenario to use in the user evaluation of the website.
   (5 marks)

c) Describe THREE metrics you could collect from direct observation.
   (6 marks)

d) As tablets are increasingly used by people with disabilities, you decide to use an expert evaluation approach to evaluate accessibility of the website.

Describe THREE elements you would check to ensure accessibility guidelines are being followed on the web site.
   (9 marks)

Answer Pointers (A2)

This is an open-ended question, so answers will vary.

a) Any five reasonable metrics, including any of:

   Age, gender, computer experience, disabilities, level of education, other devices used to access web, length of iPad use, type of iPad used, what they use the iPad for, frequency of online purchasing, use of various common online retailers/auction sites e.g. Amazon, eBay, iTunes. (1 mark each.)

   (5 marks)
b) Any reasonable scenario would be acceptable, along the lines of:

The user must:

Subtask 1
- start at the home page
- find a blue leather folio cover for an iPad Air (you know there is one on the site)
- add the cover to their basket

Subtask 2
- go to checkout
- fill in the following (false) personal information ... provided

Subtask 3
- deal with the error messages from the failed transaction
- report the problem to the site owner (who has been warned to expect test report from made up details)

(5 marks)

c) Any three of:
- Time taken to complete each subtask of the scenario
- Number of errors made during each subtask
- Type of errors made during each subtask
- Recovery from error
- Use of help

(2 marks each)

(6 marks)

d) Any three of the following or other based on the W3C Web Content Accessibility Guidelines (WCAG):
- Alternative text descriptions for all visual elements e.g. images
- Alternative text descriptions for all navigation links - e.g. menu and button links
- All functionality accessible from a keyboard
- Readable text as defined by WCAG e.g. adequate contrast between text and background, font selection etc.
- Ability to customise font size
- Text alternative to any audio based material e.g. videos
- Adaptable presentation e.g. simpler layout
- Ensure there were no elements likely to trigger seizures e.g. rapid flashing elements, rapid red transitions

(3 marks each)

(9 marks)
Examiners’ Guidance Notes (A2)

A number of candidates gave appropriate answers to each part of this question, but a number of answers gave more detail than the marks given indicated were required. Some answers gave evaluation techniques or methodologies instead of metrics. Once again, it must be emphasised that the user’s facial expression is not a valid usability metric.

A3. a) With respect to the use of colour in user interface design, describe what is meant by:

i) Contrast. (2 marks)

ii) Colour pollution. (2 marks)

iii) The Stroop effect. (2 marks)

b) Describe THREE uses where colour has been shown to be helpful in user interfaces. (6 marks)

c) In the context of Graphical User Interfaces (GUIs):

i) Describe what is meant by the term *icon* and why they are used. Give three distinct examples of GUI icons. (6 marks)

iii) Describe what *metaphors* are and why they are used. Give three distinct examples of GUI metaphors. (7 marks)

Answer Pointers (A3)

a) i.) Contrast- a large colour or luminosity difference between the foreground/text and the background. e.g. black text and white background. (2 marks)

ii) Colour pollution - excess use of colours, particular highly saturated colours, in the UI. A maximum of 6 is usually recommended. (2 marks)

iii) Stroop effect - where colour coding contradicts underlying information leading to cognitive slowing and error. (2 marks)
b) Any 3 of:
- Colour is good for segmentation of displayed information and identifying related areas in the display;
- Colour good for search tasks and less use for categorisation tasks;
- Colour is good at making elements in an interface stand out;
- Search and memorisation tasks - inexperienced users find colour more helpful than experienced users.

(2 marks each)

(6 marks)

c) The questions are open-ended and student’s answers will vary, but should cover the following points. Marks are awarded for accuracy and depth of answers.

i) Describe an icon.
An icon is a visual representation of a function or action usually associated with a toolbar button or menu item. They are usually small and may be abstract.

(3 marks)

ii) Describe why icons are used.
Icons exploit the way the human long-term memory performs recognition with greater speed and reliability than it does recall, enabling user learning of GUI functions.

(3 marks)

iii) Describe what metaphors are in GUIs
Metaphors are ways in which familiar objects, usually from outside computing, are used to describe elements in GUIs or systems.

(3 marks)

iv) Describe why metaphors are used.
Metaphors are used to help the user develop an appropriate mental model of the system. By exploiting the familiar preconceptions of the user, they help bridge the gulf between their mental model of the system and the reality of it.

(4 marks)

Examiners’ Guidance Notes (A3)

Much of this question covered very basic user interface design theory, but disappointingly, too few answers showed good understanding of this. Candidates must read about and understand the basics in order to be able to get any way towards applying them in a useful way.
Section B
Answer Section B questions in Answer Book B

B4. Human memory places important limitations on how users interact with computers. Errors and mistakes are often attributed to human memory.

a) Briefly outline the main components of human memory as described by information processing models. (5 marks)

b) In the context of human memory limitations and human computer interaction, describe what is meant by the “memory bottleneck” and explain how this occurs. (5 marks)

c) Discuss how user centred dialogue design could be used to overcome the “memory bottleneck” problem. (15 marks)

Answer Pointers (B4)

a) This refers to the basic Atkinson Shiffrin Modal Model of memory, which comprises Sensory Memory, Working Memory and Long Term Memory. The first two components are referred to as Short Term Memory. 1 Mark for naming each component and 2 marks for the STM/LTM distinction.

b) Refers to the characteristics of Working Memory (1 mark). The capacity of WM is 7+/-2 Chunks of information (1 mark). A Chunk is a semantic entity of some kind based on the relationships between materials (2 marks). WM only has a duration of seconds without rehearsal (1 mark).

c) Open ended. The basic issue is to design materials to Chunk naturally. This can be done through testing and experimentation with users as part of user requirements. The nature of this work depends on the nature of the materials but the process is always similar in extracting natural Chunks from users and then testing this again with users. 5 marks. More advanced answers would include sequencing of dialogue to ensure that material is not exceeding 7+/-2 Chunks at any given time. This is the cognitive basis of many sequential dialogue designs seen e.g. in menus and pop-ups (5 marks). Even more advanced answers would address how dialogue design, e.g. in the form of menus that are sequential use reminders to refresh users’ WMs and this is a form of rehearsal. Together these approaches attempt to control both Chunking and duration. Evaluation and testing are always crucial components (5 marks).

Examiners’ Guidance Notes (B4)
Quite a few candidates provided good knowledgeable answers to all three sections. However, on many occasions attempts were let down by a lack of detail and by being too general. Candidates should pay close attention to the number of marks allocated to each section and spend most time on e.g. c) which carries the most marks.
B5. a) Briefly explain the difference between user experience and usability in the context of evaluation.  

(5 marks)

b) Briefly explain how cognitive modelling approaches to evaluation might help design usable systems.  

(5 marks)

c) Heuristic evaluation is frequently used in industry to determine the usability of systems.

i) Briefly outline the main characteristics of heuristic evaluation?  

(5 marks)

ii) Explain the possible advantages of using heuristic evaluation.  

(5 marks)

iii) Explain the possible disadvantages of using heuristic evaluation.  

(5 marks)

Answer Pointers (B5)

a) Usability usually involves objective measures and is characterised by rigorous studies. User Experience is wider in nature and takes into account more emotional aspects of usability. The two are often contrasted but UX is really an extension of U.

b) Cognitive Modelling in evaluation really means simulating users with software architectures. The most noted is Adaptive Control of Thought Rational or ACT-R. A spin of is the CogTool system.

c)  

I. Heuristic evaluation is an approach where rules or criteria are used to evaluate a UI. Promoted by Nielsen as a simple and cheap approach, which can be applied by any user or designer. Nielsen has suggested 10 heuristics. (5 marks)

II. The advantages of Heuristic Evaluation are that it encourages user participation and the involvement of stakeholders. Also, relatively simple and easy to use which also means economical. (5 marks)

III. The disadvantages are that in order to work, the heuristics must be well defined as measures. The 10 heuristics suggested by Nielsen are to wide and vague and need to be refined. While this has been done by some, not by others. There is a problem of expertise, i.e. expert evaluators do a better and more consistent job of evaluation as compared to non experts. (5 marks)
Examiners' Guidance Notes (B5)

Many candidates provided very good answers while at the same time there were quite a few answers that indicated a serious lack of preparation. Other answers, while showing some knowledge and insight, often lacked detail. It is important that all candidates read the questions carefully and focus only on answering what is required. Writing down everything you know about a topic does not attract good marks.

B6. The following is a bespoke graphical user interface for software used in clinical genetics to assist with the collection of information about families.

In using the system, it has been noted that a number of errors have been made and you are tasked with planning a study to investigate these errors.

a) What are the main user related issues you might wish to investigate? (5 marks)
b) What are the main graphical user interface and computer related issues you might want to investigate?  
(5 marks)

c) What are the main human-computer interaction related issues you might want to investigate?  
(5 marks)

d) Based on your analysis in a), b) and c), provide an outline of how you would apply User Centred Design to designing an improved system.  
(10 marks)

Answer pointers (B6)

a) What are the main user related issues you might wish to investigate?  
5 marks

Issues to be addressed and discussed should or might include (1 Mark for each):

1. Who are users and what are their characteristics – needed for comparison with task/job description.
3. Training and learning – how adequate for tasks/jobs?
4. Organisational/management – ethos and culture, supportive, open, work patterns, etc.
5. State of users when using the system, e.g. tiredness, stress, time pressures.

b) What are the main graphical user interface and computer related issues you might want to investigate?  
5 marks

1. Ergonomic design and user interface standards. Comparison with other similar systems.
2. Workplace layout – physical movements and control.
3. Visibility and presentation of information, UI, GUI, etc.
4. Integration of task components e.g. physical notes, charts in relation to software.
5. Hardware/Software issues, e.g. type of CPU, Memory, disks, OS, networks, etc. Emphasis on implications for problem at hand.  
1 Mark for each.

c) What are the main human-computer interaction related issues you might want to investigate?  
5 marks

1. Original design documents, e.g. Task analysis and modelling of job and tasks/sub-tasks. Situational analysis.
2. Allocation of tasks and Automation; role of operation vs role of machine and the relationship between the two.
3. Dialogue design
4. Visual design of UIs, GUIs and overall work interfaces as a match to human characteristics
5. Existing documentation at plant re: previous reported problems, input and observations made by operators, etc.

1 Mark for each.

d) Based on your analysis in 1, 2 and 3, provide an outline of how you would apply User Centred Design to designing an improved system.  

10 marks

This component is open-ended problem solving and synthesis and allows candidates to apply knowledge and experience of UCD and prototypes. Answers will be judged on the merit of showing knowledge of rapid prototyping based on the information and conclusions that arise from 1, 2 and 3. The importance of formative evaluation should be emphasised and some idea given as to how this might take place. Can also include expert analysis and walkthroughs. Real end users should be involved, as should other stakeholders (e.g. patients and families). A good answer might see the need to use the existing system as a control and compare it to improved prototypes.

Examiners’ Guidance Notes (B6)

While some answers provided good attempts and showed study and preparation a number of candidates chose to write down anything they could think of that related to UI design one way or another. This kind of “brain dump” does not attract good marks. Candidates must read the question carefully and focus only on what is being requested in terms of knowledge and problem solving.