NEWCASTLE UNIVERSITY

SEMESTER 1 2008/09

GRAPHICAL USER INTERFACES

Time allowed - 1½ Hours

Instructions to candidates:

Answer ONE question from Section A and ONE question from Section B

Use separate answer booklets for each question

Marks shown for subsections are indicative only

SECTION A

Answer EITHER Question 1 OR Question 2.

Question 1.

a) Describe the layering graph drawing algorithm for binary trees, and illustrate the algorithm's behaviour by applying it to the binary tree given in Fig. 1. Include all the intermediate steps and describe the properties of the layout that are characteristic of the layering algorithm. [15 marks]

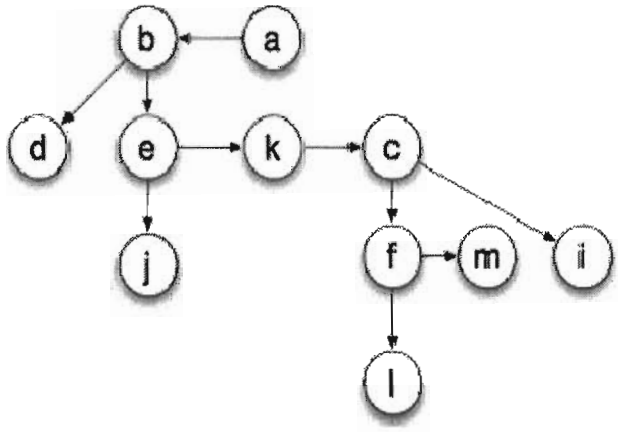

Figure 1. Example binary tree for Question 1a)

b) Describe examples of how real-time graph layout may be used in graphical user interfaces. Include in your description two distinct applications for which real-time graph drawing algorithms are required, and explain how an understanding of the properties of the drawing algorithm can be used by the interface designer. [5 marks]

c) Consider the problem of laying out a binary tree and placing textual labels next to the each node (i.e. not inside the graphical representation of a node). Suggest how you might modify either the layering algorithm or the divide-and-conquer algorithm to ensure a non-overlapping layout. [5 marks]

Question 2

a) Variable ordering, value ordering, and pruning are three heuristics that can be applied to exhaustive search techniques for point feature label placement. Devise a single labelling problem for four or five point features that illustrates how the application of each of these heuristics can improve on the performance of an exhaustive search algorithm, and demonstrate the improvement for each heuristic. [12 marks]

b) Consider the folder containing 5 files shown in Fig. 2. Using Zhang's theory of external representations for relational displays devise a graphical representation of a folder for the attributes shown in the figure. Justify your design choices in terms of his theory and point out and discuss the advantages and disadvantages of your design over conventional folder views (such as that illustrated). [13 marks]

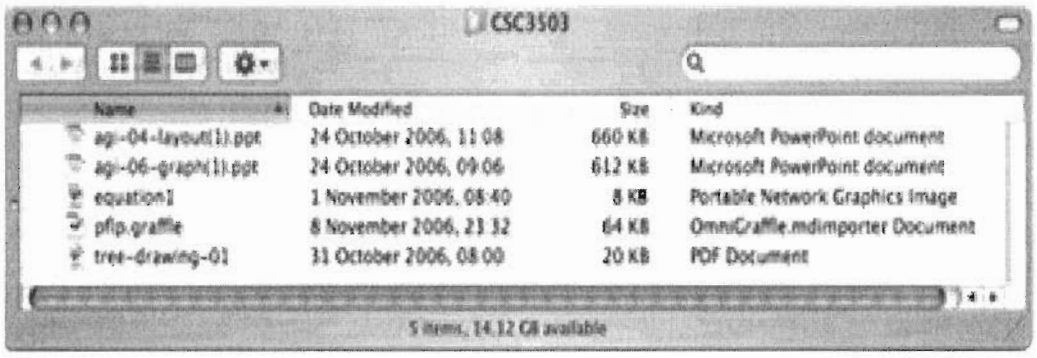

Figure 2. Example folder containing 5 files for Question 2(b).

SECTION B

Answer EITHER Question 3 OR Question 4.

Question 3.

a) Define the term *ubiquitous computing*. Using examples, explain why designing graphical interfaces for ubiquitous computing applications differs from designing interfaces for desktop computing applications. [6 marks]

b) You are given the task of designing a graphical user interface for a real-time social networking application to be run on a small portable media player. You can make the following assumptions:

- the social networking application supports group co-ordination for nomadic users who carry one of these media players;
- the application enables users to see nearby friends to: (1) send and receive notifications (notifications do not have a textual content but rather just indicate that another person wants to attract the attention of the receiver); and (2) set the range of visibility (i.e. the maximum distance for other people to still be visible in the interface);
- the portable media player: (1) has a colour-screen of about 5×5cm (resolution 200×200 pixels); (2) the display is touch-sensitive (but does not support multi-touch interaction); (3) the media player is wirelessly connected to a network; and (4) the player determines its location by geo-locating the base-station it is connected to.

Briefly describe your design for this graphical user interface. Give a justification for the choices you make. [13 marks]

c) Contrast animation and transparency. Discuss the drawbacks and advantages of each when used to increase the amount of information shown on a large public display mounted in a city square. [6 marks]

Question 4

a) Briefly describe Fitts' Law. Select an interaction technique that makes use of Fitts' Law to simplify interaction and describe both how it works and how it makes use of the law. Briefly describe an example in the context of a commonly used application. [6 marks]

b) You are given the task of designing a graphical user interface for a public automatic teller machine (ATM) that enables users to buy tickets for the cinema:

- the application runs on a public kiosk system (display size: 40×30cm, resolution: 1024×768 pixels, colour support; single touch support);
- the application enables users to pick a movie and a show time, and pick a number of seats; these steps can be executed in any order; payment is made by inserting a credit card and entering the corresponding PIN.

Briefly describe your design for this graphical user interface. Give a justification for the choices you make. [13 marks]

c) Briefly describe the Wizard of Oz evaluation technique. Explain whether or not Wizard of Oz could be used to evaluate a design for a graphical interface for a drawing application. Provide a brief rationale for your view. [6 marks]