King’s College
London

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Degree Programmes  BSc, MSci
Module Code         6CCS3SIA
Module Title        Software Engineering of Internet Applications
Examination Period  May (Period 2) 2014

Time Allowed       Two hours
Rubric             ANSWER THREE OF FOUR QUESTIONS.

All questions carry equal marks. If more than three questions are answered, the answers to the first three questions in exam paper order will count.

Calculators        Calculators are not permitted
Notes              Books, notes or other written material may not be brought into this examination

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Solutions

1. [Covers web application specification techniques and issues from part 2 of the course]

   a. (i) Accessibility means that a web interface can be used by users of differing ability – such as visually impaired, colour-blind, deaf, or senior citizen users – as effectively as by non-disabled users.

   (ii) Two techniques are: (1) Ensure that colour-contrasts on a page which give important information are visible to vision-impaired users. Tools can be used to preview sites to show them as (for example) a colour-blind viewer would see them, thus helping developers avoid colour choices which would be unusable to colour-blind viewers.

   (2) Provide alternative information, such as alt text for images, which enable assistive technologies such as screen readers to operate on the page.

   [15 (5 + 10) marks]

   b. (i) State machines can describe the possible web pages which may be displayed to the user, as states, and the actions which may be performed on these pages, as transitions. They show how users can navigate around the web site.

   (ii) States correspond to static or dynamic web pages or groups of pages. Transitions may correspond to HTML links between pages, or the submission of a form and the return of a response (page) to the browser.

   [10 (5 + 5) marks]
c. This is shown in Figure 1. (10 marks for states, 10 for transitions, 5 for correct use of nested and initial states).

25 marks

Figure 1: Interaction sequence of bank system
2. [This question covers part 3 of the course: EIS specification and design]

   a. **Presentation tier**: (i) has responsibility of managing presentation of information to clients and controlling what sequence of interaction should be followed. It also relays user requests to the business tier.
      (ii) Typical components of this tier are controller and view components, such as servlets and JSPs.

   **Resource tier**: (i) Provides data and other resources to the system.
      (ii) It contains persistent data storage, such as databases, and external resources such as credit card authorisation services or business-to-business services.

   [20 (5 each part each tier) marks]

   b. Placing business functionality in a separate business tier improves the modularity of the application, separating the logical business functions and rules from interface code. It enables use of the functionality by web and non-web clients, and by remote clients.

   [10 marks]

   c. This is shown in Figure 2.
      (4 marks for each tier).

   [20 marks]
Figure 2: Architecture of travel agent system
3. [This question covers part 3 of the course: ELS specification and design]

   a. (i) The pattern aims to encapsulate the details of complex interactions between business objects. A session facade for a group of business objects manages these objects and provides a simplified coarse-grain set of operations to clients.
   
   Interaction between a client and multiple business objects may become very complex, with code for many use cases written in the same class.
   
   Instead this pattern groups related use cases together in session facades.
   
   The elements of the pattern are:

   • Client: client of session facade, which needs access to the business service.
   • SessionFacade: implemented as a session bean. It manages business objects and provides a simple interface for clients.
   • BusinessObject: can be session beans or entity beans or data.

   Several related use cases can be dealt with by a single session facade – if these use cases have mainly the same business objects in common.
   
   (ii) It is a business tier pattern.

   [10 (5 + 5) marks]

   b. This is shown in Figure 3.

   [15 marks]
Figure 3: Architecture of session facade

Figure 4: Revised architecture of EIS
c. The dependencies of this system can be reduced by introducing a session facade between components $P1$, $P2$, $P3$ and the entity beans $E1$ and $E2$. This reduces the dependencies of the presentation tier on the business tier from 8 to 4, and increases the modularity of the business tier. (15 marks)

Figure 4 shows the revised architecture. (10 marks).

[25 marks]
4. [This question covers part 4 of the course, on web services]

a. (i) A web service is a set of functionalities made available over the internet to clients on remote hosts.
(ii) Web services should not involve fine grain exchange of data, or time-critical functionality. Functionalities involving B2B communication or publicly sharable business functionalities are suitable for web services.

[10 (5 each part) marks]

b. A Router web service selects one of a number of possible services to invoke, based on rules (Figure 5).

![Figure 5: Router pattern](image)

A Broker web service invokes all of its subordinate services, according to its rules (Figure 6).
(5 marks for each explanation, 5 marks for each diagram).

[20 (10 each) marks]
c. The Broker pattern is used first to request cost and time estimates for an order of the requested quantity of a make of coffee from a number of different suppliers. If there are suppliers able to supply the order within the customer deadline, then the Router pattern is used to confirm the order with the supplier giving the lowest quote. Otherwise, the Router confirms with the supplier promising the fastest delivery.

[20 (10 for each pattern application) marks]