Two hours

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Building Web Applications

Date: Thursday 26th May 2011
Time: 09:45 - 11:45

Answer Question 1 from Section A
and TWO questions out of the three from Section B.

Each question carries 20 marks.

This is a CLOSED book examination
The use of electronic calculators is NOT permitted
Section A

1. Answer each of the following parts concisely. Note: each of your answers should not exceed 30 words approximately. Each part carries two marks.

a) The separation of HCI and internal processing is related to the three main stages in which a servlet handles a HTTP request. Explain this relation and how these stages should be reflected in the design of a web application program text.

b) Consider the following piece of code extracted from a faulty version of the ListNames1 program. It is in breach of the design principle referred to in part (a). Explain why, considering the role of \( n \) in the program.

```java
// Stage 3
... if (n == MAX) {
    out.println("<H2>CAUTION: . . . </H2>");
    n = 0;
} ... 
```

c) What are the two types of a HTML tag attribute? Illustrate each type.

d) Explain by which mechanism and when the functions init, doGet, and destroy are called exactly.

e) Consider the HTML concepts of: element, content and tag. Define each of them in relation to the others.

f) What is the difference between a program invariant and a precondition?

g) Consider the invariant 4b of Dictionary0, \( n <= \text{max} \). What precondition, if any, should be derived from it for the operations Ins and Rem respectively?

h) A HTML page currently loaded in a browser contains the following line:

```html
<FORM METHOD="GET" ACTION="../../page1.html">
```

Before submitting the form introduced by this line, suppose the address box of the browser contains

```
http://www.body.com/head/face/eye
```

What is special about the URL value of the ACTION attribute? How is the URL in the address box called? What actual URL will be part of the HTTP request sent by the browser when the form of is submitted?

i) Consider the command function ComRem of Dictionary1. What is the associated basic dictionary operation, and what is the role of each of these two functions in outline?

j) How does the design of ComRem relate to the design principle mentioned in part (a)?
Section B

2.  
   a) Name and describe the three features of the MVC paradigm and how they relate to one another.
   
      (6 marks)

   b) Describe the main stages of the formal method of software development illustrated by the construction of the program Dictionary0. Explain precisely how these stages are related to one another. Your description must include a definition of all the main concepts involved.
   
      (8 marks)

   c)  
      i) Explain how in a given program, for any function call, its preconditions may be systematically derived from the program’s invariants.
      
      ii) The Java implementation Dictionary0 of the abstract model EDM represents the dictionary at any time by the three variables

           \[
           \text{int } n; \text{ String word[]; String definition[]};
           \]

           In terms of these three variables, formalise the functionality condition i.e. the invariant that at any time any word has at most one definition in the dictionary.

      iii) Derive the precondition corresponding to this invariant, for the call \( \text{Ins}(w, d) \) whose effect, if valid, is to insert the new entry \((w, d)\) into the dictionary. As for part (ii), express this condition explicitly in terms of the three variables \(n, \text{ word[]}\) and \(\text{definition[]}\).

      (6 marks)
3. a) To the JSF programmer, core JSF has four fundamental features. Describe these in outline, covering in particular each feature’s visibility to the JSF programmer. (8 marks)

b) The jumbled up excerpt from a JSF page is given below. It contains two forms. About half of the original text has been kept. The first form can be used to control the locale. The two possible locale are ‘French’, represented by the index 0, and another language, represented by the index 1. The second form enables the user to submit an answer to a quiz question. Rewrite the text below in the correct order. For each line, indent it suitably and preserve its integrity in all other respects.

```
*  <h:outputFormat value="#{msgs.currentScore}">
   <h:form>
   value="Locale is French; "
   *  <f:param value="#{quiz.score}"/>
   <h:outputText value="#{msgs.answer}"/>
   <h:form>
   *  <h:commandButton value="#{msgs.next}" action="next"/>
   *  <h:commandLink
   <h:inputText value="#{quiz.answer}"/>
   rendered="#{user.localeIndex == 0}"/>
   *  action="#{user.setLocaleToFrench}"
   <h:outputText
   <h:form>
   </h:outputFormat>
   value="Set locale to French"
   *  rendered="#{user.localeIndex == 1}"/>
```

(6 marks)

c) Explain the six lines marked with an asterisk (*) in the table of part (b), in the order in which they occur in this table. (6 marks)
4. a) Describe the JSF life cycle and name and briefly explain each of its six main steps.

(8 marks)

b) The following table contains the jumbled up text of a special JSF element. This element renders a list of objects, each with two components: an identifier and a name in this order.

i) Explain what this JSF element is and how it renders the list.

ii) Rewrite the text below in the correct order. For each line, indent it suitably and preserve its integrity in all other respects.

<p>| | |</p>
<table>
<thead>
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</tbody>
</table>

(6 marks)

c) Explain the six lines marked with an asterisk (*) in the table of part (b), in the order in which they occur in this table.

(6 marks)

END OF EXAMINATION