Two hours

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Engineering Web Applications

Date: Wednesday 25th January 2012
Time: 14:00 - 16:00

Please answer Question ONE from Section A and any TWO Questions from the THREE questions in Section B

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, the nature of each stage, 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 the program Dictionary1, and simplified:

```java
private static void ComEmp(C0Dictionary1 D, String Com, . . .)
{
    // Validate
    B0ErrorSet Errs = null;
    Errs = new B0ErrorSet(B0ErrorSet.EmpSet);
    // Note: no actual validation needed for this operation

    // Execute basic operation
    D.Emp();

    // Respond to request
    B1Page2Gen.DisplayResult(res, Com, Errs);
} // ComEmp()
```

Is this fragment of code consistent with your answer to (a) and if so why? What assumption are you making in your answer, if any?

c) Suppose the call ‘B1Page2Gen.DisplayResult(res,Com,Errs)’ in (b) included a change in the value of D.n. Would this be consistent with your answer to (b) or not, and if not why?

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

e) What are the two types of a HTML tag attribute? Give an example for each type.

f) Explain the difference between an *absolute URL* and a *relative URL*.

g) Why is it important to use relative URL’s in a web application?

h) Define the two concepts: (1) *Assertion* and (2) *Invariant* as aids to programming.

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

j) How does a precondition of a function myFun affect the *use* of myFun and its *implementation*?
Section B

2. a) Describe the design principles underpinning the variant Java implementation Dictionary1 of the *Evolving Dictionary Model* (EDM), as a general framework for Web applications. In particular:

i) Describe the purposes of the four main categories A, B, C and D of classes involved.

ii) Describe how the Web pages of the application are related to category B1 classes. Recall that each page indexed *p* has two associated classes. Name these two classes and explain their respective roles.

iii) Explain how this design supports the extendibility of the application and any other important criterion of good design for Web applications.

(6 marks)

b) Consider the following formalised invariants of the class C0Dictionary1:

```java
/*
2 a) for all int i with 0 <= i < n (!word[i].equals(""))
2 b) for all int i with 0 <= i < n (!definition[i].equals(""))
3) for all int i, j with 0 <= i < n, 0 <= j < n and i != j (!word[i].equals(word[j]))   (functionality condition)
4 a) 0 <= n.
4 b) n <= Max.
*/
```

i) Define the four preconditions of the function declaration

```java
public void Ins(String w, String d)
```

of the class C0Dictionary1. For each precondition, indicate from which of the above invariants it is derived.

ii) Define the two preconditions of the function declaration

```java
public void Rem(String w)
```

derived from the above invariants. For each precondition, indicate its associated invariant.

iii) Explain why the first function requires the two parameters *w* and *d*, and the second only one parameter, *w*. Which invariant justifies your answer?

iv) Critically assess the impact of the above method on software development.

(8 marks)

c) Given an appropriate driver, the use of JDBC involves three distinct stages:

i) Establishing a 'connection'

ii) Creating and executing a 'statement'

iii) Processing any result of the execution of the 'statement'

Describe these three stages.

(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. Critically assess the advantages of JSF over alternatives e.g. plain servlet programming or JSP.  

(8 marks)

b) List and briefly describe the six main stages of the JSF life cycle. (Do not treat the subsidiary stages of event handling.)  

(6 marks)

c) 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 full text below in the correct order.

```
<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
        value="Set locale to French"
        rendered="#{user.localeIndex == 1}"/>
```  

(6 marks)
4.  
   a) Explain and critically examine the notions of a Java bean and a bean property; the basic rules which a bean must satisfy; and the role of beans in developing a JSF application.  
      (8 marks)
   
   b) i) Explain the notion of a configuration file in a Web application, and the role of the file faces-config.xml in particular.
   
   ii) There follows part of the text of faces-config.xml associated with some arbitrary JSF page. Explain each of its elements in detail.
      
      ```xml
      <managed-bean>
      <managed-bean-name>bell</managed-bean-name>
      <managed-bean-class>com.corejsf.BellBean</managed-bean-class>
      <managed-bean-scope>session</managed-bean-scope>
      </managed-bean>
      ```
      (4 marks)
   
   c) The following text consists of two classes from the Quiz web application, simplified and jumbled up. Note that multiple occurrences of a line are only given once. Reconstruct these two classes.
      
      ```java
      public class Problem {
          public class Problems {
              // class Problem
              D.InitScan(), i = 0;
              return prblSet;
          } // class Problem
          // class Problems
          D.GetNext(), i++) {
              private String question;
              int i = 0;
              public Problems() {D = new D0DictionaryDB(4, errs);}
              this.question = question;
              public Problem[] prblSet() {
                  public Problem(String question) {
                      private D0DictionaryDB D = null;
                      Problem[] prblSet = new Problem[D.Num()];
                      public String getQuestion() { return question; }
                      private B0ErrorSet errs = null;
                      prblSet[i] = new Problem(D.CurWord());
                  } // public Problem[] prblSet()
                  D.NextEntry();
          }
      }
      ```
      (8 marks)

END OF EXAMINATION