OLLSCOIL NA GAILLIMHE
UNIVERSITY OF GALWAY

Semester 1 Examinations 2022-2023

Course Instance Code	3BCT1
Exam	3rd University Examination in Computer Science and IT
Module Code	CT5106
Module	Software Engineering II
Paper No.	1
External Examiner	Dr. Ramona Trestian
Internal Examiners	Prof. Michael Madden Dr. Owen Molloy *
Instructions	Answer any **4** questions. All questions are worth equal marks, which will be scaled to 100% total.
Duration	2hrs
No. of Pages	4
Discipline	Computer Science
Course Co-ordinator	Dr. Colm O'Riordan

Requirements

Release in Exam Venue	Yes [x]	No [ ]
Number of Answer Books	1	
MCQ Answersheet	Yes [ ]	No [x]
Handout	None	
Statistical/ Log Tables	None	
Cambridge Tables	None	
Graph Paper	None	
Log Graph Paper	None	
Other Materials	None	
Graphic material in colour	Yes [ ]	No [x]

1. Answer all parts of this question. Each part is worth [5] marks.

a. Explain the purpose of the urlPatterns annotation as found in servlets, and how they can be used in servlets to turn them into routers for HTTP requests.

b. Explain the difference in scope between the request, session and application in JSP / Servlet applications.

c. Add JPA annotations to the following Java bean class in order to store product instances in a specific table ("STUDENTS"), and where the id is to be auto-generated by the database.

```
public class Student implements Serializable
{
private int id;
private String firstname;
private String surname;
… // getters and setters can be ignored for this question
}
```

d. Explain, using a simple diagram, how the Model View Controller architecture can be implemented in a Java Enterprise application.

e. Assuming the following lines of code are executed in a servlet, and that the request is then dispatched to a JSP page, write the JSP code necessary to print out the user's username and email address:

```
u1 = new User();
u1.username = "JohnS";
u1.email = "john.s@bigmail.com";
request.setAttribute ("user", u1);
```

f. Explain the difference between the following 2 lines of JSP code, and what will happen when they are executed:

```
<%! int numVisits1 = 0; %>

<% int numVisits2 = 0; %>
```

g. Explain of the role of the Entity Manager and the Persistence Unit in using the Java Persistence API (JPA).

h. Explain, using an example, the use of <context-param> in Java EE applications.

[40 marks]

2. A servlet creates a List of Product objects, where each Product object has the properties *productName*, *description* and *price*. The servlet adds this List to the session object and forwards to a JSP page where the list of products is displayed as a table, using JSTL to handle the retrieval of the list of products from the session, and the iteration over the list of products.

a. Write the JSP code to display the table of products.

[20 marks]

b. Explain, using sample code, your ideas on how you might implement a simple filtering system in the JSP page to display only products between a certain price range.

[20 marks]

3. Assume you have a Java Bean entity class, called Person, which has the following properties.

```
private String id;
private String lastname;
private String firstname;
```

You may assume that a Façade session bean class has been created for Person. A HTML form is used to submit a request to a servlet. The request contains the necessary input parameters to create a new Person object.

a. Write the JPA-annotated Person entity class, specifying the table and columns to be mapped to. The primary key is the id attribute. You do not need to write the *getter* and *setter* methods.

[10 marks]

b. Write the HTML code for the input form.

[10 marks]

c. Write the servlet code necessary to retrieve the request parameters, and use the Façade class to create and persist the new Person object.

[20 marks]

4.

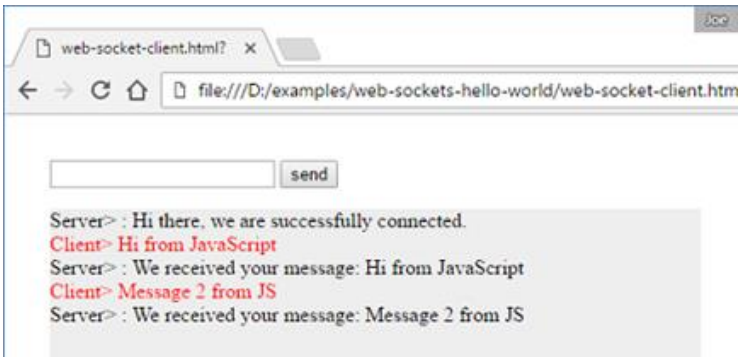
a. Explain, using sample code, your understanding of the use of the following in implementing Java Web Sockets:

```
 i.  @ServerEndpoint
ii.  @OnOpen
iii. @OnMessage
```

[10 marks]

b. Explain, using as much code as you can, how you would implement a simple Web Socket server which responds to messages from a browser client as illustrated in the following figure:

[question continued on next page]



[15 marks]

c. Write the code needed to implement the Javascript-based web socket client as shown in the figure above.

[15 marks]

5.

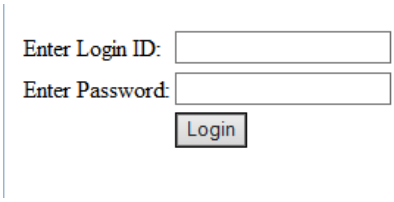
a. Explain what is mean by the following in Java Server Faces (JSF):

i. Execute Phase
ii. Render Phase
iii. Managed Bean

[10 marks]

b. In this part of the question you are asked to write the login page, using JSF components to do the following:

- Capture the user id and password, which are mapped to fields in the managed bean.
- On submission of the form to call a method in the managed bean to validate the input user id and password.



[10 marks]

c. Next write the code for a managed bean class which contains the user id and password properties and also the method used to validate the input user id and password.

[10 marks]

d. Demonstrate, using code to illustrate your answer, how the managed bean can use navigation rules (defined in faces-config.xml) to direct the user to different web pages depending on whether the inputs were successfully validated or not.

[10 marks]