OLLSCOIL NA GAILLIMHE
UNIVERSITY OF GALWAY

Autumn1 Examinations, 2022-2023

Course Instance Code	3BCT1
Exam	3rd University Examination in Computer Science
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 Answer Books	1
Discipline	Computer Science
Requirements	Release in Exam Venue [Yes]
No. of Pages	5

Requirements:

Release in Exam Venue	No[ ]	Yes [☑]
MCQ Answer sheet	No [☑]	Yes [ ]
Handout	No [☑]	Yes [ ]
Formulae & Tables*	No [☑]	Yes []
Cambridge Tables 2nd Edition**	No [☑]	Yes [ ]
Graph Paper*** A4 Graph Paper 1mm 0.1cm Squared (Standard)	No [☑]	Yes [ ]
Other Materials	No [☑]	Yes [ ]
Graphic material in colour	No [☑]	Yes [ ]

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

a. Explain using an example 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 JavaBean class in order to store product instances in a specific table ("PRODUCT"). Assume the primary key is the *barcode*, and that it is not auto-generated by the database.

```
public class Product implements Serializable
{
private String barcode;
private String name;
private double price;
… // getters and setters can be ignored for this question
}
```

d. Explain how the Model View Controller architecture can be implemented using servlets and Java Server Pages. Include a brief explanation of what options could be used for the Model layer. You should use a simple diagram to illustrate your answer.

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 product's name and price (note any assumptions you make):

```
p1 = new Product();
p1.setBarcode("1101459768");
p1.setName("Widget");
p1.setPrice(12.50);
request.setAttribute ("product", p1);
```

f. Explain the role of the *service* method in a JSP. Where would each of the following lines be executed and what would be the potential use of doing this?

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

<%= count++ %>
```

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 Employee objects, where each Employee object has the properties *name*, *position* and *salary*. The servlet adds this List to the session object and forwards to a JSP page where the list of employees is displayed as a table, using **JSTL** to handle the retrieval of the list of employees from the session, and the display of the list of employee as a table.

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

[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 employees earning above a certain salary.

[20 marks]

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

```
private String name;
private String position;
private double salary;
```

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

a. Write the JPA-annotated Employee entity class, specifying the table and columns to be mapped to. The primary key is the *name* 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 Employee object.

[20 marks]

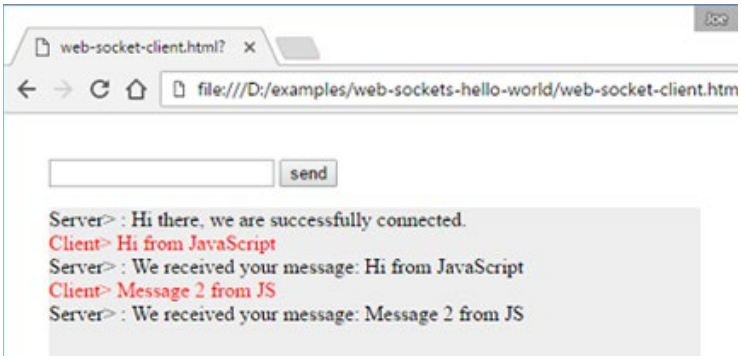
4.

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:



[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 meant 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]

[question continued on next page]

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]

END