

University of Ruhuna- Faculty of Technology
Bachelor of Information and Communication Technology Honors Degree
Level 3 (Semester I) Examination, June 2023
Academic year 2021/2022

Course Unit: ICT3113, Advanced Programming in Java/C++ (Written)
Duration: 02 hours

This question paper contains **07 pages** including this instruction page.

IMPORTANT INSTRUCTIONS:

1. The medium of this examination is English.
2. This is a Closed Book examination.
3. This Examination consists of four (04) questions that are given equal marks.
4. You must answer all four (04) questions in this examination.

1.

a. *Hibernate is an implementation of Java Persistence API (JPA).*

i. Compare the differences between “Hibernate” and “JPA” by using two (02) key points.

[10 marks]

ii. Use the information about “Database connectivity” and the “Business” classes to complete the “persistence.xml” file which is used to persist the “Business” entities in a Maven based Hibernate project.

Consider the persistence unit name as “my-business”.

“Database connectivity” information

DBMS: <i>MySQL</i>	Database: <i>bisData</i>
Host: <i>localhost</i>	Port: <i>3306</i>
User: <i>broot</i>	Password: <i>a23</i>

“Business” class information

```
@Entity
public class Business {
    //Rest of the code
}
```

“persistence.xml” file

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<persistence xmlns="https://jakarta.ee/xml/ns/persistence"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="https://jakarta.ee/xml/ns/persistence
        https://jakarta.ee/xml/ns/persistence/persistence_3_0.xsd"
    version="3.0">
//Persistence unit configuration
    <persistence-unit _____ >

//Class/Entity configuration
    <class> _____ </class>

    <properties>
        // hibernate dialect configuration for MYSQL
        <property name="_____ " value="_____ " />

        // hibernate connection driver configuration for MYSQL
        <property name="_____ " value="_____ " />

        // hibernate connection url configuration
        <property name="_____ " value="_____ " />

        // hibernate connection username configuration
        <property name="_____ " value="_____ " />

        // hibernate connection password configuration
        <property name="_____ " value="_____ " />
    </properties>
    </persistence-unit>
</persistence>
```

[30 marks]

- b. *A software framework is defined by the principle of Inversion of Control (IoC).*
- i. Briefly describe how the concept of “Inversion of Control (IoC)” applied in a “Software Framework”.
[08 marks]
 - ii. Compare the differences between a “Software Library” and a “Software Framework” by using two (02) key points.
[12 marks]
 - iii. Consider the Java code segment given below with respect to Spring Boot Framework.

```

//Annotation 01
//Annotation 02
public class HelloApplication {

    public static void main(String[] args) {
        SpringApplication.run(HelloApplication.class, args);
    }
    //Annotation 03("/hello")
    public String hello//Annotation 04(value = "name", defaultValue = "World...!!!") String name) {
        return String.format("Hello %s ...!", name);
    }
}

```

//Annotation 01 : to mark the HelloApplication class as a configuration class
//Annotation 02 : to tell Spring that this code describes an endpoint
//Annotation 03 : to tell Spring to use the hello() method to answer requests that get sent to the http://localhost:8080/hello address
//Annotation 04 : to tell Spring to expect a name value in the request

- A. Decide which four (04) annotations you need to use to run the above program as a simple web service in Spring Boot.
[16 marks]
 - B. What will be the output when you access the above web service via the endpoint “http://localhost:8080/hello”. Give your reason.
[12 marks]
 - C. What will be the output when you access above web service via the endpoint “http://localhost:8080/hello?name= SpringBoot”. Give your reason.
[12 marks]
2. *In Java the process of “Serialization” and “Deserialization” can be achieved by using the “Serializable” and the “Externalizable” interfaces.*
- a.
 - i. Briefly describe the concept of Java “Deserialization”.
[10 marks]
 - ii. List down two (02) specialties of Java “Serializable” interface.
[10 marks]

- iii. List down two (02) concerns of the Java serialization process with the “Serializable” interface.

[10 marks]

- iv. Discuss the consequence of not specifying the “serialVersionUID” in the process of “Serialization” and “Deserialization”.

[10 marks]

b. Consider the “Student” and “UniversityStudent” classes given below.

<pre>public class Student implements Serializable { private transient int id; private String name; //Assume Rest of the code is complete }</pre>	<pre>public class UniversityStudent extends Student { private transient double age; // Assume Rest of the code is complete }</pre>
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Assume that you are going to serialize a “UniversityStudent” object with below given values.

id = 20
name = “Natasha”
age = 33.0

What will be the values of name, id, and age once you deserialize the “UniversityStudent” object? Give your reasons for each value.

[20 marks]

c. Consider the “Vehicle” and “Car” classes given below.

<pre>public class Vehicle { private String color; public Vehicle() { } public Vehicle(String color) { this.color = color; } public String getColor() { return color; } public void setColor(String color) { this.color = color; } }</pre>	<pre>public class Car extends Vehicle implements Externalizable { private double speed; public double getSpeed() { return speed; } public void setSpeed(double speed) { this.speed = speed; } }</pre>
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Construct the rest of the “Car” class by,

- providing a “serialVersionUID”
- providing the required Constructor
- implementing “writeExternal” and “readExternal” methods

[40 marks]

3.

a. *The Java Remote Method Invocation (RMI) provides for remote communication between programs written in the Java programming language.*

i. List down one (01) tasks of “Stub” and one (01) task of “Skelton” in RMI.

[10 marks]

ii. Briefly describe how Java RMI takes advantage of Dynamic Code Loading.

[10 marks]

iii. Consider the “BmiServer” class given below.

```
public class BmiServer {
    public static void main(String[] args) {
        try {

            //Your Code

        } catch (RemoteException e) {
            System.out.println("Exception in creating registry..." + e.getMessage());
        }
    }
}
```

Complete the rest of the “BmiServer” class by using the following information.

- Create the registry on the port “56321”
- Use an instance of “BmiCalcImpl” as stub.
- “MyBMICalculatorServer” as the name to associate with the remote reference

[20 marks]

b. *Java Network programming is the procedure of writing programs that run on multiple computers that are linked together via a network.*

i. Briefly describe the two (02) network protocols listed below.

- TCP
- UDP

[10 marks]

ii. Briefly describe the following classes used in Java Network Programming.

- Socket
- DatagramPacket

[10 marks]

iii. Consider the “ChatServer” and “ChatClient” classes given below.

<pre>public class ChatServer { public static void main(String[] args) { ServerSocket myServer; Socket myClient; DataInputStream dis; DataOutputStream dos; try {</pre>	<pre>public class ChatClient { public static void main(String[] args) { Socket myClient; DataOutputStream dos; DataInputStream dis; try { //Your code</pre>
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<pre>//Your code } catch (IOException e) { throw new RuntimeException(e); } }</pre>	<pre>} catch (IOException e) { throw new RuntimeException(e); } }</pre>
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Write down the necessary code changes to enable the following conversation between the "ChatServer" and the "ChatClient".

Client : Hello Server...!!!
 Server : Hello Client...!!!

[40 marks]

4. a. *Design patterns are typical solutions to commonly occurring problems in software design.*

i. Compare the difference between an "Algorithm" and a "Design Pattern".

[10 marks]

ii. By referring to a real-world example briefly describe the "Observer" design pattern.

[10 marks]

iii. Consider the "MyDbSingleton" Java class given below which uses eager instantiation.

```
public class MyDbSingleton
{
    private static final MyDbSingleton sinObj = new MyDbSingleton();

    private MyDbSingleton() {}

    public static MyDbSingleton getInstance()
    {
        return sinObj;
    }
}
```

Make necessary changes in "MyDbSingleton" class to make it a thread safe singleton using "Bill Pugh Singleton implementation".

[20 marks]

b. *Implementation of Threads in Java can be achieved in two ways.*

i. Write one (01) advantage and one (01) disadvantage of using "Runnable" interface over "Thread" class to implement Threads in java.

[10 marks]

ii. Illustrate the major (05) stages of the life cycle of a Thread using a suitable diagram.

[10 marks]

- iii. By giving an example briefly describe the concept of “Daemon Threads” used in java

[10 marks]

- iv. Consider the “SimpleThread” and “ThreadDemo” Java classes given below.

<pre>public class SimpleThread implements Runnable { public void run() { String name = Thread.currentThread().getName(); System.out.println("Hello from "+ name +"...!!!"); } }</pre>	<pre>public class ThreadDemo { public static void main(String[] args) { SimpleThread st = new SimpleThread(); st.setName("First"); st.start(); } }</pre>
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- a. Write down the output when you compile and run the above java program. Give your reasons for the output.

[15 marks]

- b. What are the code changes to be done to get “Hello from Java...!!!” as the output.

[15 marks]

*** --- End of Paper ---***