



GMIT EXAMINATIONS
SESSION: Autumn 2013/2014

**PROGRAMME: BACHELOR OF SCIENCE
IN SOFTWARE DEVELOPMENT**

YEAR: 4
Time:

MODULE: DISTRIBUTED SYSTEMS

**EXTERNAL EXAMINERS: Dr. Michael Schukat
Mr. Tom Davis**

INTERNAL EXAMINERS: Dr. John Healy

TIME ALLOWED: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

Attempt ANSWER ANY FOUR QUESTIONS

Attachments:	Yes	<input type="checkbox"/>	No	✓	If yes, please list details:
Special Requirements:	Yes	<input type="checkbox"/>	No	✓	If yes, please list details:
Calculators Permitted:	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	Not applicable ✓

1. (a) Outline briefly the **benefits** and **drawbacks** of a distributed system.

(6 Marks)

(b) Explain the following terms as they apply to distributed systems:

- Location Transparency
- Heterogeneity

(6 Marks)

(c) Describe two mechanisms for **marshalling** data between applications on heterogeneous systems in a platform and application neutral manner. Discuss how these may be used to overcome **byte-ordering** and **data type** differences.

(13 Marks)

2. (a) *“Java Remote Method Invocation provides for the passing of object parameters by value only, from a client to a remote host.”*

Describe how RMI can be used to simulate a **pass by reference**. Your answer should be accompanied by a diagram illustrating the component parts involved in the process.

(12 Marks)

(b) Describe the function of the following components of the RMI architecture:

- The Remote Interface
- The RMI Registry
- Stubs and Skeletons

(9 Marks)

(c) Briefly describe how RMI can be used to enable the invocation of remote objects through using a **façade** pattern.

(4 Marks)

3. (a) *“The Service Oriented Architecture (SOA) marks a major departure from conventional client-server models.”*

Describe, using examples, the **main roles and their function** in the Service Oriented Architecture.

(15 Marks)

(b) *“Web Services Description Language (WSDL) is a W3C specification that defines a web service using a common XML grammar.”*

Describe the main **elements** described by the WSDL specification.

(10 Marks)

4. **Figure 1** below describes two Java interfaces that abstract a student and a class respectively.

```
public interface Student{
    public void setStudentName(String name, int id);
    public String getStudentName(int id);
    public int getStudentId(String name);
    public boolean deleteStudent(int id);
}

import java.util.Vector;
public interface Class{
    public boolean addClass(String className, int courseCode, String lecturer);

    // returns a list of student objects
    public Vector getStudents(String className);
}
```

Figure 1

(a) Describe how IDL could be used to represent these interfaces in a CORBA architecture.

(8 Marks)

(b) Explain the sequence of steps required to compile and deploy the IDL defined CORBA service.

(7 Marks)

(c) Outline how the CORBA API from the Object Management Group (OMG) could be used to create a Java client application to invoke the **getStudentName** method.

(10 Marks)

Note: You are not required to write the full implementation classes. Your answer should include the main steps required to perform the invocation.

5. The following Java class describes a class that calculates the factorial of a given number:

```
public class Factorial {  
    public double calculateFactorial(int max){  
        long fact = 1;  
        for (int i=2; i<=max; i++){ //Loop 13 times  
            fact = fact * i;  
        }  
    }  
}
```

- (a) Describe the format of the **XML-RPC response** generated when the above method is invoked with a parameter value of 12.
(9 Marks)
- (b) Explain how XML-RPC handles complex data types such as **arrays** and **structs**.
(9 Marks)
- (c) Briefly describe the advantages that XML-RPC offers over more evolved technologies such as SOAP and Java RMI.
(7 Marks)
6. (a) Explain, using examples, the difference between **homogeneous** and **heterogeneous** distributed database systems.
(11 Marks)
- (b) Describe how the **Two-Phase-Commit** protocol can be used to implement a distributed atomic transaction.
(9 Marks)
- (c) What is **distributed deadlock**? Briefly describe the approaches that can be used to overcome this problem.
(5 Marks)