GALWAY-MAYO INSTITUTE OF TECHNOLOGY

SEMESTER 1 EXAMINATIONS 2017/2018

MODULE: COMP08011 - Distributed Systems

PROGRAMME(S):
GA_KSOFG_H08   BACHELOR OF SCIENCE (HONOURS) IN SOFTWARE
DEVELOPMENT

YEAR OF STUDY: 4

EXAMINER(S):

Mr. Patrick Mannion	(Internal)
Mr. Tom Davis	(External)
Dr. Des Chambers	(External)

TIME ALLOWED: 2 Hours

INSTRUCTIONS: **Answer 4 questions. All questions carry equal marks.**

PLEASE DO NOT TURN OVER THIS PAGE UNTIL YOU ARE INSTRUCTED TO DO SO.
The use of programmable or text storing calculators is expressly forbidden.
Please note that where a candidate answers more than the required number of questions, the examiner will mark all questions attempted and then select the highest scoring ones.

There are no additional requirements for this paper.

QUESTION 1   *[TOTAL MARKS: 25]*

Q 1(a)   **[3 Marks]**
Briefly outline the key differences between distributed computing models and
monolithic computing models.

Q 1(b)   **[12 Marks]**
Explain, using diagrams and examples, the following terms as they apply to
distributed systems:

- Heterogeneity
- Transparency
- Scalability
- Concurrency

Q 1(c)   **[10 Marks]**
Explain what is meant by the term Inter-Process Communication.

Explain how each of the following Inter-Process Communication models work, and
identify the key differences between them. Use diagrams where appropriate.

- Remote Procedure Call Model
- Object-Oriented Model

[End of Question1]

QUESTION 2   *[TOTAL MARKS: 25]*

Q 2(a)   **[10 Marks]**
Explain what is meant by the term Externalisation in the context of Distributed Systems.

Compare the following Externalisation formats, giving an example of each:
- Binary
- Semi-compiled
- Unicode

Q 2(b)   **[10 Marks]**
Explain how an XML schema document may be used as a Data Definition Language to create a platform and language neutral mechanism for data exchange. Refer to the use of data binding, the JAXB framework and the XJC utility in your answer.

Q 2(c)   **[5 Marks]**
Explain using pseudocode (or Java code), how an object may be transferred from one process to another using a Unicode format. Your answer should include the operations performed by the client and the server.

[End of Question2]

QUESTION 3   *[TOTAL MARKS: 25]*

Q 3(a)   **[9 Marks]**
Describe the function of the following components of the RMI architecture, using diagrams where appropriate:

- Remote Objects and the Remote Interface
- RMI URLs and the RMI Registry
- Stubs and Skeletons

Q 3(b)   **[10 Marks]**
Explain the procedure that is followed when creating a custom interface which specifies how a client process may interact with a Remote object.

You have been tasked with creating a RMI File Service. The File Service will have the following remotely accessible methods:

- downloadFile() – this method retrieves a file from the File Service. It takes a file name as an argument, and will return the file requested as an array of bytes.
- uploadFile() – this method uploads a file to the File Service. It takes the file name and a byte array containing the file contents as arguments, and has a void return type.
- listFiles() – this method does not take any arguments, and returns a list of all the files which are available to download from the File Service.

Write out the Java code for a Remote FileService interface which provides the functionality described above.

Q 3(c)   **[6 Marks]**
Briefly describe how Java RMI can be used to provide an object façade/gateway to a suite of server-side objects. Your answer should include a brief discussion of the rationale for applying such an approach, and a diagram if required.

[End of Question3]

QUESTION 4   [TOTAL MARKS: 25]

Q 4(a)   [9 Marks]
Explain the meaning of the term SOAP, and how it is relevant to Distributed Systems. Make reference to the SOAP Specification, Requests, Responses, and SOAP messages in your answer. Use diagrams where appropriate.

Q 4(b)   [8 Marks]
What is the function of WSDL in the context of distributed systems? List and describe the four key aspects of a service which is described by WSDL.

Q 4(c)   [8 Marks]
State the principles of RESTful application development.

[End of Question4]

QUESTION 5   *[TOTAL MARKS: 25]*

Q 5(a)   **[8 Marks]**
State Brewer's CAP theorem, and explain the meaning of each of the three systematic requirements to which it relates.

Q 5(b)   **[6 Marks]**
Compare the following partitioning strategies for distributed databases:

- Range Partitioning
- Hash Partitioning
- List Partitioning

Q 5(c)   **[11 Marks]**
Compare the process of distributing a database across multiple nodes for the following database types. Use diagrams where appropriate.

- Relational
- Key-value store

[End of Question5]

[END OF EXAM]