



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**SCHOOL OF INFORMATICS AND INNOVATION SYSTEMS**  
**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE**  
**COMPUTER SECURITY AND FORENSIC**  
**2<sup>ND</sup> YEAR 2<sup>ND</sup> SEMESTER 2013/2014 ACADEMIC YEAR**  
**MAIN**

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**COURSE CODE: IIT 3223**

**COURSE TITLE: SYSTEMS PROGRAMMING**

**EXAM VENUE: CL I**

**STREAM: (BSc. Computer Security and Forensic)**

**DATE: 15/04/14**

**EXAM SESSION: 9.00 – 11.00 AM**

**TIME: 2.00 HOURS**

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**Instructions:**

- 1. Answer question 1 (Compulsory) and ANY other 2 questions**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

### **QUESTION 1 30 marks**

- a) What is TCP/IP? **(4 marks)**
- b) Outline the various specific protocols found in the application layer of the TCP/IP model **(4 marks)**
- c) Explain the procedure executed at routers in a network **(4 marks)**
- d) Give four examples of resources that may be shared in a distributed system. **(4marks)**
- e) What is the role of middleware in a distributed system? **(4marks)**
- f) Name two middleware communication services. **(4marks)**
- g) Explain the role of the data level in three-tiered client/server architecture. **(6marks)**

### **QUESTION 2 20 MARKS**

- a) Classify the following protocols: IP, TCP, and HTTP according to the ISO OSI classification. **(3marks)**
- b) Describe precisely what is meant by a scalable system. **(3marks)**
- c) Give at least one advantage of threads over processes. **(2marks)**
- d) Why is it sometimes so hard to hide the occurrence and recovery from failures in a distributed system? **(4marks)**
- e) Why are transport-level communication services often inappropriate for building distributed applications? **(3marks)**
- f) Processes in distributed systems are often divided into two groups: clients and servers.
  - i. Describe the client-server model. **(3marks)**
  - ii. Give a graphical representation of the request-reply interaction between a client and a server. **(2marks)**

### QUESTION 3 20 MARKS

(a) What is the purpose of a registry for object-oriented remote method invocation (RMI)?

**(4marks)**

(b) If a client invokes the same remote method for a second time, does it necessarily use the registry? Explain your reasoning.

**(4marks)**

(c) Give an example of a stateless protocol.

**(4marks)**

(d) Imagine a Web server that maintains a table in which client IP addresses are mapped to the most recently accessed Web pages. When a client connects to the server, the server looks up the client in its table, and if found, returns the registered page. In your opinion, is this server stateful or stateless? Present an argument to support your opinion.

**(4marks)**

(e) Is it possible to connect across a network two components of a distributed system written in different languages (e.g., COBOL and Java) using a distributed object-based system? Is it possible to connect such components by means of Java RMI? Give brief justifications for your answers.

**(4marks)**

### QUESTION 4 20 MARKS

a) Give two examples of identifiers (here, by the term “identifiers” we mean those identifiers that refer to entities in distributed systems).

**(2marks)**

b) Which name server addresses do DNS name servers hold by default, and why?

**(4marks)**

c) Describe the relative advantages and disadvantages of iterative and recursive name resolution in a distributed naming service.

**(4marks)**

d) Recall that a distributed commit protocol aims at having an operation executed by all members of a process group or by none of them.

A. Consider the following one-phase protocol: the coordinator simply tells all other processes to perform (locally) the operation. Give your reasoning why such a onephaseprotocolwillnotachievethegoalofadistributedcommitprotocol.

**(4marks)**

B. Describe the two-phase distributed commit protocol (2PC). Your description need not be complete, but should convey the idea on which the protocol is based.

**(4marks)**

e) Can one name belong to more than one name space? If yes, give an example.

**(2 marks)**

**QUESTION 5 20 MARKS**

- a) The distributed file system Coda allows a client to continue working with a shared file even if there is no network connection between the client and the server. Explain how this is made possible. **(4marks)**
- b) Is agreement possible in a system with unreliable communication? **(2marks)**
- c) What purpose is achieved by means of physical triple modular redundancy?( **3marks)**
- d) Can the model of triple modular redundancy handle Byzantine failures? **(3marks)**
- e) Consider two communication services for use in asynchronous distributed systems. In service A, messages maybe lost, corrupted, duplicated or delayed. In service B, messages may be lost, delayed or delivered too fast but those that are delivered arrive ordered and with the correct contents.
- A. Describe the classes of failure exhibited by each service **(2 marks)**
- B. Can service B be described as a reliable communication service? **(2marks)**
- f) If Alice wants to send secret information to Bob, should she know Bob's public or Bob's private key? **(2marks)**
- g) Describe what an access control matrix is. **(2marks)**