# CARDIFF UNIVERSITY
# EXAMINATION PAPER

| | |
|---|---|
| **Academic Year:** | 2016-2017 |
| **Examination Period:** | Spring |
| **Examination Paper Number:** | CMT202 |
| **Examination Paper Title:** | Distributed and Cloud Computing |
| **Duration:** | TWO hours |

**Do not turn this page over until instructed to do so by the Senior Invigilator.**

**Structure of Examination Paper:**

There are **THREE** pages.
There are **FOUR** questions in total.
There are no appendices.
The maximum mark for the examination paper is **60 marks** and the mark obtainable for a question or part of a question is shown in brackets alongside the question.

**Students to be provided with:**

The following item of stationery is to be provided:
**ONE** answer book.

**Instructions to Students:**

Answer **THREE** questions.

***Important note: if you answer more than the number of questions instructed, then answers will be marked in the order they appear only until the above instruction is met. Extra answers will be ignored. Clearly cancel any answers not intended for marking. Write clearly on the front of the answer book the numbers of the answers to be marked.***

The use of a translation dictionary between English or Welsh and another language, provided that it bears an appropriate school stamp, is permitted in this examination.

**1 (a)** Define what is meant by, and what characterises, a distributed system. **[5]**

**(b)** Two types of failures that can occur in a distributed system are *omission failures* and *byzantine failures.* Define both these types of failures. **[5]**

**(c)** A common problem which must be solved when designing a distributed system is achieving *mutual exclusion.* Describe this problem. **[5]**

**(d)** Explain what is meant by the term *middleware.* What is the purpose of middleware? **[5]**

**2 (a)** Describe what is meant by the term *Remote Procedure Call* (RPC). **[5]**

**(b)** *Carrier Sense Multiple Access with Collision Avoidance* (CSMA/CA) is a protocol which allows multiple processes to communicate in a wireless network. Describe this protocol. **[5]**

**(c)** Explain how a *public key cryptosystem* operates. What is the major advantage of using a *public* key cryptosystem as opposed to a *secret* key cryptosystem? **[5]**

**(d)** *Confusion* and *diffusion* are two important concepts in secret key cryptography. Explain both of these concepts. **[5]**

**3 (a)** P2P systems fall into three main categories: *centralized systems, brokered systems,* and *decentralized systems.* What are the main differences between these three categories of system? **[6]**

**(b)** *Napster* is an example of a brokered system, while *Gnutella* (version 0.4) is an example of a decentralized system. Explain, for each of the two systems:

(i) How a newly joined node publishes the files it wishes to make available. **[2]**

(ii) How a node finds the location of a desired file. **[2]**

**(c)** What are the non-functional requirements of *peer-to-peer middleware?* **[6]**

**(d)** In *unstructured* peer-to-peer systems, significant improvements on search results can be provided by the adoption of particular search strategies. Name and describe *two* alternative search strategies to simple flooding. **[4]**

**4 (a)** Cloud computing services like Amazon's EC2 assign users virtual machines (VMs) instead of allocating physical machines directly. Doing so provides a number of major benefits to Amazon or the customer. Identify *three* of these benefits. For each of these benefits, provide a brief explanation of why it is desirable. **[6]**

**(b)** Briefly explain the difference between *private* and *public* clouds. **[2]**

**(c)** Describe how *virtualisation* is accomplished. **[4]**

**(d)** You are required to provide a web API for an audio publishing company so that it can publish data for its audio tracks, and the data can then be used by 3rd party applications. Your company's service is due to be hosted "in the Cloud". Your solution is required quickly and the budget for on-going IT support for the project will be small. Discussing and justifying your answer with respect to the given scenario, explain whether you would use an IaaS or a PaaS based solution. **[8]**