Semester One of Academic Year (2015---2016) of BJUT

《Distributed Systems》

Module Code: COMP3008J

Exam Paper A

Exam Instructions: Question 1 is compulsory. Answer any TWO other Questions

Honesty Pledge:

I have read and clearly understand the Examination Rules of Beijing University of Technology and University College Dublin and am aware of the Punishment for Violating the Rules of Beijing University of Technology and University College Dublin. I hereby promise to abide by the relevant rules and regulations by not giving or receiving any help during the exam. If caught violating the rules, I would accept the punishment thereof.

Pledger: _____ **Class No:** _____

BJUT Student ID: _____ **UCD Student ID**_____

Notes:

The exam paper has 2 parts on 4 pages, with a full score of 100 points. You are required to use the given Examination Book only.

Instructions for Candidates

Full marks will be awarded for complete answer to **Question 1** and complete answers **to any TWO other Questions** (Question 2, Question 3, Question 4 and Question 5).

Instructions for Invigilators

Candidates are allowed to use non-programmable calculators during this examination.

Obtained score

Part 1: Is compulsory

QUESTION 1

a) What is a Distributed System? Give examples of distributed systems.

[5 marks]

b) In terms of a distributed system what is the meaning of *middleware*?

[5 marks]

c) Briefly describe how *reliable multicast* may be implemented in a distributed system.

[5 marks]

d) Briefly describe the Global Snapshot algorithm for saving state information in a distributed system.

[5 marks]

e) What is a *digital signature*? How can this be implemented using *shared key encryption*?

[5 marks]

f) Briefly describe the core system architectures that are used in distributed systems.

[5 marks]

g) When enforcing *mutual exclusion* in a distributed system, what are the advantages and disadvantages of using a distributed mutual exclusion algorithm?

[5 marks]

h) In a peer-to-peer system, what is a *routing overlay*?

[5 marks]

i) Compare and contrast *static* versus *dynamic* replication.

[5 marks]

j) Explain the difference between *symmetric* and *asymmetric encryption.*

[5 marks]

[Total 50 marks]

Obtained score

Part 2: Answer any TWO questions

QUESTION 2

a) In a distributed system, physical time can be synchronised using Cristian's algorithm or the Berkeley algorithm. Choose ONE of these and explain how it works.

[5 marks]

b) What is a *logical clock*? One way of implementing a logical clock is by using *Vector Time*. Using an example, show how vector time can be used.

[10 marks]

c) One way of electing a coordinator of a distributed system is to use a *ring voting algorithm*. Describe how this can be used and how it compares with the *bully algorithm* in terms of bandwidth and turnaround time.

[10 marks]

[Total 25 marks]

QUESTION 3

a) Briefly outline the five types of attack that should be guarded against in a distributed system.

[5 marks]

b) Describe in detail how *Kerberos* can be used for secure authentication in a distributed system.

[10 marks]

c) What are the key requirements of a computing *grid*? What extensions must be made to basic *web services* in order to satisfy these requirements?

[10 marks]

[Total 25 marks]

QUESTION 4

a) What is a distributed file system? List the main components that make up a distributed file system.

[5 marks]

b) Describe and compare the two Remote File Access models, namely the *Upload/Download Model* and the *Remote Access Model*, that are described in the course.

[8 marks]

c) A key concept in distributed file system design is *caching*. Describe how caching can be applied to the Remote Access Model. Include in your description answers to the following questions:

i) What are the advantages of disk caches and memory caches?

ii) What cache update policies can be used?

iii) Discuss the cache-consistency problem.

iv) What are the benefits of using a cache?

[12 marks]

[Total 25 marks]

QUESTION 5

a) Describe in detail the three *mutual exclusion* algorithms covered in the course. Your answer should include a discussion of their advantages and disadvantages in terms of the number of messages required and other problems that may affect the system.

[15 marks]

b) In a peer-to-peer system, what is a *routing overlay*? Describe how the *Pastry* peer-to-peer middleware implements routing.

[10 marks]

[Total 25 marks]