Beijing-Dublin International College

SEMESTER 1 FINAL EXAMINATION - (2019/2020)

School of Computer Science

COMP3008J Distributed Systems

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Time Allowed: 120 minutes

Instructions for Candidates:

Answer all questions. All questions do not carry equal marks.

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

I have read and clearly understand the Examination Rules of both Beijing University of Technology and University College Dublin. I am aware of the Punishment for Violating the Rules of Beijing University of Technology and/or 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 accept the punishment thereof.

Honesty Pledge:_____ **(Signature)**

Instructions for Invigilators

Non-programmable calculators are permitted.
No rough-work paper is to be provided for candidates.

Question 1:

Three hosts are communicating with one another in a distributed system. Their clocks run at different speeds:

- Process A has a fast clock: dC/dt = 1.2
- Process B has a perfect clock: dC/dt = 1
- Process C has a slow clock: dC/dt = 0.8

The following messages are sent (T denotes real time in seconds).

- A sends a message to B at time T=20
- A sends a message to C at time T=50
- A sends a message to B at time T=60
- C sends a message to A at time T=80
- B sends a message to C at time T=90

Assuming all messages take exactly 10 real-time seconds to arrive:

- What are the timestamps of the three processes if we use Lamport's algorithm to enforce a global logical clock?
- Explain each step of your answer.

(10%)

(Total 10%)

Question 2:

In the context of Distributed File Systems (DFS), answer the following questions:

a. What do you mean by 'location transparency'? **(2%)**

b. What do you mean by 'location independence'? **(2%)**

c. What is a cache? **(2%)**

d. What is meant by cache-consistency problem, and how do you solve it? **(2%)**

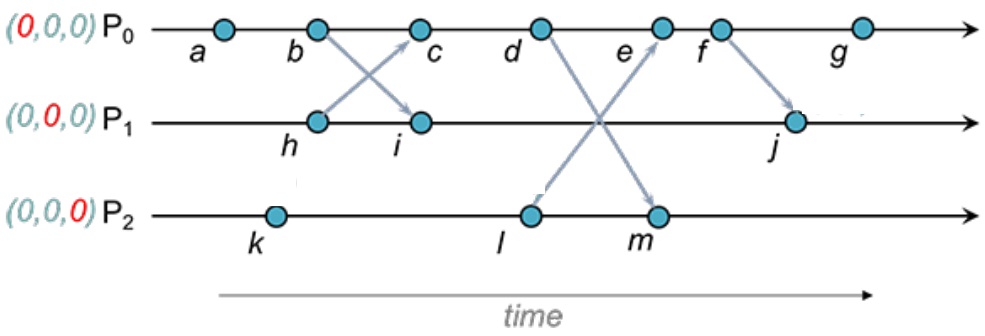
e. What are the benefits of using cache? **(2%)**

(10%)

(Total 10%)

Question 3:

The following figure describes three processes P_0, P_1 and P_2, and there are several events that occurred in these processes. All the three processes have their initial vector times set as (0,0,0). Compute the vector time for all the events in the figure, and explain your answer.



(10%)

(Total 10%)

Question 4:

In the context of Replication Systems for Distributed Systems, answer the following questions:

a. What do you mean by 'Gossiping' in distributed systems? Explain how it is analogous to epidemics (rapid spread of infectious disease) in a community. **(5%)**

b. What are the primary five steps involved in handling a request to perform an operation on a logical object? **(5%)**

(10%)

(Total 10%)

Question 5:

State at least five primary differences between 'Routing Overlays' and 'IP Routing'.

(15%)

(Total 15%)

Question 6:

What is Group Membership Service (GMS)? What are the four main objectives of GMS?

(10%)

(Total 10%)

Question 7:

Why are distributed systems vulnerable to security attacks? Explain.

(10%)

(Total 10%)

Question 8:

Define the terms 'confusion' and 'diffusion', based on Shannon's Information Theory.

(5%)

(Total 5%)

Question 9:

State at least four primary differences between Symmetric and Asymmetric Encryption algorithms.

(10%)

(Total 10%)

Question 10:

In relation to the type of security attacks in distributed systems, define the term 'Masquerading' and 'Denial of Service'.

(10%)

(Total 10%)