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MAIN EXAMINATION

MAY – AUGUST 2021

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE

REGULAR PROGRAMME

CMT 412: DISTRIBUTED OPERATING SYSTEMS

Date: AUGUST 2021	**Duration: 2 Hours**
Instructions: Answer Question ONE and any other TWO Questions.	

1. a) In what respect are distributed computing systems better than parallel processing systems? Give examples of three applications for which distributed computing systems will be more suitable than parallel processing systems. **(7 marks)**

(b) i)Explain the Remote Procedure Call mechanism in detail with the help of a diagram. **(5 Marks)**

ii) State 5 differences between Remote Procedure Call and Remote Method Invocation. **(5 Marks)**

c) Explain different desirable features of good message passing system. (**5 Marks)**

d) What is group Communication? **(2 Marks)**

e) Explain the different architectural models of distributed system. **(6 Marks)**

2. a) Consider a bully election with six processes, P1 – P6. P6 (the current coordinator) fails and P3 starts the election. How many messages are exchanged (with the help of diagrams) until the new coordinator is elected. (**12 Marks**)

b) i) Consider the Ricart-Agrawala algorithm (non-token based). How many messages are passed in order for a process to get permission to enter a critical section?

(4 Marks)

ii) Consider the Ricart-Agrawala Second algorithm (token-based). How many messages are passed in order for a process to get permission to enter a critical section?

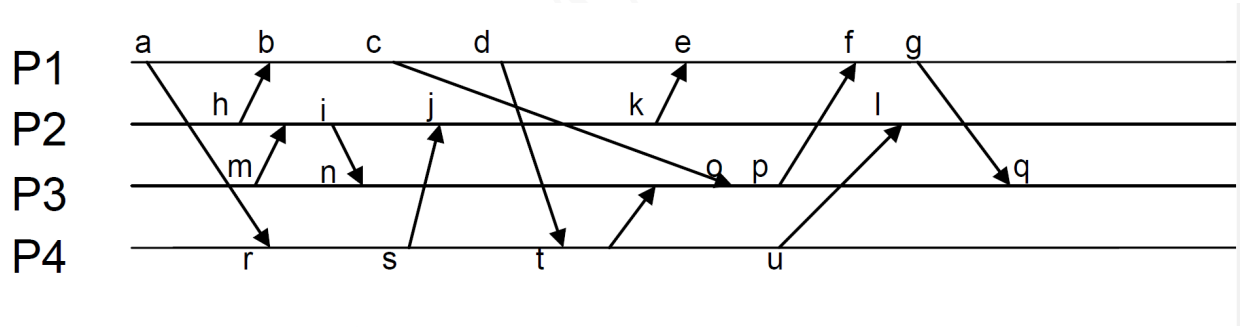
(4 Marks)

3. a) A client has a time of 5:05 and a server has a time of 5:25. Using the Berkeley algorithm, the client's clock will be set to: **(4 Marks)**

b) A client gets a timestamp of 4:12:30.500 from a time server. The elapsed time between the request and response was 20 msec (0.020 sec). The current time on the client is 4:12:30.510. Using Cristian's algorithm, what is the time set to on the client?

(**4 Marks)**

c) Consider the snapshot below:



Indicate the timestamps of nodes a, b, c, e, f, h, l, j, k, m, s, u. **(12 Marks)**

4. a) Identify these fault types: **(10 Marks)**

i) Faults in components of a system which occur with a certain probability.

ii) Faults due to mistakes in the specification of a system or mistakes in the implementation of software or mistakes in the design of hardware.

iii) Faults that remain in existence indefinitely, until corrective action is taken.

iv) Faults that remain in the system for some period and then disappears.

v) Faults caused by a malfunction of a device or system that occurs at intervals, usually irregular, in a device or system that functions normally at other times.

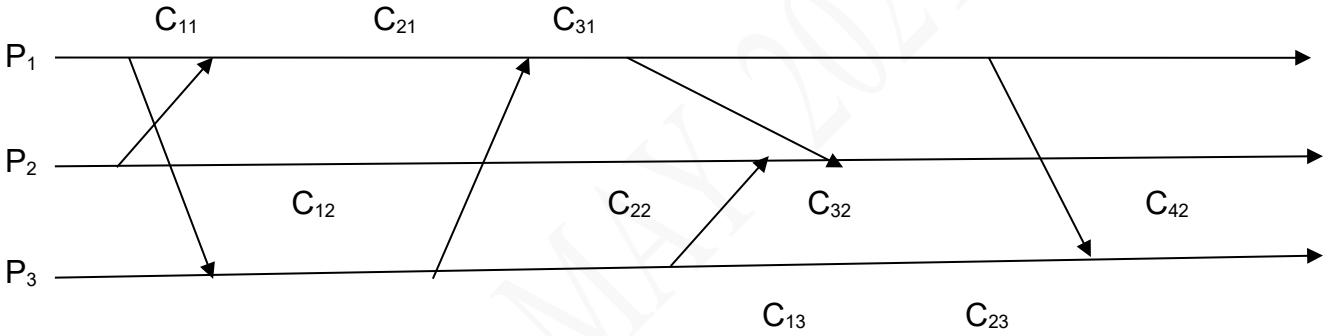
b) Differentiate between the following terms:

i) Hot Standby and Cold Standby. **(4 Marks)**

ii) Backward and Forward recovery **(4 Marks)**

c) How many processors do you need in order to achieve k fault tolerance with byzantine faults. **(2 marks**)

5. a) Consider the following snapshot.



Determine for each of the following cuts if it is inconsistent, consistent or strongly consistent:

$\{C_{21}, C_{12}\}$, $\{C_{31}, C_{42}\}$, $\{C_{22}, C_{13}\}$, $\{C_{32}, C_{23}\}$, $\{C_{23}, C_{42}\}$, $\{C_{11}, C_{12}\}$ **(6 marks)**

b) Different copies of identical software always produce the same behavior for identical inputs thereby making software redundancy difficult to implement. Outline five approaches that you can employ to mitigate against this occurrences. **(5 marks)**

c) Identify and describe two ways in which mobile devices explore their environment. **(4 marks)**

d) Briefly describe five features found in real time systems. **(5 marks)**