
UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2003/2004

September/October 2003

CCS521 – Advanced Distributed Systems Concepts and Design

Duration : 3 hours

INSTRUCTION TO CANDIDATE:

- Please ensure that this examination paper contains **FOUR** questions in **FOUR** printed pages before you start the examination.
 - Answer **ALL** questions.
 - You can choose to answer either in Bahasa Malaysia or English.
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ENGLISH VERSION OF THE QUESTION PAPER

1. (a) Frequently used names and their attributes can be cached at a client or at intermediate name servers to eliminate or reduce the need for name resolution.
- (i) Explain how this mechanism can improve performance.
 - (ii) Explain how the same mechanism can improve fault tolerance.
 - (iii) When does this cache need to be invalidated?
 - (iv) Propose a scheme for cache invalidation.
- (12/25)
- (b) Compare and contrast the iterative name resolution and the recursive name resolution in terms of effectiveness of caching results and communication costs. Use an example to illustrate your comparison.
- (8/25)
- (c) Distinguish between primary based consistency protocols and replicated write protocols.
- (5/25)
2. (a) In Maekawa algorithm, processors must cast their votes before hearing about all possible candidates. Hence a processor might cast the "wrong" vote. This does not cause a problem if the system can agree on the winner. However, if no candidate wins, a deadlock occurs. Suggest a method to recover from this deadlock situation.
- (3/25)
- (b) Assume that all nodes initiate the election simultaneously in Chang and Roberts ring election algorithm. Analyse the best and worst case message complexities.
- (8/25)
- (c) (i) Given the situation below:
- | | |
|--------------------------|--------------------------|
| <u>Process 1</u> | <u>Process 2</u> |
| x=1 | y=1 |
| if (y equal 0) kill (p2) | if (x equal 0) kill (p1) |
- Assume that the integer variables x and y are initialised to 0. A sequentially consistent memory allows 6 possible statement interleavings. List all the possibilities and in each case state which process is being killed (if any).
- (ii) Using processor consistency for the situation in 2(c)(i) will result in a situation where both processes can be killed. State the situation.
- (14/25)

3. (a) The hello interface provides two methods:

Greet: with two parameters namely type of languages (an integer or short) and message (a string).

Reply: with two parameters namely happiness (a boolean) and answer (a string).

Define the hello interface in CORBA IDL and JAVA RMI. Compare the methods in the **two (2)** languages for specifying *input* and *output* arguments.

(6/25)

- (b) Compare static invocation versus dynamic invocation in CORBA.

(5/25)

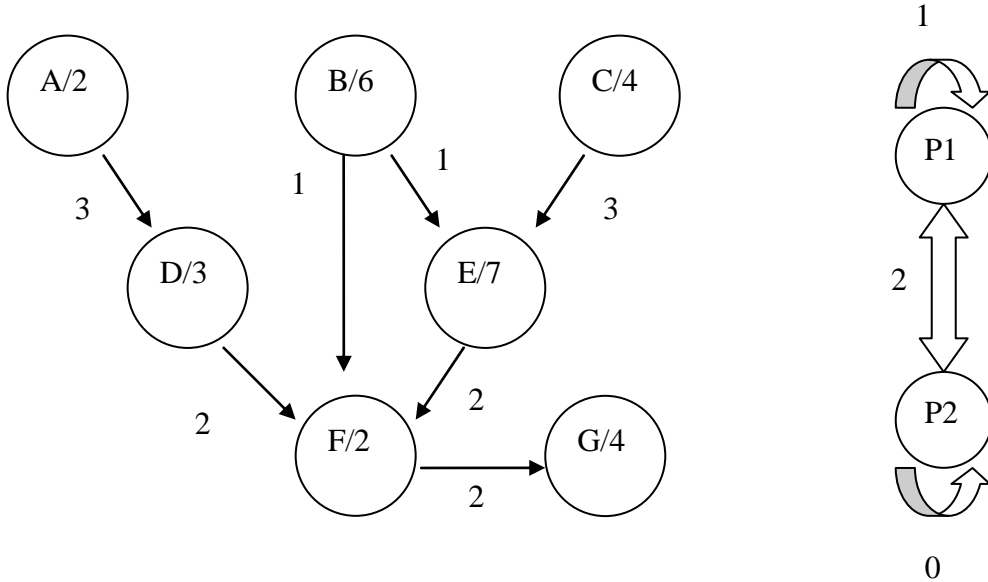
- (c) In the static scheduling, the scheduler needs to know the behaviour of the tasks before the assignment, but in reality it is very difficult to even estimate the nature of process in a distributed system. How can this be overcome in the dynamic scheduling?

(7/25)

- (d) Compare a sender-initiated load balancer with a receiver-initiated load balancer in terms of transfer policies and effectiveness.

(7/25)

4. (a) There are 7 tasks (A, B, C, D, E, F, G) that can be scheduled in two processors (P1, P2). Below are the diagrams that show the computation cost and communication cost of each task and processor. By taking into consideration of communication overhead, schedule the above tasks in two processors. What is the critical path? Calculate the makespan of the tasks for the optimal solution.



(8/25)

- (b) There are some major technical issues for resource management in grid computing such as utilisation of other domain resources and scheduling. What kind of core services provided by Globus in this context?
- (c) Using the layering approach, draw a layer diagram to position cluster, socket, CORBA, MPI, resource management and high throughput image processing application.
- (d) Identify **four (4)** main characteristics in peer-to-peer computing. Based on the chosen characteristics, give your comments on Napster file sharing system.

(6/25)

(5/25)

(6/25)