Selected Questions

Exam 2
Fall 2006

Question 5

The clock in the clock tower in the town of Chronos broke. It was repaired but now the clock needs to be set. A train leaves for the nearest town, Temporis, 100 miles away. It returns 4 \frac{1}{2} hours later with a report that the time according to the clock tower in Temporis is 4:05.

(a) To what value should the time be set on the clock tower?

Round-trip delay = 4:30
4:05 + (4:30/2) = 4:05 + 2:15 = 6:20
Question 5

The clock in the clock tower in the town of Chronos broke. It was repaired but now the clock needs to be set. A train leaves for the nearest town, Temporis, 100 miles away. It returns 4 hours later with a report that the time according to the clock tower in Temporis is 4:05.

(b) The maximum speed that the train can travel is 50 mph. What is the error of the clock?

Best case: 100 miles @ 50 mph = 2 hours
Minimum time traveling: 4 hours
Uncertainty window: 4:30 - 4:00 = 30 min
Error = ±15 min

Question 7

The Chandy-Misra-Haas deadlock probing algorithm:

a) sends a message to see if it comes back to the originator.
b) sends queries to systems to see if they are deadlocked.
c) allows a server to identify which process generated the deadlock.
d) Forces a timestamp ordering of resource allocation that prevents deadlocks.
Question 8

False deadlocks can be fixed by:

a) reliable message transmission.

**b) proper message ordering.**

c) atomic multicasts.

d) avoiding the use of a central server.

Question 10

Event a has a Lamport timestamp of 4.
Event b has a Lamport timestamp of 8.

What can we tell about events a and b?

a) Events a and b are causally related.

b) Events a and b are concurrent.

c) Event a happened before event b.

**d) If events a and b are causally related, then event a happened before event b.**
Question 11

Which event is concurrent with the vector timestamp (2, 4, 6)?

a) (3, 5, 7)
b) (1, 3, 5)
c) (1, 4, 6)
d) (1, 4, 7)

Question 12

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:

a) 5:15
b) 5:20
c) 5:25
d) 5:30

\[
\frac{5:05 + 5:25}{2} = 5:30/2 = 5:15
\]
**Question 13**

Which offers the most fault-tolerant message delivery?

a) Atomic multicast.
b) Totally ordered reliable multicast.
c) Causally ordered reliable multicast.
d) Hardware multicast.

**Question 14**

When we had to send an IP packet over an ethernet network, we found the corresponding ethernet address via the Address Resolution Protocol (ARP). How do we find the ethernet address that corresponds to a particular IP multicast address?

a) All IP multicast packets use the same reserved ethernet address.
b) ARP is also responsible for handling multicast addresses.
c) By mapping some of the bits of an IP multicast address onto an ethernet address.
d) By mapping all of the bits of an IP multicast address onto an ethernet address.
Question 14

32-bit class D IP address:

1110 XXXX XXXX XXXX XXXX XXXX

48-bit ethernet address:

0000 0001 0000 0000 0101 1110 0xxx XXXX XXXX XXXX XXXX XXXX

28-bit multicast group ID

Lower 23 bits

23-bit vendor component

Question 15

How does IP multicast achieve reliable packet delivery?

a) It doesn't
b) Via best-effort multicast.
c) Via atomic multicast.
d) Via IGMP (Internet Group Management Protocol)
Question 16

A copyset is used:

a) In a DSM system that employs page caching.
b) In a DSM system as an alternative to page caching.
c) To implement lazy release consistency.
d) To implement entry consistency.

Question 17

An ethernet card may support all of the following mechanisms for multicast except:

a) Filtering packets based on a hash of the multicast address.
b) Searching through a small table for a matching ethernet address.
c) Searching through a larger table of ethernet addresses in main memory.
d) Accepting all multicast packets via multicast promiscuous mode.
**Question 18**

If a frequency analysis of ciphertext reveals a statistical equivalence to the corresponding frequencies of plain English text, we can guess that the cipher is:

a) a monoalphabetic substitution cipher.
b) a polyalphabetic substitution cipher.
c) a transposition cipher.
d) a rotor machine.

**Question 19**

A rotor machine implements:

a) a monoalphabetic substitution cipher.
b) a polyalphabetic substitution cipher.
c) a transposition cipher.
d) a one-time pad.
**Question 20**

False sharing in a DSM system refers to:

a) an unwanted page being cached on another system  

b) unrelated data being resident on the same page.  

c) invalid data in the directory, leading the system to falsely believe the page is shared.  

d) two versions of the same page being present on one system.

**Question 21**

A bully election algorithm:

a) picks the first process to respond to an election request.  

b) relies on majority vote to pick the winning process.  

c) assigns the role of coordinator to the process holding the token at the time of election.  

d) picks the process with the largest ID.
Question 22

Which mutual exclusion algorithm works when the membership of the group is unknown?

a) Centralized.
b) Ricart-Agrawala.
c) Lamport.
d) Token Ring.

Question 23

Weak consistency models offer an advantage over sequential consistency because:

a) memory synchronization does not have to occur with each memory operation.
b) caching may be used.
c) only the needed data needs to be shared, not the entire memory system.
d) they ensure that each write operation invalidates or updates all cached copies before the next instruction is executed.
Selected Questions

Spring 2006
Exam 2

Question 4

What is false deadlock?

- Release and Request messages for resources arrive out of order, causing a centralized deadlock detection algorithm to detect a cycle when one really will not exist.

- They do not have to be requests/releases for the same resource.
Question 5

What is false sharing?

- When processes are accessing unrelated data that happens to reside on the same shared page. This leads to thrashing.

- Not: when different data resides on the same page.

Question 6

Assign Lamport timestamps to the following events:

```
P0  5  a  b
P1  1  c  d  e
P2  1

a. 6  d. 7
b. 7  e. 8
c. 6  f. 9
```
You have several computers cooperating on a parallel program. CPU 1 tries to write to page 302, which is currently owned by CPU 0. Explain the sequence of operations that takes place in a DSM system.

- CPU 1 attempts to write and get a page fault.
- Page fault handler contacts directory to find current owner of page 302.
- CPU 1 fetches page from CPU 0 (CPU 0 sends page).
- CPU 0 creates a free page frame and loads page 302 into it.
- CPU 0 adjusts PTE in MMU and restarts instruction.
- CPU 1 writes to page 302 successfully.

10. Which of the following is *not* a condition for deadlock?
   - a. Hold & wait: processes that hold resources can wait for another one.
   - b. Non-agreement: two or more processes cannot agree on resource allocation.
   - c. Non-preemption: a resource cannot be revoked from a process that has it.
   - d. Circular wait: two or more processes are waiting for resources held by one of the others.
11. Which set of events is concurrent (all events are concurrent with each other)?
   a. (3, 1, 5, 7), (3, 2, 6, 7), (2, 1, 6, 8)
   b. (2, 1, 3, 4), (2, 2, 3, 3), (3, 3, 2, 5)
   c. (1, 2, 3, 4), (2, 3, 4, 5), (3, 4, 5, 6)
   d. (1, 5, 6, 7), (1, 4, 5, 7), (1, 3, 2, 2)

If we do an element-by-element comparison:
(2, 1, 3, 4) is neither \(\geq\) nor \(\leq\) to (2,2,3,3)
2=2; 1<2; 3=3, 4>3.
(2,2,3,3) is neither \(\geq\) nor \(\leq\) to (3,3,2,5)
2<3; 2<3; 3>2; 3<5

12. After the first phase of a two-phase commit protocol, the coordinator:
   a. Sent out a query asking whether the cohorts are ready to commit.
   b. Received responses to the query from all cohorts.
   c. Sent a request to commit (or abort) but did not receive acknowledgements.
   d. Received acknowledgements to the commit (or abort) directive.
13. A linear compensating function adjusts a clock to:
   a. Tick at constantly decreasing or increasing intervals until synchronization is achieved.
   b. Compensate for variations in a clock’s frequency to make it appear to tick at a constant rate.
   c. Tick at a constant faster or slower interval.
   d. Compensate for sudden changes such as leap seconds or daylight savings time.

14. 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?
   a. 4:12:30.480
   b. 4:12:30.490
   c. 4:12:30.510
   d. 4:12:30.520

Cristian’s algorithm sets the time to:

server time + \( \frac{1}{3} \) (elapsed time)

= 3:12:30.500 + 0.020/2
= 3:12:30.500 + 0.010
= 3:12:30.510
15. Which mutual exclusion algorithm is useful when the membership of the group is unknown?
   a. Centralized.
   b. Lamport’s.
   c. Token ring.
   d. All of the above.

   Lamport’s requires reliable group multicast.
   Token ring requires the ability to construct a logical ring of processes based on the group.
   Centralized doesn’t require you to know about any other process.

16. How does IP multicast achieve reliable packet delivery?
   a. It doesn’t.
   b. Via best-effort multicast.
   c. Via atomic multicast.
   d. Via IGMP (Internet Group Management Protocol).
17. A copyset is used:
   a. In a DSM system that employs page caching.
   b. In a DSM system as an alternative to page caching.
   c. To implement lazy release consistency.
   d. To implement entry consistency.

A copyset is nothing more than a list of processors that have a copy of a particular shared memory page.

Selected Questions

Exam 3
Fall 2006
Question 4

The Diffie-Hellman algorithm is not an encryption algorithm. What is it good for?

It allows two parties to establish a common key that no other two parties can compute.

Question 9

A write-ahead log is important in a two-phase commit protocol because:

a) It allows auditors to examine the transactions.
b) It ensures all-or-nothing atomicity.
c) It allows a system to recover its state in the protocol if it died.
d) It reduces message traffic since all participants can reference the same write-ahead log file.
The End.