PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Midterm **Examination:** Semester 1 **Academic Year:** 2005-2006
Date: 6th August 2005 **Time:** 9.00-12.00
Subject Number: 240-573 **Room:** R300
Subject Title: Distributed Computing (การคำนวณแบบกระจาย)

Exam Duration: 3 hours

This paper has 10 pages and 7 questions
Total marks: 120 (30%)

Authorized Materials:

- Writing instruments (e.g. pens, pencils).
- Notebooks, handouts and dictionaries are permitted.
- Books are not permitted.

Instructions to Students:

- Answer questions in Thai.
- Attempt all questions.
- Any unreadable parts will be considered wrong.
- Write your name and ID on every page.

ทุจริตในการสอบ

โทษขั้นต่ำ ปรับตกในรายวิชานั้นและพักการเรียน 1 ภาคการศึกษา

โทษขั้นสูง ให้ออก

Name _____ ID _____

Question 1 (8 marks; 10 minutes)

Consider this URI: http://www.someSite.org:8081/foo/index.htm

i. What is the protocol specified?

_____

ii. What is the host name of the service?

_____

iii. What is the port number of the process that provides the service?

_____

iv. Where is the document located?

_____

Question 2 (12 marks; 15 minutes)

A naming scheme is said to allow ***location transparency***] if the scheme allows objects to be addressed without explicit knowledge of their physical location. For example, the U.S. phone number system is location transparent, as a caller does not need to know the whereabouts of the callee when dialing up. The U.S. postal address system, on the other hand, does not allow location transparency, since you must address the recipient with his/her physical address (excluding postal office boxes, that is).

Consider each of the following naming schemes. For each, determine if it is location transparent? Justify your answer.

i. The domain name system (DNS) **(4 marks)**

_____

_____

_____

_____

_____

ii. Uniform Resource Location (URL) **(4 marks)**

iii. Uniform Resource Name (URN) (2 marks)

iv. Extensible Name Service (XNS) (2 marks)

Question 3 (25 marks; 30 minutes)

In a distributed system three processes P_1, P_2, P_3 are engaged in interprocess communication. Suppose the following sequence of events occurred:

At time 1, P3 issues a receive from P2.

At time 2, P1 sends m1 to P2.

At time 3, P2 issues a receive from P1.

At time 4, P2 receives m1.

At time 5, P2 sends message m1 to P3.

At time 6, P3 receives m1; P1 issues receive from P2.

At time 7, P2 issues a receive from P3.

At time 8, P3 sends m2 to P2.

At time 9, P2 receives m2.

At time 10, P2 sends m2 to P1.

At time 11, P1 recieves m2.

a. Draw a time event diagram each (ระบุเวลาและข้อความที่ส่งในแต่ละเหตุการณ์) to show the sequence of events and the blocking and unblocking of each process:

i. on a communication system which provides blocking send operation and blocking receive operation. (10 marks)

P1 P2 P3

ii. on a communication system which provides non-blocking send operation and blocking receive operation. (10 marks)

P1 P2 P3

Name _____ ID _____

b. Draw a sequence diagram to document the interprocess communication between P1, P2, and P3. (5 marks)

P1 P2 P3

Question 4 (15 marks; 20 minutes)

Consider the Simple Mail Transfer Protocol (SMTP). An excerpt from the RFC for this protocol provides the following sample session.

```
   R: 220 USC-ISI.ARPA Simple Mail Transfer Service Ready
S: HELO LBL-UNIX.ARPA
R: 250 USC-ISI.ARPA

S: MAIL FROM:<mo@LBL-UNIX.ARPA>
R: 250 OK

S: RCPT TO:<Jones@USC-ISI.ARPA>
R: OK

S: DATA
R: 354 Start mail input; end with <CRLF>.<CRLF>
S: Blah blah blah...
S: ...etc. etc. etc.
S: .
R: 250 OK

S: QUIT
R: 221 USC-ISI.ARPA Service closing transmission channel
```

a. What is the format of each request? (2 marks)

_____

b. What is the format of each response? (3 marks)

_____

_____

Name _____ ID _____

c. Use a sequence diagram to describe the interactions among the participating processes.

Client **Server** **(explanation)**

Question 5 (25 marks; 30 minutes)

a. Explain the difference between process and program. (2 marks)

b. Explain the difference between process and thread. (3 marks)

c. Tell the differences amongst the following distributed computing paradigms.

i. Message Passing, Socket API (4marks)

ii. Client-Server (4 marks)

iii. Message System (4 marks)

iv. Remote Procedure Call, Remote Method Invocation (4 marks)

v. Distributed Objects (4 marks)

Question 6 (15 marks; 15 minutes)

Suppose a multicast group currently is participated by two processes: $\mathbf{P_1}$ and $\mathbf{P_2}$. Suppose $\mathbf{P_1}$ multicasts $\mathbf{m_{11}}$ then $\mathbf{m_{12}}$, $\mathbf{P_2}$ multicasts $\mathbf{m_{21}}$ then $\mathbf{m_{22}}$.

a) How many different orders can all the messages be delivered to each process? (4 marks)

b) How many different orders can all four messages be delivered to each process if the messages are causally related as $\mathbf{m_{11}}$ -> $\mathbf{m_{21}}$ -> $\mathbf{m_{12}}$ -> $\mathbf{m_{22}}$ (2 marks)

c) What are the possible orders of message delivery to each process if the multicast is (i) FIFO, (ii) causal, and (iii) atomic? (6 marks)

d) **What are the possible orders of message delivery to each process if the** messages are causally related as $\mathbf{m_{11}}$ -> $\mathbf{m_{21}}$ -> $\mathbf{m_{12}}$ -> $\mathbf{m_{22}}$ and the multicast is (i) FIFO, (ii) causal, and (iii) atomic? (3 marks)

Name _____ ID _____

Question 7 (30 marks; 30 minutes)

Suppose the following events take place in chronological order, in a multicast group participated by three processes $\mathbf{P_1}$, $\mathbf{P_2}$, and $\mathbf{P_3}$:

$\mathbf{P_1}$ multicasts $\mathbf{m_1}$.
$\mathbf{P_2}$ responds to $\mathbf{m_1}$ by multicasting $\mathbf{m_2}$.
$\mathbf{P_3}$ multicasts $\mathbf{m_3}$ spontaneously.
$\mathbf{P_1}$ responds to $\mathbf{m_3}$ by multicasting $\mathbf{m_4}$.
$\mathbf{P_3}$ responds to $\mathbf{m_2}$ by multicasting $\mathbf{m_5}$.
$\mathbf{P_2}$ multicasts $\mathbf{m_6}$ spontaneously.

For each of the following scenarios, state in the corresponding entry in the table below whether it is permitted or not by that mode of multicast.

a. All processes are delivered $\mathbf{m_1}$, $\mathbf{m_2}$, $\mathbf{m_3}$, $\mathbf{m_4}$, $\mathbf{m_5}$, $\mathbf{m_6}$, in that order

b. $\mathbf{P_1}$ and $\mathbf{P_2}$ are each delivered $\mathbf{m_1}$, $\mathbf{m_2}$, $\mathbf{m_3}$, $\mathbf{m_4}$, $\mathbf{m_5}$, $\mathbf{m_6}$.
$\mathbf{P_3}$ is delivered $\mathbf{m_2}$, $\mathbf{m_3}$, $\mathbf{m_1}$, $\mathbf{m_4}$, $\mathbf{m_5}$, $\mathbf{m_6}$.

c. $\mathbf{P_1}$ is delivered $\mathbf{m_1}$, $\mathbf{m_2}$, $\mathbf{m_5}$, $\mathbf{m_3}$, $\mathbf{m_4}$, $\mathbf{m_6}$
$\mathbf{P_2}$ is delivered $\mathbf{m_1}$, $\mathbf{m_3}$, $\mathbf{m_5}$, $\mathbf{m_4}$, $\mathbf{m_2}$, $\mathbf{m_6}$
$\mathbf{P_3}$ is delivered $\mathbf{m_3}$, $\mathbf{m_1}$, $\mathbf{m_4}$, $\mathbf{m_2}$, $\mathbf{m_5}$, $\mathbf{m_6}$

d. P1 is delivered **m1, m2, m3, m4, m5, m6**
P2 is delivered **m1, m4, m2, m3, m6, m5**
P3 is delivered **m1, m3, m6, m4, m2, m5.**

e. P1 is delivered **m1, m2, m3, m4, m5, m6**
P2 is delivered **m1, m3, m2, m5, m4, m6**
P3 is delivered **m1, m2, m6, m5, m3, m4.**

f. $\mathbf{P_1}$ is delivered $\mathbf{m_2}$, $\mathbf{m_1}$, $\mathbf{m_6}$
$\mathbf{P_2}$ is delivered $\mathbf{m_1}$, $\mathbf{m_2}$, $\mathbf{m_6}$
$\mathbf{P_3}$ is delivered $\mathbf{m_6}$, $\mathbf{m_2}$, $\mathbf{m_1}$

g. No message is delivered to any of the processes.

Scenario	Reliable multicast	FIFO multicast	Causal multicast	Atomic multicast
a.				
b.				
c.				
d.				
e.				
f.				
g.				

--- End of Examination ---

Lecturer: Pichaya Tandayya

Name _____ ID _____