PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester 1 **Academic Year**: 2005-2006

Date: 6th October 2005 **Time**: 9.00-12.00

Subject Number: 240-573 **Room**: R300

Subject Title: Distributed Computing (การคำนวณแบบกระจาย)

Exam Duration: 3 hours

This paper has 13 pages and 7 questions.
Total marks: 160 marks.

Authorized Materials:

- Writing instruments (e.g. pens, pencils).
- Dictionaries and paper sheets (e.g. notebooks, handouts) are permitted.
- Books and Calculators 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

โทษสูงสุด ให้ออก

Lecturer: Pichaya Tandayya

Name____ID____________________

Question 1 (20 marks; 20 minutes)

a. Explain (i) how the data submitted by a browser user using the web form below is forwarded to the web script **getForm.cgi** during its execution and (ii) how the program for **getFrom.cgi** retrieves the data. (10 marks)

```
<html>
<head>
<title>Food Quiz</title>
</head>
<body>
<form method="get" action="getForm.cgi">
<H2> Pop Quiz: </H2>
What is your name: <input name="name"><P>
What is your favorite food:
 <select name="color">
 <option selected>pizza
 <option>chicken ala king
</select><P>

Press <input type="submit" value="here"> to submit your query.
</form>
</body>
</html>
```

Answer: (i)

Answer: (ii)

Name____ID______________________

b. Consider the **data marshalling** involved in the transmission of the input data items between the web form and the web script: Describe and explain how each of the two aspects (web form and web script) is achieved in this case. (10 marks)

Answer:

Name____ID______________________

Question 2 (25 marks; 25 minutes)

During one particular web session, the following transactions occurred, in time order:

Transaction 1:
User requests a document http://www.alpha.com/books/store.html, and receives in the response:

Set-Cookie: ID=1

Transaction 2:
User requests a document http://www.alpha.com/music/store.html, and receives in the response:

Set-Cookie: ID=2
Set-Cookie: NAME=John; path=/

Transaction 3:
User requests a document http://www.beta.com/index.html, and receives in the response:

Set-Cookie: NAME=John; expires=Wednesday, 09-Nov-02 23:12:40 GMT

a) How many cookies have resulted from this session so far?

b) User requests a document http://www.alpha.com/music/buy.html. What is sent by the browser in the Cookie header line, if any, in the HTTP request?

Cookie:

c) User requests a document http://www.alpha.com/books/buy.html, what is sent by the browser in Cookie header line, if any, in the HTTP request?

Cookie:

d) User requests a document http://www.beta.com/music/page2.html, what is sent by the browser in Cookie header line, if any, in the HTTP request?

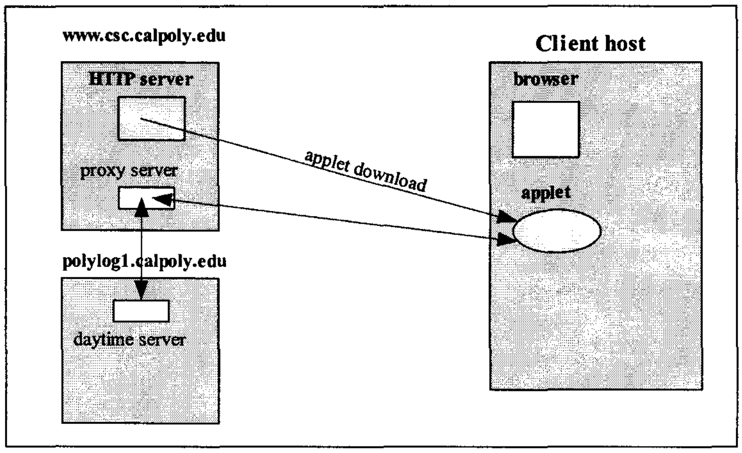
Cookie:

e) How many cookies remain after the session is over?

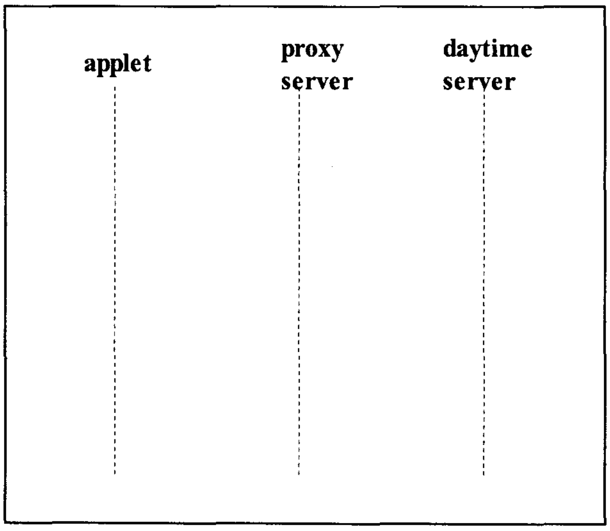
Name______________________________________ID____________________

Question 3 (10 marks; 15 minutes)

Due to security restrictions, an applet cannot make network connection to any host other than the one from which it is downloaded. Suppose you are asked to write a **proxy server** for a certain applet. When downloaded to a client system from the CSL's web server, *www.csc.calpoly.edu*, the applet is to display a timestamp obtained from the daytime server running on port 13 of the central UNIX system *polylog1.calpoly.edu.* These three systems are separate, interconnected systems. The proxy server acts as an intermediary for the applet to request and then receive a timestamp from *polylog1.* (See diagram below)



Complete the sequence diagram below to show the interaction among the applet, the proxy server, and the daytime server. Include in the diagram connection request(s) and message(s) passed.



Name____ID_________________________

Question 4 (30 marks, 40 minutes)

Suppose web **form 1**, web **form 2, Servlet1** (show below), **Servlet2** and **Servlet3** (not shown) are all filed on a web server in the same directory. Note that **form 1** invokes **Servlet1** and form 2 invokes **Servlet2.**

```
<HTML>
<BODY>
<H1>This is form1</H1>

<FORM MTHOD="post" ACTION="servlet/Servlet1>

What is thy NAME: <INPUT NAME="name"><P>
What is thy quest: <INPUT NAME="quest"><P>

Press <INPUT TYPE="submit" VALUE="here">
to submit your query.
</FORM>
<HR>
</BODY>
</HTML>
```

```
<HTML>
<BODY>
<H1>This is form 2</H1>
<FORM METHOD="get" ACTION="servlet/Servlet2">
What is thy favorite color:
 <SELECT NAME="color">
 <OPTION SELECTED>red
 <OPTION>white
 <OPTION>blue
 </SELECT>
<INPUT TYPE = "HIDDEN" NAME = 'id'  VALUE="2">
<P>
Press <INPUT TYPE="submit" VALUE="here">
to submit your query.
</FORM>
<HR>
</BODY>
</HTMI >
```

```
import javax.servlet.*;
import javax.servlet.http.*;
import java.io.*;
import java.util.*;

public class Servlet1 extends HttpServlet
{
  public void doPost(HttpServletRequest req,
   HttpServletResponse res)
   throws ServletException, IOException
  {
    res.setContentType("text/html");
    PrintWriter out = res.getWriter();
    out.println("<html>");
    out.println("<head><title>Servlet Response" +
            "</title></head>");
    out.println("<body>");
    Cookie c;

    String  name, value;
    name = "name";
    value = req.getParameter(name);
    c = new Cookie(name, value);
    res.addCookie(c);

    name = "quest";
    value = req.getParameter(name);
    c = new Cookie(name, value);
    c.setMaxAge(5*60);
    res.addCookie(c);

    out.println("</body></html>");

  } //end doPost
} //end class
```

During one browser session, a user browses **form 1**, then **form 2**. On **form 1**, the user enters "Mary" to the first question, and "happiness" to the second question. On **form 2**, the user chooses "red". Assume that there is no existing cookies on the user's system.

a) How are the data entered in **form 1** forwarded to **Servlet1**? Describe the data transferred among the browser, the HTTP server, and **Servlet1** in terms of HTTP request, HTTP response, environment variables, and/or cookies. (10 marks)

Name____________________________________ ID__________________

b) When **Servlet2** is initiated, what session state data items (name-value pairs) does it receive? Complete the following table to answer the question (you may not need to use all the rows): (5 marks)

name	value

c) For each session data item (name-value pair) that **Servlet2** receives, explain how the data originated and how it was received by **Servlet2**. Describe the data transferred among the browser, the HTTP server, Servlet1, and Servlet2 in terms of HTTP request, HTTP response, environment variables, and/or cookies. (10 marks)

Name____ID____________________

d) Suppose after **form2** has been submitted and **Servlet2** has executed, another browser session is started by the user on the same computer, and a third servlet, **Servlet3**, filed in the same directory as **Servlet1** and **Servlet2**, is invoked directly through the browser. Which, if any, name-value pair(s) from the first session will be available to Servlet3?

Question 5 (10 marks, 15 minutes)
A RMI server provides a "pass-the-word-on" service. The server allows participants to register for the service. The server passes a message to each participant **<u>in turn</u>**, allowing each participant to make changes to the message before the server passes the possibly modified message on to the next (wrapping around) participant. The passing of the message continues indefinitely in a round-robin fashion.

Here's a sample session:

Server to participant 1:	(an empty string)
Participant 1 to server:	Hello, Mary here.
Server to participant 2:	Hello, Mary here.
Participant 2 to server:	Hello, Mary. Jane here.
Server to participant 1:	Hello, Mary. Jane here.
Participant 1 to server:	Hello, Jane.
Server to participant 2:	Hello, Jane.
Participant 2 to server:	Anyone else?
Server to participant 3:	Anyone else?
Participant 3 to server:	Hello? John here. What's up?
Server to participant 1:	Hello? John here. What's up?
Participant 1 to server:	Hello, John and Jane! Mary here.
...	

Note that new participants may join in at any time, and that the participants are serviced in turn, in the order of their registration.

You may assume that each client will stay connected to the server indefinitely.

Using a combination of narrative and/or diagram(s), explain how you use RMI to implement the application. You may continue your answer on the next page.

Question 6 (30 marks, 30 minutes)
Suppose you are developing a tic-tac-toe game to be played by two users on separate computers that are interconnected through a network. Throughout a game, the players should see the same game board displayed, and should take turns to update the game board until the game is over. Choose **two** of the following distributed computing paradigms and describe how you can make use of each in the implementation of your software. Focus your description on (i) how data is shared and communicated between the two users, and (ii) how the player sequencing is controlled (that is, how the players are controlled so that they take turns to update the game board.)

- Message passing
- Distributed objects (such as RMI with callback)
- Object spaces
- Mobile agents
- Group communication (multicast)

Paradigm1:

Answer:

Name____ID____________________

Question 7 (35 marks; 35 minutes)

a. Compare the following paradigms and provide a brief description of each paradigm: RMI, Mobile Agents, Object Space and CORBA. (20 marks)

Name____ID______________________

b. Compare the following methods and provide a brief description of each one: CGI, Servlet and Web Service. (15 marks)

---------------------------- End of Examination ----------------------------

Lecturer: Pichaya Tandayya

Name____ID____________________