

**Department of Computing
End of Semester 1 Central Examinations - June 2012**

Attendance Mode: Internal
Centre(s): Bentley Campus
Unit(s): 4547 - Software Components 400
302975 - Systems Programming and Design 561
Duration: 2 Hours *Prior to commencement of the examination there will be a 10-minute reading period. During this period notes may be written in margins of the examination paper. Commencement of the examination will be indicated by the supervisor.*
Total Marks: 100
Calculator: No, not allowed
Supplied by the University: None
Supplied by the Student: None

THIS IS A CLOSED BOOK EXAMINATION

IMPORTANT INFORMATION

- The possession or use of:

Mobile phones or any other device capable of communicating information, are prohibited during examinations.

Electronic Organisers/PDAs (with the exception of calculators) or other similar devices capable of storing text or restricted information are prohibited during examinations.

Any breach of examination regulations will be considered cheating and appropriate action will be taken in accordance with University policy.

Other Information:

This paper consists of four (4) questions with a total of 100 marks.

ATTEMPT ALL QUESTIONS

You can answer questions in any order. Note that the examination is printed double-sided. You may use the back page of the examination paper if you run out of room when answering a question.

Student ID:

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Family Name:

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Other Names:

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Examination paper **IS NOT** to be released to student

QUESTION ONE (total: 23 marks): RPC and Asynchronous Calls

a) (3 marks). Describe the difference in the server object's lifetime between Per-Call, Per-Client and Singleton server objects in WCF.

Answer:

b) (3 marks). For each of the three server object types from part (a), describe the kind of situation in which they would be most suitable.

- c) **(4 marks)**. When connecting to a server, WCF provides a DuplexChannelFactory as well as the normal ChannelFactory. In this context, what is meant by the term “duplex communication”? Your answer should cover both the meaning of duplex (vs normal) as well as what the server must define for a duplex channel to be valid.

Answer:

- d) In WCF, the reference to the remote callback client must be retrieved from .NET.
i) **(2 marks)**. On what thread is this reference to the client available on? Why?

Answer:

Question 1d (cont.)

- ii) (2 marks). How could one use this reference in a different thread such as a background worker thread?

Answer:

- e) (3 marks). Describe what a oneway call is, and specify how it differs from an asynchronous call.

Answer:

- f) Consider a Web-based newscasting system that has a server 'publish' news by pushing it to clients that have 'subscribed' to the newsfeed via callbacks to the clients. Clients are untrusted in that they are over the Internet and anybody is able to write a client and connect to the service. There are three choices in the way the callback can be implemented:
- Server calls back to clients with normal (synchronous) calls
 - Server calls back to clients with asynchronous calls
 - Server calls back to clients with oneway calls
- i) **(3 marks)**. Discuss a major problem with using normal synchronous calls to have the server make callbacks to the (untrusted) clients and explain why asynchronous and oneway calls do not suffer from this problem.

Answer:

- ii) **(3 marks)**. Of the asynchronous and oneway approaches, which model would you choose to implement the newscasting callback? Justify your choice.

Answer:

QUESTION TWO (total: 27 marks): CGI and ASP.NET

- a) (4 marks). Specify the information that CGI POST sends to the server when the user submits an HTML form. Your answer should indicate all information sent to the server, a definition of what data is marshalled and the format that this data is sent in.

Answer:

- b) (2 marks). Give one (1) advantage and one (1) disadvantage of GET in comparison to POST for CGI form data submission.

Answer:

- c) **(4 marks)**. Describe two (2) reasons how ASP.NET's event-driven approach to Web programming simplifies Web applications development in comparison to more traditional approaches such as PHP that require the programmer to directly interact with the CGI parameters.

Answer:

- d) **(3 marks)**. Outline the lifetime of an ASP.NET Page object, indicating when it would be created, how long it would last and when it would be destroyed.

e) (5 marks). Consider the following statement:

Although CGI continues to underpin a significant amount of Web server-side processing, it will eventually be dropped entirely in favour of Ajax solutions

Discuss whether you agree or disagree with this statement, justifying your answer (note that it is worth 5 marks, so explain and contrast CGI with Ajax in depth, covering points that span the topics in the *entire* unit from week 3 onwards, not just the Web).

Answer:

- f) Regarding state management for Web applications:
- i) **(6 marks)**. Name and describe three (3) approaches to maintaining state in a Web-based ASP.NET application.

Answer:

- ii) **(3 marks)**. Give one (1) advantage for each of the three approaches you described in part (i) in comparison to the other two.

Answer:

END OF QUESTION TWO

QUESTION THREE (total: 26 marks): SOA and Web Services

- a) (3 marks). Discuss the role that an HTTP Web server plays in hosting a WCF Web Service (ie: why is a Web server involved and what does it do?).

Answer:

- b) (4 marks). Describe the relationships between SOAP, WSDL, XSD and XML.

Answer:

c) **(3 marks)**. Define interoperability and explain why it is desirable.

Answer:

d) **(2 marks)**. WCF is a service-oriented architecture that explicitly forbids passing objects by reference across the network. Give one (1) reason why passing-by-reference is such a problem.

Answer:

e) Consider the following WCF Web Service interface and associated classes:

```
public class Transaction {
    int id;
    int type;
    Account fromAcc;
    Account toAcc;
    double amount;
}

public class Account {
    int id;
    string name;
    double balance;
    List<Transaction> transList;
}

public interface IBank {
    Account GetAccount(int id);
    Account GetTransaction(int id);
    Transaction Deposit(Account acc, double amt);
    Transaction Withdraw(Account acc, double amt);
    Transaction Transfer(Account from, Account to, double amt);
}
```

- i) **(10 marks)**. The definitions are incomplete in that they are not legal for use with WCF. For each class and interface, specify *in detail* what must be defined – your answer *must* consider efficient distributed computing practices (as you had to do with your assignment) when defining what each item should be.

NOTE: You can rewrite the code, but you may choose instead to describe what is needed for each class – be warned that you must give enough detail in your descriptions in order to gain full marks (ie: don't forget the small bits!).

Answer (continue over page):

Question 3e-i (answer) continues here:

Question 3e (cont.)

- ii) (4 marks). Consider the following code that seeks to use the IBank to perform a transfer \$1,000 from Account 5 to Account 20. However, although it will compile, it is **flawed** in that it contains a few logic errors.

```
public static void Main(string[] args) {
    IBank bank;
    DuplexChannelFactory<IBank> bankFactory;
    NetTcpBinding binding = new NetTcpBinding();

    string sURL = "http://www.bank.com.au:1200";
    bankFactory = new DuplexChannelFactory<IBank>(binding, sURL);
    bank = bankFactory.CreateChannel();

    Account a5 = bank.GetAccount(5);
    Account a20 = bank.GetAccount(20);
    Transaction t = Transfer(a5, a20, 1000);
}
```

Assuming that you have corrected the mistakes of the Bank interface, identify two (2) logic errors and describe when and for what reason they will cause an exception at run-time.

Answer:

QUESTION FOUR (total: 24 marks): Ajax and Internet Applications

a) **(3 marks)**. What is the difference between a persistent and non-persistent XSS attack?

b) **(5 marks)**. Describe the steps involved in carrying out a successful cross-site scripting (XSS) attack.

c) Consider a forum on the Web that allows anonymous users to post messages where messages can contain HTML tags such as links, bold fonts, etc.

i) **(3 marks)**. Why is it that such a forum is particularly vulnerable to XSS attacks?

Answer:

ii) **(4 marks)**. Describe two (2) methods to reduce the risk of a successful XSS attack, even though the forum must continue to support HTML. As part of your answer you must explain *why* each method will limit XSS attacks.

Answer:

- d) Below is an Ajax Web page that uses the Bank Web Service from Question 3e to look up and retrieve an account's details given its ID. It is based on SOAP 1.2.

```

<html><head>
<script language="JavaScript" type="text/JavaScript">

var req = null;

function GetAccount(acctID) {
  if (window.XMLHttpRequest != undefined)
    req = new XMLHttpRequest();
  else
    req = new ActiveXObject("Microsoft.XMLHTTP");

  req.open("POST", "http://www.bank.com.au/BankService.svc", false);
  req.setRequestHeader("Content-Type", "application/soap+xml");

  var sSOAPParamsAsXML = "YOU MUST REWRITE THIS YOURSELF FOR Q4d-i";

  var sSoapMsg =
'<?xml version="1.0" encoding="utf-8"?> \
<soap12:Envelope xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance\
  xmlns:xsd="http://www.w3.org/2001/XMLSchema" \
  xmlns:soap12="http://www.w3.org/2003/05/soap-envelope"> \
<soap12:Body> \
  <GetAccount xmlns="http://www.bank.com.au/Bank"> '
    + sSOAPParamsAsXML +
  '</GetAccount> \
</soap12:Body> \
</soap12:Envelope>';

  req.send(sSoapMsg);
}

function OnGetAccountComplete() {
  // YOU MUST FILL THIS IN YOURSELF FOR Q4d-ii
}

function btnGetAcct_click () {
  var txtID = document.getElementById("txtID");
  ConvertDateAsync(txtID.value, OnGetAccountComplete);
}
</script>
</head>

<body><form name="frmDisplayAcct">
  ID: <input type="text" id="txtID" value=""/><br/>
  <input type="button" id="btnGetAcct"
    onclick="btnGetAcct_click();" value="Get Account"/><br/>
  Name: <input type="text" id="txtName" value=""/><br/>
  Balance: <input type="text" id="txtBal" value=""/><br/>
</form></body>
</html>

```

Question 4d (cont.)

- i) **(2 marks)**. the `sSOAPParamsAsXML` variable defines the XML string containing the parameters to be passed to `GetAccount()` via SOAP 1.2. Write the line assigning `sSOAPParamsAsXML` so that it is correct.

Answer:

- ii) **(7 marks)**. Given that the Web Service returns an Account object in the following format (values are just for this example):

```
<Account:id>2</Account:id>
<Account:name>John Smith</Account:name>
<Account:balance>1000000.50</Account:balance>
```

Write the code for `OnGetAccountComplete()` that will extract the name and balance fields from the SOAP return message and fill them into the corresponding text fields in the form on the HTML page (`frmDisplayAcct`).

Hint: You can cheat a little since you know there is only one account being returned, so use `getElementByTagName("XXX")` on the `req.responseXML` object to get each of the account fields. Just remember it returns a node object containing a `childNodes` array which finally is the one that contains the contents (`nodeValue`).

Answer (continue over page):

Question 4d-ii (answer) continues here:

END OF EXAMINATION PAPER