

FINAL EXAM

2002

COSC 1174/1175 - ADVANCED CLIENT SERVER ARCHITECTURES

Date: 13th November
Time: 6:00pm

Time Allowed: 3 Hours
Number of Pages: 3

Instructions to candidates:

1. Read instructions carefully.
2. The total marks of this exam are 100, which accounts for 60% of the final assessment.
3. This is a closed book exam.
4. Read the questions carefully. You should aim to clarify any ambiguities at reading time. If you feel compelled to make assumptions, then clearly state them in writing.
5. You should show working notes where appropriate.
6. You should attempt all the five questions.

Question A (Basics of CORBA)

1. Explain how DII and DSI provide dynamic features for CORBA applications.
2. A client receives a transient object from its server. The reference is later used to invoke the referenced object. However, the server has already shutdown; thus an exception is returned. After waiting for a couple of minutes, the client again sends the same request to the referenced object and succeeds. Discuss why the client's first attempts failed, while the second succeeded.
3. Let us consider the different object bindings in CORBA environments.
 - a. Explain how the binding of a persistent IOR works.
 - b. What are the differences between the binding of a persistent IOR and the binding of a transient IOR?
4. CORBA-based systems often uses two kind of repositories, namely interface and implementation repositories.
 - a. What is the information contained in each of these repositories?
 - b. Why these repositories are needed?

$$4(=2+2) + 2 + 7(=5+2) + 5(=2+2+1) = 18$$

Question B (Performance)

1. Consider the IDL design provided below.
 - a. Explain why such an IDL design induces bad performance.
 - b. Propose an alternative design that will improve performance of applications (using such an IDL). Justify your answer.

```
interface Student {  
    attribute string name;  
    attribute string age;  
    attribute SubjectSeq sub;  
};
```

```
interface Factory {  
    StudentSeq WhoIsEnrolledIn(Subject S);  
    SubjectSeq WhatSubjects(Student st, long year);  
    SubjectSeq OffredSubjects(Department Dept);  
};
```

```
interface Subject {  
    attribute string name;  
    attribute long creditpoints;  
    attribute Department dept;  
};
```

```
interface Department {  
    string name();  
    attribute string location;  
};
```

```
typedef <Subject> SubjectSeq;  
typedef <Student> StudentSeq;
```

2. A certain design of an ORB's de-multiplexing strategy can also induce bad performance for client applications. Students have seen some of these problems with SUNSoft IIOP marshalling/demarshalling engine.
 - a. Explain the different components of this engine.
 - b. What are the performance problems related to this engine?
 - c. Explain how these performance problems could be resolved.

$$10(=3+7) + 11(=4+3+4) = 21$$

Question C (POA - Portable Object Adapter)

1. What is the POA's role within a CORBA environment?
2. What are the advantages gained from placing a POA between an ORB and object implementations?
3. Explain all the de-multiplexing steps of a client's request (say $o \rightarrow op()$, where o is an object reference and $op()$ is an IDL operation) from when the time the client issued the request till the appropriate servant performs the operation.

4. Why POA policies play a key role in building of robust, scalable and adaptable distributed applications?
5. Some of the de-multiplexing steps at the server level (i.e. POA level) may induce performance problems.
 - a. What are these problems?
 - b. Show how these problems could be addressed.
6. Explain the concept of servant and show how this concept plays a key role in building a variety of applications with different requirements (e.g. database applications).

$$1 + 2 + 5 + 3 + 6(=3+3) + 4 = 21$$

Question D (Caching)

1. Several technical issues are considered when dealing with a design of a caching strategy.
 - a. List two main issues.
 - b. Explain each of these issues.
2. LRU, LFU, LRU-min and GDS (Greedy Dual Size) are probably some of the well known caching policies. Explain each of these policies.
3. Hierarchical and traversal caches are other alternatives for existing cache architectures.
 - a. Explain each of these caching architecture.
 - b. Show their advantages and/or disadvantages.
4. We assume that you have been asked to extend an existing caching technique for CORBA environments.
 - a. Which one will you be choosing and why?
 - b. Explain how this extension will be made.

Note that students need to consider each issue you have listed in 1.

$$5(=1+4) + 4 + 6(=2+4) + 5(=1+4) = 20$$

Question E (Load Balancing)

1. Some of the load distribution techniques use load index. Provide two ways of computing a load index.
2. Mean flow time and mean slow down are probably the two important metrics used to evaluate load distribution strategies. Explain these metrics.
3. Let us consider two well-known load-balancing strategies, namely SITA-E and TAG.
 - a. Explain each of these strategies.
 - b. Show advantages and disadvantages of each of them.
4. LLF (Least Load First) has some major limitation(s) when dealing with (very) large tasks.
 - a. Explain these limitations.
 - b. Propose an extension of LLF to deal with some of these limitations. Justify your answer.

$$4(=2+2) + 2 + 8(=4+4) + 6(=2+4) = 20$$