Dept. Math. & Comp. Sc. **Distributed Systems**
Vrije Universiteit **07.08.2001**

1a Give at least five different forms of distribution transparency and briefly explain each of them. *5pt*

1b Why is it impossible to achieve complete distribution transparency? *5pt*

1c To what extent is it possible to resolve the name *www.lcs.mit.edu* in a way that the distribution of the resolution process is transparent to a client? *5pt*

2a Explain how multicast RPC works (such as in Coda and other systems), and motivate its use. *5pt*

2b Sketch the design of a multicast RPC susbsystem that can support a call to a very large number of procecess. *10pt*

2c Explain how you would implement multicast RPC in CORBA so that existing clients and servers need not be changed. *5pt*

3a Explain what the main problem is that we bump into when using replication as a scaling technique, and how that problem can be solved. *5pt*

3b Exploiting locality is important for scalability. Does DNS exploit locality? *5pt*

4a Web hosting services can dynamically decide where to place replicas. Explain how this can be achieved. *10pt*

4b Explain the difference between pull-based and push-based replication, and explain when either technique is preferred. *5pt*

4c What is the role of a lease in the context of replication? *5pt*

4d Give three different forms of leases and briefly explain each one. *10pt*

5a What is the important difference between supporting causally-ordered message delivery directly by applications or by letting the middleware handle causality? Be sure to explain your answer. *10pt*

5b "To support causally-ordered message delivery by means of vector timestamps, we need to assume messages are also received in the order they are sent." Is this statement true or false? Explain your answer. *5pt*

Grading: *The final grade is calculated by accumulating the scores per question (maximum: 90 points), and adding 10 bonus points. The maximum total is therefore 100 points.*