Dept. Math. & Comp. Sc. **Distributed Systems**
Vrije Universiteit **10.08.1998**

1a Explain how *remote procedure calls* work. Be accurate. *5pt*

1b For most RPC systems you can either use a TCP-based or a UDP-based implementation. What are the advantages and disadvantages of using a UDP implementation? Also explain how an application will notice the difference between the two. *5pt*

1c What is the major problem of using RPCs in a wide-area network. Describe solutions to make this problem less severe. *10pt*

2a Describe several forms of *file sharing semantics* in distributed file systems, and explain why these semantics are so important when it comes to implementing distributed file systems. *5pt*

2b What are the conditions for hierarchical file caches to be effective? Be sure to motivate your answer. *5pt*

2c Explain how file sharing can take place in a distributed filesystem where each user has his own name space. *5pt*

2d Name a few disadvantages of a distributed file system in which the server invalidates client caches. *5pt*

3a Explain how you can implement totally ordered multicasts by using Lamport's logical clocks. *10pt*

3b Explain how Amoeba implements *reliable* totally ordered multicasts. *10pt*

3c Do you need totally ordered multicasting in a system that guarantees only weak consistency between replicas? Clearly motivate your answer! *5pt*

4a Describe the *two-phase commit* protocol and its relation to *atomic multicasting.* *5pt*

4b Explain how *optimistic concurrency control* for transactions works. *5pt*

4c What is the difference between a *flat transaction* and a *nested transaction*? Name a few advantages of nested transactions. *5pt*

4d What is the benefit of *strict two-phase locking* for nondistributed transactions? Explain also what the additional benefit is when using strict two-phase locking for distributed transactions. *10pt*

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.*