



- 1a Explain what relocation transparency is and give a concrete example of its application. 5pt
- 1b Caching and replication are generally applied as scaling techniques, but introduce another scaling problem. What is this problem and how can it be solved? 5pt
- 2a What is isochronous transmission mode? 5pt
- 2b Give an example of a complex continuous data stream, and explain how synchronization in a such a stream is generally accomplished. Motivate why synchronization is done that way. 5pt
- 3 Sketch a simple solution for supporting migration transparency for mobile remote objects. 5pt
- 4a Explain how a remote name space can be mounted. 5pt
- 4b Recursive name resolution is more effective than iterative name resolution. Why? 5pt
- 4c Explain the difference between a name service and a directory service, and why the latter is often more difficult to scale worldwide. 10pt
- 5a Show that Lamport timestamps are insufficient for capturing causality. 5pt
- 5b Explain how Lamport timestamps can be used to realize totally ordered multicasting. 5pt
- 5c Consider a distributed system that promises to preserve causality in the delivery of messages. Explain what this promise means, and why the system cannot, in general, keep this promise. 5pt
- 6a When is an execution of operations by concurrent processes sequentially consistent? 5pt
- 6b What is the essential difference between data-centric and client-centric consistency models? 5pt
- 7a Reliable multicasting is difficult to scale to very large groups of processes. Why? 5pt
- 7b Consider the problem of reliably multicasting a message to a large group of processes. If it is required that the message is only *eventually* delivered to each process, what would your solution be? 5pt
- 7c Explain what atomic multicasting is. 5pt
- 8 What is a piecewise deterministic execution model, and why is it so useful? 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.