Part I

This part covers the same material as the midterm exam.

1a Explain what is meant by administrative scalability and why it is often such a difficult problem to solve. *5pt*

1b What are the main differences between a network operating system and a (middleware based) distributed system? *5pt*

2a Give at least two examples of a middleware protocol. *5pt*

2b What is the difference between passing an object by reference or an passing object by value in the case of a remote object invocation? *5pt*

3a Motivate the extensive use of threads in distributed systems. *5pt*

3b Consider a mobile agent having its own thread of control. Are we dealing with weak or strong mobility when the agent moves to another machine? Motivate your answer. *5pt*

4a Explain what a closure mechanism is in naming systems, and give at least one example. *5pt*

4b Iterative and recursive name resolution in a distributed naming system have different scalability properties. Explain what the most important difference is. *5pt*

5 Explain what is meant by a consistent global state when dealing with distributed snapshots. *5pt*

Part II

6a A file is replicated on 10 servers. List all combinations of read quorum and write quorum that are permitted by the quorum-based voting protocol when dealing with replicated writes. *5pt*

6b Explain how an epidemic-based distribution protocol works for propagating updates. *5pt*

6c Give an example of a causal-consistent execution of read and write operations in a distributed system. *5pt*

6d It has been argued that middleware protocols for achieving causal consistency should be replaced by application-level protocols. What is a strong argument in favor of such a replacement? *5pt*

7a Explain what a virtually synchronous reliable multicast is and what the advantage of this scheme is. *5pt*

7b What is a pessimistic message logging scheme and why is it preferred over optimistic approaches? Be precise. *5pt*

8a Sketch two different approaches for implementing a subject-based publish/subscribe system. *5pt*

8b How does Jini realize referential decoupling of communicating processes? Can this method scale? *5pt*

8c What is the (semantic) difference between writing a tuple instance to a transparently N times replicated JavaSpace, and writing that tuple instance N times to a nonreplicated JavaSpace? *5pt*

Final grade: *(1) Add, per part, the total points. (2) Let T denote the total points for the midterm exam $(0 \leq T \leq 45)$; $D1$ the total points for part I; $D2$ the total points for part II. The final number of points E is equal to* $\max\{T, D1\} + D2 + 10$.