

SES #	TOPICS	LECTURE NOTES
1	Course overview. Synchronous networks. Leader election in synchronous ring networks.	(PDF)
2	Leader election in rings. Basic computational tasks in general synchronous networks: leader election. Breadth-first search. Broadcast and convergecast. Shortest paths.	(PDF)
3	Spanning trees. Minimum spanning trees.	(PDF)
4	Fault-tolerant consensus. Link failures: the two generals problem. Process failures (stopping, Byzantine). Algorithms for agreement with stopping and Byzantine failures. Exponential information gathering.	(PDF)
5	Number-of-processor bounds for Byzantine agreement. Weak Byzantine agreement. Time bounds for consensus problems.	(PDF)
6	k -set-agreement. Approximate agreement. Distributed commit.	(PDF)
7	Asynchronous distributed computing. Formal modeling of asynchronous systems using interacting state machines (I/O automata). Proving correctness of distributed algorithms.	(PDF)
8	Non-fault-tolerant algorithms for asynchronous networks. Leader election, breadth-first search, shortest paths, broadcast and convergecast.	(PDF)
9	Spanning trees. Gallager <i>et al.</i> minimum spanning trees.	(PDF)
10	Synchronizers. Synchronizer applications. Synchronous vs. asynchronous distributed systems.	(PDF)
11	Time, clocks, and the ordering of events. State-machine simulation. Vector timestamps.	(PDF)
12	Stable property detection. Distributed termination. Global snapshots. Deadlock detection.	(PDF)
13	Asynchronous shared-memory systems. The mutual exclusion problem. Mutual exclusion algorithms.	(PDF)
14	More mutual exclusion algorithms. Bounds on shared memory for mutual exclusion. Resource allocation. The Dining Philosophers problem.	(PDF)
15	Shared-memory multiprocessors. Contention, caching, locality. Practical mutual exclusion algorithms. Reading/writing locks.	(PDF)
16	Impossibility of consensus in asynchronous, fault-prone, shared-memory systems.	(PDF)
17	Atomic objects	(PDF)
18	Atomic snapshot algorithms. Atomic read/write register algorithms.	(PDF)
19	List algorithms: locking algorithms, optimistic algorithms, lock-free algorithms, lazy algorithms.	(PDF)
20	Transactional memory: obstruction-free and lock-based implementations.	(PDF)
21	Wait-free computability. The wait-free consensus hierarchy.	(PDF)
22	Wait-free vs. f -fault-tolerant atomic objects. Boosting fault-tolerance.	(PDF)
23	Asynchronous network model vs. asynchronous shared-memory model. Impossibility of consensus in asynchronous networks. Failure detectors and consensus. Paxos consensus algorithm.	(PDF)
24	Self-stabilizing algorithms	(PDF)
25	Timing-based systems. Modeling and verification. Timing-based algorithms for mutual exclusion and consensus. Clock synchronization.	(PDF)