

Requirements for Grundlagenfach “Information Systems and Distributed Systems”

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Exam is without any supporting material (books, notes, etc.). Exam will be given in English. The exam involves questions from two fields: information systems and distributed systems. The material is based mostly on the two 2nd Year courses in Database Systems (IS-G) and Computer Networks. Furthermore, it is partly based on the two 3rd Year Kernfach courses in Information Systems (IS-K) and Distributed Systems (DS-K).

Contents of this document:

1. **Requirements for Distributed Systems (Pages 2-4)**
2. **Requirements for Information Systems (Pages 5-6)**

1. Requirements for Distributed Systems (see below for Information Systems)

Literature (Distributed Systems):

[1] Andrew Tanenbaum, *Computer Networks* (4th Edition)

[2] G. Coulouris, J. Dollimore, T. Kindberg, *Distributed Systems: Concepts and Design*, Addison-Wesley (4th Edition)

Syllabus (Distributed Systems):

1. Basics of Computer Networks:

- a. What's the Internet?
- b. What's a protocol?
- c. Network edge vs. core
- d. Access net, physical media
- e. Performance: loss, delay
- f. Protocol layers, service models
- g. Backbones, NAPs, ISPs

2. Application Layer:

- a. Concrete protocols: http, ftp, smtp, pop, dns, etc.
- b. How to program network applications
- c. Socket API for two programming languages (e.g. Java and C)
- d. network application protocols
- e. client-server paradigm
- f. service models

3. Transport Layer:

- a. Transport layer services
- b. Multiplexing/Demultiplexing
- c. Connectionless transport: UDP
- d. Principles of reliable data transfer
- e. Connection-oriented transport: TCP
- f. Principles of congestion control
- g. TCP congestion control

4. Network Layer:

- a. Network layer services
- b. Routing principle: path selection
- c. Hierarchical routing, scalability
- d. IP, the Internet Protocol
- e. Internet routing protocols reliable transfer
- f. Routing convergence

- g. What's inside a router?

5. Link Layer:

- a. Link layer services
- b. Error detection and correction
- c. Multiple access protocols and LANs
- d. Link layer addressing, ARP
- e. Specific link layer technologies
- f. Ethernet
- g. hubs, bridges, switches
- h. PPP
- i. IEEE 802.11 LANs

6. Distributed Systems:

- a. Remote Procedure Call
- b. Client-Server model
- c. 2-Phase-Commit
- d. Mutual exclusion
- e. Lamport logical clocks

Study reference (Distributed Systems):

Topic	Tanenbaum	Coulouris et al.	Comments
1 Basics of Computer Networks	Chapter 1 (everything, mostly 1.1, 1.3, 1.4, 1.5.1) Section 2.2	Chapter 1 (everything, mostly 1.2, 1.3)	
2 Applications	Chapter 7 (except 7.4) Any network programming (sockets) book - 6.1 for a start	Chapter 2 (2.2) Chapter 4 (4.4) Chapter 5 (5.5)	Questions on how to program sockets are possible
3 Transport	Chapter 6 Section 5.3, 5.4 Sections 3.3, 3.4, 3.5.1	Chapter 3 (3.3, 3.4) Chapter 4 (4.2)	
4 Network Layer	Chapter 5 (mostly 5.1, 5.2, 5.6)	Chapter 3 (3.4)	
5 Link Layer	Chapter 3 (mostly 3.1, 3.2, 3.6.2) Chapter 4 (mostly 4.1, 4.2, 4.3, 4.7)	Chapter 3 (3.5, Ethernet and 802.11)	

6 Distributed Systems	RPC		Chapter 5 (5.1, 5.3)	Questions on basic programming of client server models are possible
	C/S		Chapter 4 and 5 (4.4, 5.5)	
	2PC		Chapter 14 14.3	
	Lamp.		Chapter 11 (11.1, 11.2, 11.3, 11.4)	
	M. Exc.		Chapter 12 (mostly 12.2)	

2. Requirements for Information Systems

Literature (Information Systems):

[1] H. Garcia-Molina, J. Ullman, J. Widom: Database Systems – The Complete Book

[2] D. Chamberlin et al.: XQuery 1.0 - An XML Query Language (W3C Candidate Recommendation); available at www.w3c.org/XML/Query

Syllabus (Information Systems):

1. Conceptual Data Model
 - a) The Entity Relationship Model
2. The relational data model
 - a. Relations, Schema, Keys, and Instances
 - b. ER to Relational mapping
 - c. Relational Algebra
3. Design of Relational Schemas
 - a. Functional Dependencies
 - b. Armstrong Axioms
 - c. Third Normal Form
 - d. Boyce Codd Normal Form
 - e. Multi-valued Dependencies
 - f. Fourth Normal Form
4. SQL
 - a. Data Definition Language
 - b. Data Manipulation Language
 - c. Query Language
 - d. Constraints and Triggers
5. Index Structures
 - a. B-trees
 - b. Hash Indexes
 - c. Inverted Files
6. Transactions
 - a. ACID Paradigm
 - b. Serializability
 - c. 2-phase Locking

d. Distributed Commit

7. XML

a. XML and DTDs

b. XQuery

Study reference (Information Systems):

Topic	Reference
1. Conceptual Model	[1], Chapters 1 and 2
2. Relational Data Model	[1], Chapters 3.1-3.3, 5
3. Design of Relational Schemas	[1], Chapters 3.4-3.7
4. SQL	[1], Chapters 6 and 7
5. Index Structures	[1], Chapter 13
6. Transactions	[1], Chapters 18.1-18.3 and 19.5
7. XML	[1], Chapter 4.7, [2]