

Advanced Networking

Course Introduction

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Università della Svizzera italiana

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- General course information
- Program
- Preliminary schedule
- A preview of *Advanced Networking*

- On-line course information

- ▶ on iCorsi

- ▶ and on my web page: <https://www.inf.usi.ch/carzaniga/edu/adv-ntw/>

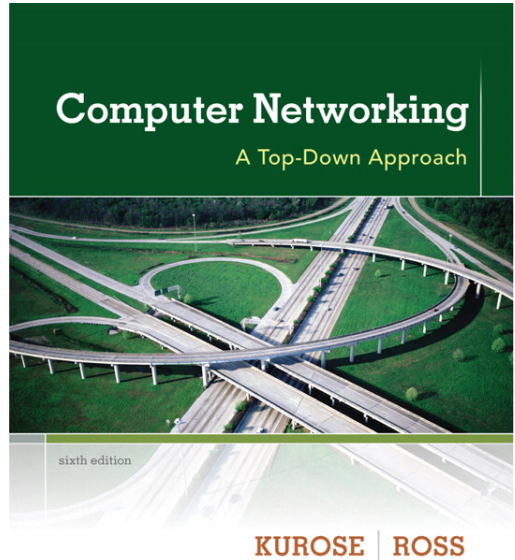
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- Announcements through iCorsi
 - ▶ *you are responsible for reading them!*

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- Office hours
 - ▶ Antonio Carzaniga: *by appointment*
 - ▶ Pasquale Polverino: *by appointment*

***Computer Networking
A Top-Down Approach***

James F. Kurose
Keith W. Ross

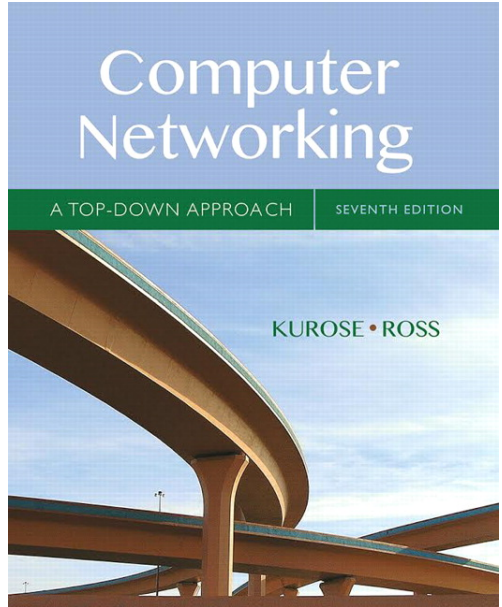
Addison-Wesley



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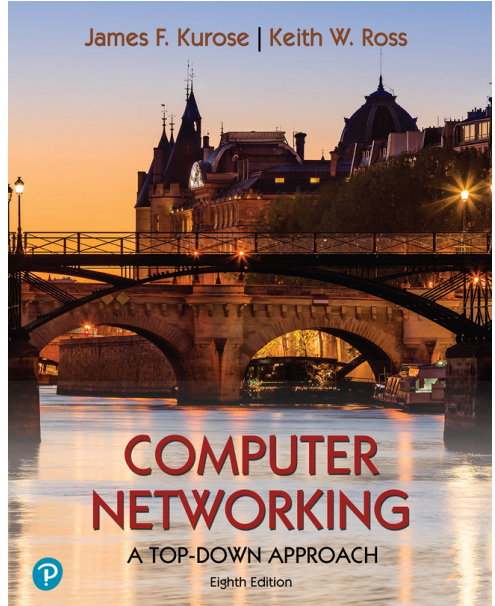
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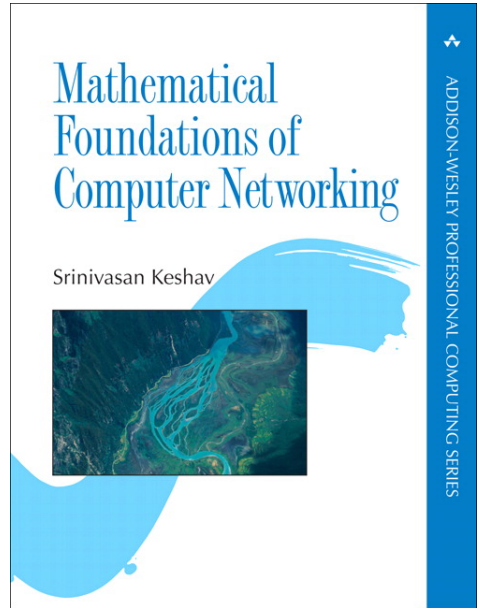
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***Mathematical Foundations
of Computer Networking***

Srinivasan Keshav

Addison-Wesley Professional



- +70% homework assignments and projects
- +30% paper presentations. Maybe—or maybe not. (More on this later)
- $\pm 10\%$ instructor's discretionary evaluation
 - ▶ participation
 - ▶ extra credits
 - ▶ trajectory
 - ▶ ...

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ALWAYS properly acknowledge your sources!

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- Using non-original material may be appropriate
 - ▶ e.g., software libraries
 - ▶ ***always clearly identify the external material, and acknowledge its source; failing to do so means committing plagiarism.***
 - ▶ the work will be evaluated based on its *added value*

- Committing plagiarism on an assignment or an exam will result in
 - ▶ *failing that assignment or that exam*
 - ▶ *deduction of one points from the final course grade*
- Penalties may be escalated in accordance with the regulations of the Faculty of Informatics

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 - ▶ corollary: the grade of an assignment turned in more than two days late is 0

What this course is about

(*What* and *How*)

- Problem solving plus theory (or “theory”)
 1. I give you a problem, which we discuss together
 2. You solve it on your own
 3. We discuss your solutions
 4. We present our solution
 5. We generalize and study the theory

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■ The Feynman^{*} technique (sort-of)

- ▶ The best way to learn a concept is to *teach it!*
- ▶ Seminars on topics of your choice, possibly including the topics of the course
- ▶ We all discuss, but the point is that ***you are the teacher!***

* Richard Feynman, theoretical physicist, great teacher, genius, amazing human being!

- Recap on Basic Networking Concepts: Network architecture, application protocols, TCP, datagram network service, router architecture, forwarding, routing, and in particular link-state routing.
 - ▶ ...or not. Let's do it *in-line* instead!

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 - ▶ sockets programming in C
 - ▶ peer-to-peer file transfer (homework)
 - ▶ HTTP/2

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 - ▶ HTTP/2
- Quantitative analysis of networks
 - ▶ delay, loss, and throughput in packet-switched networks
 - ▶ queuing theory (theory plus homework)

■ Transport layer

- ▶ Reliability
- ▶ Congestion control
- ▶ TCP (homework—a “simple” TCP, step-by-step)
- ▶ QUIC

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■ Network layer

- ▶ General model: forwarding and routing
- ▶ Addressing (IPv4, IPv6, homework)
- ▶ Basic, static routing with Mininet (homework)
- ▶ BGP
- ▶ MPLS
- ▶ Traffic engineering (theory, homework)

- Other network architectures
 - ▶ data-center networks
 - ▶ DCTCP
 - ▶ ECMP

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■ Network security

- ▶ Firewalls with IPTables, Netfilter, and PFSense
- ▶ IPsec
- ▶ TLS
- ▶ DNS Sec

- Programming the network
 - ▶ controller model and OpenFlow
 - ▶ data-plane programming in P4 (maybe)
 - ▶ DPDK

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- Network simulation (or maybe not)
 - ▶ NS3
 - ▶ simulation of DCTCP vs. TCP in a data center (homework)
 - ▶ simulation of Random Early Detection technique