

Purdue University
School of Electrical and Computer Engineering
ECE547

Graduate Area: Communications, Networking, Signal & Image Processing

Title: Introduction to Computer Communication Networks

Number of Credits: 3

Time and Room: MWF 11:30am-12:20pm, WANG 2579

Instructor: Xiaojun Lin, linx@ecn.purdue.edu

Office: MSEE 340

Office Hour: M 12:30am-1:30pm, W 1:30-2:30pm (or email for appointment)

TA or Class Helper: TBA

Textbooks (Required, in addition to the class notes)

- Mischa Schwartz, "Telecommunication Networks: Protocols, Modeling, and Analysis," Addison Wesley, 1987. (ISBN-10: 20116423X)
- A. Leon-Garcia and I. Widjaja "Communication Networks, Fundamental Concepts and Key Architectures," McGraw Hill, 2nd edition 2003. (ISBN-10: 0-07-246352-X, 0-07-119848-2(ISE))

Highly Recommended References

- R. Srikant and L. Ying, "Communication Networks: An Optimization, Control and Stochastic Networks Perspective," Cambridge University Press, 2014. (ISBN-10: 1107036054)
- D. Bertsekas and R. Gallager, "Data Networks," Second Edition, Prentice Hall, 1992. (ISBN-10: 0132009161). Available online at <http://web.mit.edu/dimitrib/www/datanets.html>

Other References

- Papers distributed in class, and class notes.
- M. Harchol-Balter, "Performance Modeling and Design of Computer Systems: Queueing Theory in Action," Cambridge University Press, 2013. (ISBN-10: 1107027500)
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Homework

Homework is a very important part of the course.

- For on-campus students, homework will be collected at the beginning of the class in which they are due.
- For off-campus students, homework submission and grading will be handled electronically on Blackboard. After you enter the class "Fall-2016-ECE-54700-Main", enter the folder "Homework Assignment (for off-campus students only)". Please scan your homework and upload the pdf file to the corresponding

assignment by the due-date (Please try the “Test Assignment due 08/26” now to see if you can submit your pdf correctly).

- Late homework will not be accepted.
- You may discuss the homework with other students. However, your submitted homework must be your own work, and you are strongly advised to solve independently as much of the homework as you possibly can. This will serve you well come exam time.
- We have created a discussion forum on Blackboard. After you enter the class “Fall-2016-ECE-54700-Main”, enter “Discussion Board (for both on-campus and off-campus students)”. Here, you can post questions, which will be forwarded to all students who subscribed to the forum. Students are also welcome to reply to these questions. The instructor and the TA will monitor the forum from time to time. **Please refrain from asking for or posting the complete solution in the forum.**
- Solution will be posted after the homework is due. Homework will only be graded minimally (based mainly on effort). Hence, it is very important that you check the posted solution carefully to make sure you get all answers right.

Grading

- Homework 5%
- Project 20%
- Midterms 40%
- Final 35%

* No late project will be accepted under any circumstance

Exams

- Midterm 1: TBA
- Midterm 2: TBA
- Final Exam: TBA

Course Policies

- All exams will be closed book exams.
- There will be no make-up exams.
- Regrade requests must be filed in writing within one week after the exam has been returned to you.
- No cheating allowed. Any form of cheating will result in an immediate failure of the course, and may (and probably will) include other disciplinary actions.
- Definition of cheating should be common sense, but if in doubt look at the definition and examples of academic integrity given on <https://www.purdue.edu/odos/academic-integrity/> by the office of the dean of students.
- No late project will be accepted under any circumstance.
- Suggestions: Attend all classes, solve homework problems independently, and discuss extra problems in groups.

Prerequisites

Prerequisite or Corequisite: EE 302 (Undergraduate Probability Theory). We will use quite a bit of probability background when we study queueing theory. I will provide a couple of lectures reviewing the key concepts when we get to that part of the materials. (If you have doubts on your probability background, you are encouraged to take ECE 600 before or at the same time as ECE 547, which will be more than sufficient.)

Objective

To learn the fundamentals of networking. Focus on an analytical approach to network design, dimensioning, and controls followed by examples implemented on the current Internet.

Description

Fundamental understanding of basic network design, routing, dimensioning and control; here we will study various network functions such as error-recovery algorithms, flow control, congestion control, routing, multi-access, switching, etc. We will also study these in the context of current Internet solutions (e.g. TCP, IP, etc.) and future open problems, and possible solutions.

Course Outcome (for undergraduate students only):

A student who successfully fulfills the course requirements will have demonstrated:

- an understanding of the fundamental principles underlying computer communication networks [1,3,4;a,e]
- an ability to obtain mathematical models of networking systems. [1,2,4;a,e]
- an ability to perform queueing analysis of simpler queueing networks, convergence analysis of routing protocols, and stability analysis of random access mechanisms. [1,2,4;a,e,k]
- an ability to solve simple network design and optimization problems to meet specifications in throughput and delay. [1,4;a,c,e,k]
- an ability to use simulation tools for network analysis and design. [1,3,4;a,c,e,k]

Tentative course structure

- Historical Perspective of Networking
- Main Issues in Network Design and Engineering
- Elementary Queueing Theory for Network Design and Admission Control
- Error Recovery Mechanisms: Examples and Performance Analysis
- Flow Control (Rate based and Window based)
- TCP Congestion Control (TCP Reno, TCP Vegas, AQM, etc.)
- Fundamentals of Network Routing (Dijkstra, Bellman Ford, etc.)
- Routing in the current Internet (IP routing)
- Multiaccess Communication (Polling and Random Access)
- Open Problems and Possible Solutions.

Procedures under a Pandemic

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. In such an event, information will be provided on the course web page below.

For up-to-date information about the course, check out the course webpage at:

<https://engineering.purdue.edu/~ee547/>