CS- 542 – Computer Networks I

"I predict the Internet will soon go spectacularly supernova and in 1996 catastrophically collapse."

Robert Metcalfe, 1995

Instructor

Dr. Edward Chlebus, Industry Professor of Computer Science
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Office hours: Tuesday and Thursday, SB 218D, noon – 1 pm

I do my best to be available in my office during my office hours but I strongly suggest making an appointment in advance. Send me an email from your IIT email address, sign your message, give your A#, and the course and section numbers. Usually I need to know all these details to reply to your email. This summer term I teach ~30 students and advise all the European dual-degree exchange students in the CS Department so I receive many messages every day. If you don't receive my response within 24 hours, resend you email.

Teaching Assistant

Manushi Patel, mpatel188@hawk.iit.edu
Virtual office hours: Wednesday, 11 am – noon

For most of the semester my TA will hold virtual office hours. Please make an appointment with her to receive a meeting link. The TA will hold in-person office hours after the HW assignments and the exams are graded. Then you will be able to visit her to receive feedback on your solutions to the HW/exam problems.

Lectures

Tuesday and Thursday, 8:50 am – noon, Stuart Building 113

- 542-01: live section, SB 113
- 542-02: online section
- 542-03: online section for students of the Beacon program in China

All the lectures are recorded and uploaded to Canvas by the IIT Office of Technology Services (OTS). The lecture videos are available to all the students enrolled in CS-542. Let me know if there are any technical issues with video or audio quality. I have a good working relationship with the OTS and will contact them if necessary.

I encourage all my students to attend live classes but your attendance doesn't affect your final grade (for obvious reasons the remote students can not join us on campus).

Homework Assignments

There are two assignments (the weight of each of them is 15%) consisting of a set of review questions that will help you study for the exams. No coding required to solve the HW problems. HW1 will be given before the midterm, HW2 before the final. Teamwork (max 3 students/team) is allowed and encouraged but individual submissions are also OK. Teamwork means discussing and brainstorming problems to obtain the best solutions, not waiting for the remaining teammates to do the job. The results of your teamwork are graded but I reserve the right to reduce individual grades for students whose contribution to obtaining the final results is insufficient.

You will be notified via email after the assignments (along with the detailed submission instructions and a clearly specified due date) are uploaded to Canvas. My TA will hold in-person office hours after each assignment has been graded. I strongly encourage all of you to review your graded assignments with my TA to clear your doubts.

Exams

There are two exams (closed book, a double-sided A4/letter format cheat sheet and calculators allowed). The weight of each of them is 35%. They are scheduled as follows:

- midterm: Thursday, June 12
- final: Thursday, June 26

The final exam is not cumulative and covers only the material presented after the midterm. You will take the exams in person (except the remote students living, e.g. in California) in an auditorium. The students enrolled in the online section CS-542-02 need my permission to take the exams remotely from their homes/offices. Such permissions will be granted only under exceptional circumstances.

Session A of the summer term lasts only 6 weeks so the pacing of this course is very fast. The Registrar (not the IIT faculty) is responsible for this tight schedule of Session A. Don't be surprised that the exams are only 2 weeks apart. The Registrar set a strict grade posting deadline that I must meet.

I encourage you to visit my TA or me to individually review your graded exams. We will accommodate absolutely all students who are interested in receiving feedback.

In-Class Media

I keep uploading the lecture slides to the folder
Canvas/Modules/Lecture Slides
as we proceed with the course material. This way you know what material I have already presented.

From my point of view there is a significant difference between a slide show and a lecture. My lectures are NOT slide shows. I like explaining problems and interacting with the audience so I also use a whiteboard. We will analyze many examples in this course. Before the exams I will show you some animated presentations to review the covered material. Students studying the course material by reviewing only the slides will be at a disadvantage.

Grading

All the students will be graded based on the assignments and exams specified above. No extra credit assignments will be given to individual students at the end of the semester. Absolutely no favoritism in my courses.

I don't use the traditional grading scale (A – 90%, B – 80%, C – 70%) which is completely unrealistic from my point of view. The grade cut-off points in this course are usually much lower and oscillate around 80% for an A and 65% for a B. They are determined at the end of the summer term based on the distribution of the percentage grades of the entire class. This concept of adaptive grading is equivalent to curved grading but eliminates curving grades of individual assignments or exams.

The grading criteria and the final grade cut-offs are identical for all the enrolled students. Absolutely no exceptions to this rule. It's a matter of fairness.

Academic Honesty

Zero tolerance for cheating and cheaters. Absolutely no excuses. *"Cheating is a choice not a mistake."* Each student caught cheating will receive zero for his/her assignment or exam. Such students may be expelled from this course or their final semester grades may be reduced. Their behavior will be reported to the CS Department Chair and the Dean, and an academic honesty violation report will be filed.

Textbook

Forouzan B.A., TCP/IP Protocol Suite, McGraw-Hill, 4th Edition, 2010,
ISBN 978-0-07-337604-2

Course Description

CS-542 is the second of the sequence of four networking courses:

- CS-455: Data Communications
- CS-542: Computer Networks I: Fundamentals
- CS-544: Computer Networks II: Network Services
- CS-547: Wireless Networking

that I teach in our department. They present a coherent and comprehensive overview of wireline and wireless network technologies, architectures and protocols.

This course covers the functions of the network and transport layers of the OSI reference model. IP addressing, Internet Protocol (IP), Address Resolution Protocol (ARP), User Datagram Protocol (UDP) and Transmission Control Protocol (TCP) are studied in details. The emphasis is on:

- IP address space management
- protocol specification, operation and implementation
- interactions between the transport and network layers, and the network and data link layers

which enable the efficient end-to-end communication.

Topics Covered

- Overview of the OSI model and the TCP/IP protocol suite
  - network models
  - layered network architecture
  - duties of all the layers

- Basic switching technologies
  - circuit-switching
  - packet switching
  - datagram approach

- IP classful addressing
  - netid and hostid
  - classes and blocks
  - network address

- special addresses
- private addresses
- unicast, multicast and broadcast addresses
- mask
- subnetting
- supernetting

- IP classless addressing
  - variable-length blocks
  - base 256 numbering system
  - mask
  - prefix and suffix
  - subnetting
  - subnet addresses
  - fixed-length masks
  - variable-length masks
  - address allocation

- Delivery, forwarding and routing of IP packets
  - direct versus indirect delivery
  - forwarding techniques
  - forwarding with classful addressing
  - forwarding with subnetting
  - forwarding with classless addressing
  - routing table
  - static versus dynamic routing tables
  - address aggregation
  - longest mask matching
  - hierarchical routing

- Address Resolution Protocol (ARP)
  - mapping a logical address to a physical address
  - ARP request broadcast
  - ARP reply unicast
  - ARP packet format
  - ARP packet encapsulation
  - proxy ARP
  - ARP package
  - cache table

- Internet Protocol (IP)
  - IP datagram format
  - fragmentation

- options
- IP package
- reassembly table
- reassembly module

- User Datagram Protocol (UDP)
  - process-to-process communication
  - port numbers
  - socket address
  - UDP datagram format
  - connectionless services
  - client process
  - server process
  - UDP package
  - control-block table

- Transmission Control Protocol (TCP)
  - connection-oriented services
  - numbering system
  - acknowledgment
  - flow control
  - congestion control
  - segment format
  - connection establishment and termination
  - data transfer
  - sliding window protocol
  - TCP timers