Introduction to Data Communication and Networking CIS 66

Faculty Information:

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Location: TLC

Advisory: English Writing 200 and Reading 200 (or Language Arts 200), or English as a Second Language 261, 262 and 263; Computer Information Systems 3 or 93. **Hours:** Five hours lecture (60 hours total per quarter).

Student Learning Outcome Statements (SLO):

- Describe the various components, protocols, architectures, and applications of current communication and networking technologies, which are used in LANs, WANs, and the Internet.
- Define the basic properties of the TCP/IP, local area, wide area, and fiber optic networks.

Course Objectives:

A. Identify major components and application of networking.
B. Describe the basic network models, and compare and contrast them.
C. Describe the relation between data and signal and compare and contrast analog and digital signals.
D. Demonstrate how digital data and analog data can be converted to digital signal. **E.** Demonstrate how digital data and analog data can be converted to analog signal. **F.** Compare and contrast methods of bandwidth utilization such as multiplexing and spread spectrum.
G. Compare and contrast guided and unguided transmission media.
H. Compare and contrast different method of switching.
I. Describe telephone and cable Networks.
J. Describe different methods used for error detection and correction.
K. Describe the concepts of data link control such as framing, flow control, and error control.
L. Describe the rationale for multiple access control and compare and contrast different multiple access methods.
M. Discuss the architecture of different wired LANs and their applications.
N. Discuss the architecture of different wireless LANs and their applications. **O.** Compare and contrast different connecting devices and their use in backbone and virtual networks.
P. Discuss the architecture of different wireless WANs and their applications. **Q.** Discuss the architecture of SONET network and its use in the Internet backbone.
R. Discuss the architecture of virtual circuit networks such as Frame Relay and ATM.

Grading System for this course

For Letter Grade:
Grade: A+ assigned with 97% or higher
Grade: A assigned with 93% or higher

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Grade: A--- assigned with 90% or higher
Grade: B+ assigned with 87% or higher Grade:
B assigned with 83% or higher Grade: B---
assigned with 80% or higher Grade: C+
assigned with 77% or higher Grade: C
assigned with 73% or higher Grade: D+
assigned with 70% or higher Grade: D
assigned with 63% or higher Grade: D---
assigned with 60% or higher Grade: F
assigned with 0% or higher
For Pass/No Pass:
Grade: Credit assigned with 70% or higher
Grade: No Credit assigned with 0% or higher
Incomplete
Audit
Withdrawal

Grading

Homeworks 35% of the grade
Lab 35% of the grade
Midterm 15% of the grade
Final 15% of the grade

Texts and Supporting References
Computer networks
Andrew S. Tanenbaum, David J. Wetherall. ------ 5th ed.
(Author) ISBN---10: 0-13-212695-8
ISBN---13: 978-0-13-212695-3

Attendance
You are responsible for completing all work assigned in this class in a timely fashion.
You do not have to contact me with a reason of absence.
You should be enrolled in the class at De Anza College for getting course access and to attend the class.

Withdrawing
Once you are added to the class it is your responsibility to withdraw. I will not drop you from the class. The earned grade will be assigned at the end of the quarter.

Academic Dishonesty
You are encouraged to discuss the ideas presented in the class. Copying or Cheating of work will result in zero grade for that assignment and may result in a failing grade. Basically I cannot tolerate cheating. You must work your solutions independently and all assignments and tests should be your own original work NO MAKEUP TESTS WILL BE GIVEN. You must pass the final to get a passing grade in this class.

Introduction to Data Communication and Networking CIS 66

Overview

Computer networks from ISPs to WiFi and cellular networks are a key part of the information economy. These networks are the foundation for the Web, and they enable companies such as Google, Facebook and Amazon. This course introduces the fundamental problems of computer networking, from sending bits over wires to running distributed applications. For each problem, we explore the design strategies that have proven valuable in practice. Topics include error detection and correction, multiple-access, bandwidth allocation, routing, internetworking, reliability, quality of service, naming, content delivery, and security. As we cover these topics, you will learn how the internals of the Internet work to support the Web and other networked applications. You will develop a detailed understanding of widely-used networking technologies such as TCP/IP, HTTP, 802.11, Ethernet, and DNS.

Topics Covered

We progress through the following topics week by week.

Introduction, Protocols, Layered Model

- Network components
- Uses of networks
- Traceroute and socket API
- Protocols and layering Reference
- models (Internet, OSI) History of
- the internet

Physical and Direct Link Layer

- Simple link models (latency, bandwidth-delay product)
- Media and signals
- Modulation schemes (baseband, passband)
- Fundamental limits (Shannon)
- Framing
- Error detection schemes (checksum, CRC)
- Error correction schemes (Hamming)

Retransmissions, Multiple access, Switching

- Retransmissions (ARQ)
- Multiplexing schemes (TDM. FDM)
- Random access / Ethernet (CSMA family)
- Wireless access / 802.11
- Contention-free access / Token Ring

- LAN switching (switches vs. hubs, spanning tree, backward learning)

Network Layer and Internetworking

- Datagram and virtual circuit models (IP, MPLS)
- IP addressing and forwarding (prefixes, longest matching prefix)
- IP helpers: ARP, DHCP
- Internetworking (fragmentation, path MTU discovery, ICMP)
- IPv4 and IPv6
- Network Address Translation (NAT)

Routing

- Shortest cost routing model
- Dijkstra's algorithm
- Flooding
- Distance Vector and Link-state
- Equal-cost multi-path routing
- Hierarchical routing (prefixes, aggregation, subnets)
- Multiple parties and policy (BGP)

Transport Layer, Reliable Transport

- Sockets, ports and service APIs
- Reliable and unreliable delivery (TCP, UDP)
- Connection establishment and teardown
- Flow control and sliding windows
- Retransmission timeouts

Congestion Control

- Fairness and Efficiency
- Additive Increase Multiplicative Decrease (AIMD)
- TCP congestion control (slow start, fast retransmission and recovery)
- Congestion avoidance (ECN)

Web and Content Distribution

- Naming (DNS)
- Web protocols (HTTP, caching)
- Content Distribution Networks (CDNs)
- Peer-to-Peer (BitTorrent)

Quality of Service and Real-Time Apps

- Streaming media and Conferencing
- Scheduling disciplines (FIFO, WFQ)
- Traffic shaping with Token Buckets
- Differentiated Services
- Rate and Delay Guarantees

Course Logistics

Timeline

The course has ten weeks of content material, including one optional week on network security. There is a weekly review and homework for each of the nine content weeks, plus a midterm and final exam. It is a lot of material, and a course that you can be proud to have completed!

The timeline we plan to follow for the main activity in weeks 1 through 12 is given below. More detail on the topics for each week is given on the Syllabus page. We aim to allow access to weekly content materials early on Sunday morning to let you to begin going over the material on the weekend before the week starts; see deadlines below for the timing of homeworks and exams. We will send out weekly announcements early Monday mornings, as the course week runs from one Monday to the next.

1. Introduction, Protocols and Layering
2. Physical and Direct Link layers
3. Retransmissions, Multiple access,Switching
4. Network layer and Internetworking
5. Routing
6. Midterm, and breather Transport layer, Reliability Transport
7. Congestion Control
8. Web and Content distribution
9. Quality of Service and Real-time Apps
10. Final Exam

Video Lectures and Slides

Each week has roughly 2 hours of video lecture content (sometimes more, sometimes less). We realize that this is a large amount of material! The video is divided into segments of around 15-20 minutes, each with an associated slide deck that is also available. We release one week of video at a time.

The slides and videos include material from the associated text: TANENBAUM, ANDREW S.; WETHERALL, DAVID J., COMPUTER NETWORKS, 5th Edition, © 2011. Electronically reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey. This material is for students of the course and may not be re-posted elsewhere.

Homeworks and Reviews

There are 9 homework assignments, each of which covers the lecture material for one week and is similar to textbook questions.Each homework will be released along with the lecture material to which they correspond. Homework constitute the bulk of your grade (see Grading below), with each homework worth an equal amount.

There is also an optional review for each week of lecture material. The reviews are to help you check your understanding of the material and practice related problems. The reviews do NOT count towards your grade, and you may take them as many times as you like.

Homework tips: Do the review first, and take your time on the homework, and read the questions carefully*! The questions are intended to cause you to reflect on the lecture material; they are not like the in-video quizzes that are answered on the spot. Thus you should look at the questions and then go back and review your lectures (and the text if you have it). It is OK if you do not know the answer right away and have to think a bit -- you have time and multiple attempts, plus you may use the discussion forums.

Lab assignments

As well as the required homeworks, there are 5 Lab assignments that are more open-ended and allow for hands-on exploration of networking concepts, e.g., using practical tools such as Wireshark.To do these assignments, you will need a willingness to dig into the material, plus some comfort with installing and running programs on your computer. You should approach these assignments with a sense of adventure and flexibility!

Exams

We will have a midterm and final exam. You will take them in your web browser, submitting multiple choice and short-answer style responses, just like the homeworks. The midterm will cover the first five weeks of content. The final will primarily test the material that comes after the midterm . The exams are required and each exam is worth an equal amount (see Grading below)

Cheating Policy: Exams should be completed in the time allotted without consulting with other people. You may consult any of the course materials or any materials referred to in the course. You should not otherwise search the web while taking the exam.

Discussion Forums

Please use the discussion forum as a resource to help yourself and help the class. We ask that you take a little care to post in the most appropriate forum, and to look at other posts to see if your question has already been answered. For homeworks and exams, we ask that you not directly post the answers to respect the learning of other students. We welcome students who reply and help other students, and encourage everyone to up/down vote posts. By voting, you help us to focus our attention where it is needed (we respond to highly voted posts first) and encourage appropriate behavior. We aim to respond to upvoted posts within 48 hours, and often much more quickly.

Posting tips: It's worth repeating what we said above to check first for a similar post that you can join! Many questions are posted multiple times. By looking first, not only will you get an answer to your question right away, but you make the discussion forum more useful for all students by not spreading one question over many threads. For students who are providing answers, feel free to encourage the poster to look at the course pages so that we build a more effective community.

Deadlines

There are deadlines for the weekly homeworks and for the exams. In all cases we allow a three week period for submitting your solutions to give you as much timing flexibility as we are able.

For each homework, we release it along with the weekly material that it covers with a soft deadline of two weeks, and a hard deadline of three weeks (without penalty). The soft deadline indicates when we would like you to finish the homework: the same week as when the material is covered, or the following week. The hard deadline provides you with an additional week to suit your schedule without penalty.

For the exams, we release them along with the last week of content that they cover, with the usual soft deadline of two weeks, and a hard deadline of three weeks (without penalty). Note that this means the exams are released ahead of the week in which they are the planned activity. The midterm is planned as the activity in week 6 and it is released with the week 5 materials. The final is planned as the activity in week 1. and we release it along with the week 10 material .

With these deadlines, all exams and homeworks are completed by the end of week 10. At that time the course is finished and we will assign grades.

Grading

The homeworks are worth 70% of your grade, and the exams are worth the remaining 30%. Each of the nine homeworks has the same grade value. Each of the two exams has the same grade value. You will be allowed more than one submission attempt for both homeworks and exams to allow you to learn from your mistakes and improve your performance.