Computer Networks
CSCI 3300

Prof. Allen Harper
Bowdoin College
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Lecture
Tuesday and Thursday 11:40am-1:05pm in Searles 126

Lab
In-class labs will occur during specified lecture periods

Final Exam
TBD

Course Description
Computer networks are everywhere: e-mail, the Web, wireless networks, mobile devices, networked sensors, satellite communication, and peer-to-peer applications. New applications based on networks appear constantly. This course will introduce students to the field of computer networks by taking a top-down approach. It begins with an overview of computer networks, hardware and software components, the Internet, and the concept of protocols and layered service and then delves into the details of the four main layers making up the computer network stack: Application (HTTP, FTP, e-mail, DNS, peer-to-peer applications and socket programming), Transport (TCP, UDP, and congestion control), Network (IP, routers, and routing algorithms) and Link Layer and Local Area Networks (medium access control, switches, and Ethernet). Also covers wireless and mobile networks (CDMA, Wi-Fi, cellular internet access, mobile IP, and managing mobility). [Taken from the Bowdoin Computer Science website]

The emphasis of this course is on understanding the network protocols. The course will follow a top-down analytical approach with the Internet serving as the model network. By the conclusion of the semester students will understand the layered architecture of the Internet protocol stack and the important protocols which make the internet work such as TCP, IP, and DNS. In addition, students will understand models supported by the Internet and the applications such as WWW and email. The course will cover various LAN technologies and hardware such as routers, switches and hubs.

Topics

1. Introduction**:** Network architectures and protocols; protocol layering; the Internet and OSI Reference models; history of the Internet.
2. The Application Layer: Basic services; qualities of service; network programming.
3. The Transport Layer: basic principles; reliable data transfer; pipelined protocols; connection management; flow control; TCP and UDP protocols; congestion control.
4. The Network Layer: service models; routing algorithms; routing in the Internet; the IP protocol.
5. The Link Layer: data link functions; error detection and correction; multiple access protocols; CSMA, CSMA/CD and ALOHA protocols; Ethernet; hubs, bridges, switches.
6. Wireless and Mobile Networks: multiple access protocols for mobility; CDMA; Wireless links and network characteristics; WiFi; 802.11 Wireless LANs; MAC protocol; Cellular internet access

Measurable Student Learning Outcomes

At the completion of the course, students will be able to:

1. Explain the concept of packet-switching and identify and analyze the different types of packet delay in packet-switched networks
2. Describe the essential principles of a transport layer protocol (reliable data transfer, flow control, congestion control)
3. Use IP addressing and apply routing algorithms to find shortest paths for network-layer packet delivery
4. Describe and compare data link layer services and multiple access techniques
5. Use networking tools to observe and analyze behaviors of networking protocols
6. Write network-aware programs to demonstrate an understanding of network protocols

Prerequisites

Departmental approval

Textbook (Required: On Hatch Reserve)

Computer Networking: A Top-Down Approach Featuring the Internet
(Seventh edition) 2017
Authors: James F. Kurose and Keith W. Ross
Publisher: Addison-Wesley
ISBN:

Grading Policy

Your final grade in the class will be calculated as follows:
5% (~5) Problem Sets
5% (~5) Labs
15% (~10) Journal Reading Response Papers
15% (~4) Programming Assignments
60% (3) Exams
Optional: Final Paper or Programming Project which can substitute for one exam.

Class attendance, participation, and decorum
Students are expected to attend all class sessions, as well as complete all assignments, labs, and exams. The use of any technology, including your own, for non-classwork purposes is not allowed. Cell phones are a distraction for everyone and should be silenced and not accessed during class. Your class participation will be determined based on your attendance and active participation in class throughout the semester. Participating in discussions, answering questions, reading the textbook before class, and participating during in-class activities are all good ways to show "active participation." Being considerate of your fellow students in the classroom is also an important part of your "class participation". You can do this by not causing a distraction for your fellow classmates -- arrive on time for class, avoid side conversation or noise during class, etc. A good learning environment is also one in which everyone feels welcome and comfortable; so, please be respectful of the diversity of backgrounds, beliefs, and lifestyles of the students in our class. If being a good participant is not reward enough, then consider class participation to perform a tie-breaking function when your grade is being computed.

Late Policy
No late work will be accepted without Dean's Office approval or by prior (24-hour notice) arrangement with instructor.

Exams and Exam Attendance
There are three (3) exams in this course. Each exam will cover approximately 1/3 of the material. The third exam will be held during the final exam time period. While the exams are not strictly cumulative, in a course such as Computer Networks that presents a sequential development of ideas, success on later topics will depend on a thorough understanding of the previous material. **Students my only re-sit for an exam with Dean's approval.**

Policies on Collaboration and Honor Code
Below you will find a copy of the CSCI 1101 collaboration guidelines. Please check the Bowdoin Academic Honor Code for official definitions of these practices.

Computer Science Collaboration Policy

Plagiarism, cheating, and falsification of information are violations of academic integrity that will not be tolerated.

The department employs four 'levels' of collaboration, where each level defines a set of allowed (and disallowed) behaviors. Higher levels are more restrictive, while lower levels are more permissive. Assignments in a course will typically employ a range of different levels. Our goal is to provide you extensive opportunities for collaboration (as is the norm in 'the real world') while still ensuring that you become an independent programmer capable of doing significant work on your own.

Specific courses may have additional rules or guidelines that supplement the standard policy described below (such as governing the mechanics of group work). Be sure to get this information from your professor.

In the interest of fairness to all students, violations of the collaboration policy are grounds to initiate an action that would come before the Judicial Board. Remember that you are responsible for reading, understanding, and adhering to the policy. If you have any questions about any aspects of the policy, please do not hesitate to ask for clarification.

Level 0: No Restrictions

Level 0 is generally only used for in-class exercises, or work not for credit. At this level, there are no restrictions on collaboration, and you may make use of whatever resources you like. Such resources could include other students both in and out of the course, your textbook (or other books), and Internet-based resources. No attribution of sources is required at this level.

Level 1: Verbal collaboration without code sharing

Level 1 is generally used for most regular assignments and labs. At this level, you are allowed and encouraged to discuss ideas and approaches with other class members, but such collaboration should not involve any written medium, including (but not limited to) computers, chalkboards, and paper. However, drawing pictures is permitted.

You may receive general programming and debugging advice, but you are required to write and debug all your own code, and at no time should you look at or receive another student's code in any form (on a computer, via printout, verbally, etc.). Similarly, you should not share your code with others or allow it to be shared (except with teaching staff), including sharing with future students after you have completed the course yourself. Providing help beyond what is allowed is as much of an infraction of the honor code as receiving help.

External resources: It is never permitted to view completed assignments, projects, or exams from the current or previous iterations of the course, regardless of their source. Otherwise, use of books or the internet for reference purposes is permitted, such as looking up the use of a programming function. However, blindly copying sections of code found online without attribution is not allowed, and you should never submit code that you do not understand or would not be able to clearly explain.

It is permissible to use software and materials available from external sources (understanding that you only get credit for work that you complete yourself) if you explicitly acknowledge those sources and what material you used. All materials used must be freely and legally available, and guidelines for proper attribution are provided below.

To be clear, if you turn in someone else's work, you will not receive any credit for it, but if it is properly acknowledged, it will not be considered a breach of the collaboration policy.

Crediting sources: When you use other sources to complete your work, you must credit the source of the ideas. This includes crediting other people (e.g., your classmates) or a website. You do not need to credit the book, in-class discussions, or conversations with teaching staff (TAs or professors). Anyone or anything else that contributed to the completion of your assignment should be credited with the following:

- Author: The person who contributed the work should be clearly identified as the author; the partners on a partner project should be clearly identified as the authors. Note that by implication, you should learn the names of the people you work with. Not knowing someone's name is not an excuse for not giving them credit.
- Borrowed/Shared Ideas: If you discuss ideas with others, and the discussion has an impact on the work you submit, you should credit whomever you talked with and note their contribution. This might be either that you had a group discussion with everyone contributing ideas, or that someone had a great idea that you incorporated.
- Outside Sources: Other materials used as sources should be referenced using a standard style. If you have questions about using and citing references, please ask your professor and/or look at examples in the readings for this class.

You may credit your sources using the comments in your program, in a note in a writeup, or in any other readily apparent way.

Level 2: Discussions with teaching staff only

Level 2 is typically used for assignments in which we wish to assess your understanding as well as your ability to solve problems independently. At this level, all the restrictions of Level 1 apply, but you are further limited to discussing your work only with teaching staff. In other words, you may not discuss your work in any capacity with anyone that is not currently a professor or TA in the course. Teaching staff can offer help in developing approaches or provide advice on how to solve a specific problem, but may also encourage you to overcome obstacles on your own. Although computer science is inherently collaborative, being able to solve problems on your own is an important skill that we want you to develop!

The same rules for using external resources (such as the internet) apply as specified in Level 1.

Level 3: Professor clarifications only

Level 3 is typically used for exams. At this level, no external resources are allowed, and the only help you are allowed is asking a professor (who will likely not offer much help beyond basic clarifications).