

ECE3600/CS3251/ECE6607 Computer Communications/Networking I

Instructor: Professor Henry Owen

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Course Objective: To study the basic concepts of communication networks, protocols and their performance including the use of network analysis tools and sockets programming.

The class will be taught as a flipped class. Lectures, assignments, quizzes will be completed online at your own pace and the class meetings will be used to do some hands-on network analysis using Wireshark, work on some sockets programming tasks, answer student questions, work practice problems, and have interactive discussions. There are approximately 150 asynchronous ten-minute lecture videos followed by approximately 150 after video practice problems which you may do as many times as you want before the due date (and only the highest score before the due date is recorded). The class also includes approximately six to eight “wireshark” assignments done in class and an in-class midterm and an in-class final.

Text:

J. F. Kurose, K. W. Ross, *Computer Networking, A Top-Down Approach*, 7th Ed, Addison-Wesley, 2018 ISBN 978-0133594140 (Note this is **NOT** the latest edition:) See for example electronic version: <https://www.vitalsource.com/products/computer-networking-james-kurose-keith-ross-v9780134296159>

You may use the 8th edition if you want, it is only about 5% different from the less expensive 7th edition.

To be successful in this class you will need to read the textbook. Although the lectures follow the textbook closely, students who do not read the textbook (and incorrectly assume they got all the material needed just from the lectures and slides) typically do not learn as much (or have as high a grade) as those that do read the textbook. Students who try to read most of the material all at once instead of on a regular basis typically do not learn as much.

Grading*:

On-Line Practice Quizzes**	20%
Wireshark (in class) exercises	20%
Sockets Programming Assignments	20%
Mid-term	20%
Final	20%

*Graduate students will have eight wireshark assignments and additional reading

**May work practice quizzes as many times as you want, only highest grade recorded

Assignments not turned in by the due date/time will be penalized by 10% per day.

Assignments to be turned in by uploading a pdf file (not word, not text, not rtf) to the canvas web site.

Grading Scale

Your final grade will be assigned as a letter grade according to the following standard scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Class Web Site:

<https://canvas.gatech.edu/>

Academic Honesty and Academic Integrity: Follow the Georgia Tech Honor Code <http://www.deanofstudents.gatech.edu/>. All conduct in this course will be governed by the Georgia Tech honor code. Use of any resources that contain or provide solutions to the assignments, quizzes, programs, mid-term, or final is a violation of the honor code. Except for the mid-term and final, you are encouraged to communicate with your classmates to get help on how to approach the problem, discuss specific steps to solve the problem, etc. as long as you are not discussing the actual “numerical” answer or copying actual “code”. The idea is to help each other but not work or solve their problems for them. We do want this to be a helpful and supportive environment.

It is considered a violation of the honor code in this course to:

- Use previous solutions to course assignments.
- Use online wireshark solutions to help you complete the wireshark assignments
- Communicate with anyone about any Computer Communications subjects/materials while completing the midterm and final exams, those exams to be complete individually without help.
- Any use of a resource during an exam like Quizlet, CourseHero, Chegg, etc. to obtain old exams or old solutions to any class problems or exams either old or new; or to arrange to have someone do class related work.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Collaboration & Group Work (Repeated to encourage collaboration)

With the exception of the mid-term and final, you are encouraged to communicate with your classmates to get help on how to approach the problem, discuss specific steps to solve the problem, etc. as long as you are not discussing the actual “numerical” answer or copying actual “code”. The idea is to help each other but not work or solve their problems for them. We do want this to be a helpful and supportive environment.

Digital Etiquette:

You are encouraged to actively participate in the course discussion forums.

If you have a general question on how to work a problem, please ask it in the canvas discussions. If your question requires sharing your specific answer, please ask the questions via an email directly to the instructor. Please do not ask questions directly to the instructor via private email if you are NOT including specific answers. Posting on the canvas forum allows others to learn from your questions as well.

All class announcements/notifications will be sent through canvas announcements. Students are responsible for configuring canvas to notify them of all announcements/notifications.

Class Attendance: Missing a “large” number of the interactive classes will lower your course grade since the class curve at the end of the semester will only be applied only to those that attended the interactive classes. If you miss an exam without notice prior to the start of the exam, you will receive a zero for that exam. All lectures and online quizzes (which are take as many times as you want before the due date and only the highest grade is recorded), are all to be completed online in an **asynchronous** manner within certain time/date ranges. Class periods will be used to will be used to do some hands-on network analysis using Wireshark, work on some sockets programming tasks, answer student questions, work practice problems, and have interactive discussions.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Assignments/quizzes not submitted to Canvas by the due date/time will be penalized by 10% per day. Unfortunately, if you rework a problem again after the due date (for example reviewing for the mid-term exam) canvas will mark your practice problem late. Due dates are posted with each assignment/quiz in canvas.

Note: Undergraduate students are not required to read, nor will you be tested on any material with the word “Optional” on it. Optional material is provided just in case you want to dig deeper on some of the topics. Graduate students will be responsible for the optional material.

OUTLINE

Introduction

- network edge
- end systems, access networks, links
- network core
- packet switching, circuit switching, network structure
- delay, loss, throughput in networks
- protocol layers, service models

Application Layer

- Web and HTTP
- Electronic mail
- Domain Name System
- video streaming and content distribution networks
- Socket programming with UDP and TCP

Transport Layer

- multiplexing and demultiplexing
- connectionless transport: UDP
- principles of reliable data transfer
- connection-oriented transport: TCP
- principles of congestion control
- TCP congestion control

Network layer: The Data Plane

- data plane
- control plane
- Router architecture
- IP: Internet Protocol
- Generalized Forward and SDN

Network Layer: The Control Plane

- routing protocols
- intra-AS routing in the Internet: OSPF
- routing among the ISPs: BGP
- The SDN control plane

Link Layer and LANs

- error detection, correction
- multiple access protocols
- LANs
- data center networking
- day in the life of a web request

Wireless Networking

- Wireless links, characteristics
- IEEE 802.11 wireless LANs (“Wi-Fi”)

Network Security

- Principles of Cryptography
- Message Integrity and Digital Signatures
- End Point Authentication
- Securing Email
- Securing TCP Connections: TLS
- Network Layer Security: IPSEC and Virtual Private Networks
- Securing Wireless Networks

Course Goals and Learning Outcomes

Upon successful completion of this course, students should be able to:

- Describe the theoretical fundamentals of how the internet works
- Use a layered model to explain the primary functionalities of internetworking
- Identify algorithms and functionalities to allow reliable data transport over an unreliable network
- Explain the fundamental protocols in the internet and have the ability to apply them to new networks
- Describe Software Defined Networking's fundamental concept and its impact on the internet
- Explain the fundamentals of link layer protocols
- Ability to work with sockets network interface

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services during the first week of classes and notify the instructor during the first week of classes.