

# University at Albany, Computer Science

## Computer Communication Networks

*ICIS 516– Fall 2017*

*Meeting time: 1:15PM-2:35PM*

*Location: BB0221*

Instructor	Mariya Zheleva
Instructor title	Assistant Professor
Office location	UAB 418
Office hours	T 3:00PM-4:30PM and W 3:30PM-5:00PM in UAB418
E-mail address	<a href="mailto:mzheleva@albany.edu">mzheleva@albany.edu</a>
TAs/Peer educators	Tuan Tran, Viral Patel

**Textbooks:** Kurose and Ross, *Computer Networking: A Top-Down Approach Featuring the Internet, 6th edition*, and assigned research papers.

### **COURSE DESCRIPTION:**

This course will cover fundamentals in computer communication networks as well as some state-of-the-art advances in the field. We will begin with topics in wired networks including Internet applications, transport and routing protocols, data link layer communications and Internet stability. We will then survey recent advances in applications (such as content-delivery networks), congestion control and wireless technologies. The students will have the opportunity to apply their understanding of networking fundamentals while working on hands-on programming assignments and an Internet measurement project. Students will also gain experience in efficient reading and understanding of technical papers.

### **LEARNING OBJECTIVES/OUTCOMES:**

At the completion of this course the students will:

- Understand the operation of computer communication networks.
- Reason about the shortcomings in current networks' design.
- Obtain hands-on experience in network applications and protocols through practical projects.
- Be able to design, execute and analyze the results of real-world, large-scale experiments on Internet performance.

### **RESOURCES:**

- **Course website:** <http://www.cs.albany.edu/~mariya/courses/csi516F17>
- **Blackboard:** Blackboard will be used to disseminate announcements, maintain grades, provide course materials, the most current syllabus, and assignment documents. However, this is not an online course and class attendance and participation is essential and required.

## ASSESSMENTS AND POLICIES:

The accomplishment of course objectives will be assessed by applying the studied concepts and tools in a combination of team and individual assignments that includes research and design, and a written component.

**Projects:** Students are required to work on two class project that will form 35% of their final grade (15% for P1 and 20% for P2). The project descriptions will be posted on the website.

**Homework assignments:** Students must complete five homework assignments, which will be fully described on the course website. They will be totaled together to account for 20% of the final grade. I do not accept late assignments. All assignments are to be completed individually and are due by 11:59PM on the due date (unless otherwise specified). Any re-grading requests will be considered up to 5 business days after posting the grades for the corresponding assignment. No re-grading after the 5-day period has passed.

**Class participation:** Students must read the assigned materials ahead of class and participate in the in-class discussions. This item will comprise 5% of the final grade.

**Exams:** This class will include two exams, a midterm and a final. The midterm exam is on October 18, 2017 and the final is TBD. These exams account for 45% of the overall grade (20% for the midterm and 25% for the final). They will cover all textbook material and assigned papers and will be closed notes, closed textbooks.

**Make-up Exams:** Make-up exams will be given only for valid and verifiable excuses (e.g. a major medical situation). If you are going to miss an exam, you must contact your instructor ahead of time and arrange to take a make-up exam at an alternate date/time.

### Grading:

Grading Item	Weight
Class participation	5%
Homework <ul style="list-style-type: none"><li>• HW1 -- Internet architecture.</li><li>• HW2 -- Applications.</li><li>• HW3 -- Transport.</li><li>• HW4 -- Routing. IP.</li><li>• HW5 -- Data Link Layer.</li></ul>	20%
Project 1 (Socket programming)	10%
Project 2 (Internet measurement)	20%
Midterm Exam (In class. Closed book, closed notes. Based on textbook and papers.)	20%
Final Exam (In class. Closed book, closed notes. Based on textbook and papers.)	25%

**Policy on I grade:** A grade of *I* will only be given for genuine extenuating circumstances that are beyond your control ***after the midterm point***. Both of the following conditions must be met:

1. Your work must be in good standing as of the passing of the midterm point (i.e. October 23, 2017); that is, you must have an average score of at least 50% on homework assignments and at least 50% on the programming assignments completed up to that point. Furthermore, your grade from the midterm exam must also be equivalent to at least a C. Therefore, if you miss the midterm exam or have hardly turned in homework or programming assignments, you are not eligible for an *I* grade.
2. Written documentation must be supplied about the extenuating circumstance either by you or the University administration.

Under no circumstances will the condition for completing an *I* grade be that the entire course be retaken later without a new registration.

**Policy on final grades:** Final grades are computed based on the above formulas and are NOT negotiable. Per department policy, "...students may not submit additional work or be re-examined for the purpose of improving their grades once the course has been completed and final grades assigned."

**Attendance and Class participation:** I expect you to attend every class. If you miss a couple of classes, this will affect your grade. I also expect active participation in in-class discussion; if you attend class but do not participate, you will not receive the full class participation credit. To prepare for these discussions, you must read the assigned reading before coming to class. I will use a tool called Socrative to facilitate class discussion, get feedback on your learning and track attendance. If you miss a class, it is your responsibility to find out the material covered in the class. It will not be possible for your instructor to conduct makeup classes.

**Cheating:** Cheating is not tolerated. Please, read the university Community Rights and Responsibilities ([http://www.albany.edu/studentconduct/assets/University\\_at\\_Albany\\_CommunityRights8-7-15.pdf](http://www.albany.edu/studentconduct/assets/University_at_Albany_CommunityRights8-7-15.pdf)) for more information on cheating.

- Cheating in an exam will result in an E grade for the course. Further, the students involved will be referred to the Dean's office for disciplinary action.
- Cheating on assignments – homework exercises and programming assignments *are meant to be individual exercises* (unless otherwise stated); you must do these by yourself. Cheating in a homework or programming assignment will result in a ZERO for that homework or program for all the students involved. Students who cheat in two or more homework/programming assignments will receive an E grade for the course. The names of such students will also be forwarded to the Dean's office for disciplinary action.

**Responsible Computing:** Students are required to read the University at Albany Policy for the Responsible Use of Information Technology ([http://www.albany.edu/its/policies\\_responsible\\_use\\_of\\_IT.htm](http://www.albany.edu/its/policies_responsible_use_of_IT.htm)). Students will be expected to apply the policies discussed in this document to all computing and electronic communications in the course.

**Students with Disabilities:** Reasonable accommodations will be provided for students with documented physical, sensory, systemic, cognitive, learning and psychiatric disabilities. If you believe you have a disability requiring accommodation in this class, please notify the Director of the Disability Resource Center (Campus Center 137, 442-5490). That office will provide the course instructor with verification of your disability, and will recommend appropriate accommodations. For further information refer to the University's Disclosure Statement regarding Reasonable Accommodation found at the bottom of the document at the following website: <http://www.albany.edu/disability/docs/RAP.doc>. This website can be reached by following the link under "Reasonable Accommodation Policy" at the following webpage <http://www.albany.edu/disability/faculty-staff.shtml>.

**Academic Honesty and Overall Regulations:** Every student has the responsibility to become familiar with the standards of academic integrity at the University. Faculty members must specify in their syllabi information about academic integrity, and may refer students to this policy for more information. Nonetheless, student claims of ignorance, unintentional error, or personal or academic pressures cannot be excuses for violation of academic integrity. Students are responsible for familiarizing themselves with the standards and behaving accordingly, and UAlbany faculty are responsible for teaching, modeling and upholding them. Anything less

undermines the worth and value of our intellectual work, and the reputation and credibility of the University at Albany degree. Plagiarism and other acts of academic dishonesty will be punished. Read the Standards of Academic Integrity and policies in the Undergraduate Bulletin ([http://www.albany.edu/undergraduate\\_bulletin/regulations.html](http://www.albany.edu/undergraduate_bulletin/regulations.html)).

## **COURSE OUTLINE AND READINGS:**

The following schedule of lecture topics and reading assignments is preliminary and may be changed as the semester progresses. The final schedule and specific assignments will be provided on our course website. Students are expected to have read the listed material before class.

## Introduction

### **Mon 08/28 Lecture 1**

Topic -- Class overview. Internet evolution and architecture.

Reading -- 1.2, 1.3, [Clark88]

Comment --

### **Wed 08/30 Lecture 2**

Topic -- Internet architecture. Layering. The end-to-end argument.

Reading -- 1.4 [Saltzer+84], [Clark88]

Comment --

### **Mon 09/04 No class. Labor day**

Topic --

Reading --

Comment --

## Application layer

### **Wed 09/06 Lecture 3**

Topic -- Delay, packet loss and throughput. Applications.

Reading -- 1.4, 2.1, 2.2

Comment -- [HW1 assigned](#).

### **Mon 09/11 Lecture 4**

Topic -- WWW and HTTP. DNS.

Reading -- 2.2, 2.5, [Duan+12], [Anonymous14]

Comment --

### **Wed 09/13 Lecture 5**

Topic -- More DNS. Peer-to-peer.

Reading -- 2.6, [Damiani+02]

Comment -- We will cover [Duan+12], [Anonymous14] today.

### **Mon 09/18 Lecture 6**

Topic -- More Peer-to-Peer. Wrap up application layer.

Reading -- 2.7

Comment -- [HW1 due](#). [HW2 assigned](#).

## Transport layer

### Wed 09/20 Lecture 7

Topic -- Socket programming. Intro to transport layer.  
Reading -- 3.1, 3.2  
Comment -- [P1 assigned.](#)

### Mon 09/25 Lecture 8

Topic -- Connectionless transport (UDP). Principles of reliable transport.  
Reading -- 3.3, 3.4, 3.5  
Comment --

### Wed 09/27 Lecture 9

Topic -- Pipelined protocols. TCP  
Reading -- 3.5, [Cerf+87]  
Comment --

### Mon 10/02 Lecture 10

Topic -- TCP contd. Intro to congestion control.  
Reading -- 3.6, 3.7  
Comment -- [HW2 due.](#) [HW3 assigned.](#)

### Wed 10/04 Lecture 11

Topic -- TCP congestion control.  
Reading -- 3.7, [Jacobson88], [Chiu+89]  
Comment --

### Mon 10/09 Lecture 12

Topic -- Wrap up transport layer  
Reading --  
Comment -- [P1 due.](#)

### Wed 10/11 No class

Topic -- Mariya is traveling  
Reading --  
Comment -- [HW3 due.](#)

### "Mon 10/16 Midterm Review"

The midterm covers Intro to the Internet; Application layer; Transport layer.  
Reading -- Chapters 1, 2 and 3 and the assigned papers.  
Comment --

### "Wed 10/18 Midterm."

The midterm covers Intro to the Internet; Application layer; Transport layer.  
Reading -- Chapters 1, 2 and 3 and the assigned papers.  
Comment -- In class. Closed book, closed notes. [P2 assigned.](#)

## Network layer

### Mon 10/23 Lecture 13.

Intro to networking. Virtual circuits vs. datagram networks. Project 2. <  
Reading -- 4.1, 4.2, 4.4  
Comment --

### Wed 10/25 Lecture 14

More on Project 2. Router design.  
Reading -- 4.3  
Comment --

**Mon 10/30 Lecture 15**

Topic -- Packet scheduling and Active queue management. Internet Protocol (IP)  
Reading -- [Floyd+93], [Demers+89], 4.4  
Comment --

**Wed 11/01 Lecture 16**

Topic -- IP addressing.  
Reading -- 4.4  
Comment --

**Mon 11/06 Lecture 17**

Topic -- More on IP. NAT. ICMP. IPv6  
Reading -- 4.4  
Comment -- [HW4 assigned.](#)

**Wed 11/08 Lecture 18**

Topic -- Routing behavior on the Internet.  
Reading -- [Paxon+96]  
Comment -- By now, you should be very familiar with [Paxon+96] through your work on P2. This class will be a discussion on your interpretation of the paper and on data analysis techniques.

**Mon 11/13 Lecture 19**

Topic -- Data analysis for Project 2. Routing algorithms.  
Reading -- 4.5  
Comment --

**Wed 11/15 Lecture 20**

Topic -- Writing a technical paper for Project 2. Routing algorithms contd.  
Reading -- 4.5  
Comment --

**Mon 11/20 Lecture 21**

Topic -- Routing on the Internet.  
Reading -- 4.6  
Comment --

**Wed 11/22 -- No class. Thanksgiving**

Topic --  
Reading --  
Comment --

## Data link layer

**Mon 11/27 Lecture 22**

Topic -- Intro to Data Link Layer. Error detection and correction. Multiple access links and protocols  
Reading -- 5.1, 5.2, 5.3  
Comment -- [HW4 due.](#) [HW5 assigned.](#)

**Wed 11/29 Lecture 23**

Topic -- Multiple access links and protocols cont. Switched LAN. Datacenters.

Reading -- 5.3, 5.6

Comment -- P2 due.

**Mobile wireless networks**

**Mon 12/04 Lecture 24**

Topic -- Multiple access

Reading -- 5.3

Comment --

**"Mon 05/08 Final Exam Review".**

The final exam covers Network layer; Data link layer and papers.

Reading -- Chapter 4, 5 and assigned papers.

Comment --