1. Meet the Professor

1.1. Instructor Contact Information:
Title: Assistant Professor
Name: Tamer Nadeem
Office Location: 3204 E&CS Building
Office Hours: Monday – 2:30-4:00pm
or by appointment
Email Address(es): nadeem@cs.odu.edu
Telephone Number(s): 757-683-7718

1.2. About the Professor
Teaching and Education Background
Dr. Tamer Nadeem joined the department of computer science at ODU as an assistant professor in January 2011. He received his Ph.D. degree in Computer Science from the University of Maryland, College Park in 2006. Prior to joining ODU, he spent 5 years as a research scientist at Siemens Corporate Research (SCR) in Princeton, USA in which I led several research projects in the general areas of smart mobility for optimized intelligent transportation systems and dynamic radio management for enterprise and industrial wireless networks. Since I joined ODU, I have taught the wireless networked systems course once a year. I also introduced new course on application development for smart devices focusing on programming for Android devices and have been teaching it once a year. I also introduced new seminar course in Spring 2013 on physical cyber systems. The success of the seminar course encourage me to continue the trend and plan to introduce another seminar course on smart sensing in Spring 2017.

Research Interests
While at SCR, Dr. Nadeem led the development of several projects in the area of dynamic radio management for enterprise wireless networks, efficient cross layer protocols for vehicular networks, intelligent transportation systems, location estimation and tracking of WLAN devices, and statistical characterization of VoWLAN. From 2004-2005, Dr. Nadeem was at Fujitsu Labs of America (FLA) in College Park, USA. While he was at FLA, he participated in designing, analyzing, and evaluating new paradigms for 802.11 wireless networks such as access points with sectorized antennas. Dr. Nadeem holds two US patents (#7,171,558, 2007 &
#7,630,343, 2009) and has 15 pending patents. He has over 45 publications in peer reviewed scholarly journals and conference proceedings. He serves on the organizing committees of several conferences including recently ACM MobiCom 2013, ACM MobiSys 2013, and ACM HotMobile 2012. Recently, he served as program chair of the International Wireless Communications & Mobile Computing Conference (IWCMC) - Mobile Computing Symposium for years 2013, 2014, 2015 & 2016. He serves as a member of the technical committees of various conferences in the areas of wireless management and vehicular networking. He also serves on several panels on vehicular networking. Dr. Nadeem's technical interests include wireless management for smart devices and enterprise networks, vehicular networks, intelligent transportation system, cyber physical systems, smart grid communication, network security, mobile and pervasive computing, and location determination systems.

Selected Papers and Publications

My ODU CS website (http://www.cs.odu.edu/~nadeem/) has more information about me, including my research interests, research projects, and publications.

2. Course Information

2.1. Course Description

This course explores computer networking, focusing on the applications and protocols that run on the Internet. We will take a top-down approach to the layered network architecture, studying applications first and then proceeding down the network “stack” towards the physical link. We will look at the operation of applications such as the web, FTP, e-mail, and DNS. At the transport layer, we will study both connectionless UDP and connection-oriented TCP. Since TCP is the protocol that the majority of Internet traffic uses, we will study its operation in-depth, including flow control and congestion control. We will also look at how data is routed through the Internet, regardless of transport protocol. We will also introduce current “hot” topics, such as network security and wireless/mobile network.

2.2. Course Overview

By the end of the semester, you should be able to complete the following tasks, among others:

- Design and implement a socket-based application using either TCP or UDP. Examples include chat, echo, a web client, and an FTP client.
- Explain how the choice of a transport protocol can affect networked applications.
- Use networking tools such as ping, traceroute, tcpdump, and dig to investigate a network.
- Explain what happens on the network when you click a link on a web page.
- Explain how an email message you send to a friend is sent and delivered.
- List the two main types of routing algorithms and which protocols use those algorithms. Describe the main differences between the two algorithms.
- Explain why routers cannot have a routing table with an entry for every other router in the Internet.
• Compute the end-to-end delay for a packet given the propagation delay, link bandwidth, and packet size.
• List the five layers of the Internet protocol stack and give an example of each.
• Explain the difference between congestion control and flow control and how each is implemented in TCP

Course requirements include (1) readings for class preparation and class participation, (2) programming assignments and homework, (3) survey report, (4) in-class presentations (for CS 555), (5) Mid-term exam and (6) final exam.

2.3. Course Meeting
Meeting place: Dragas 1115
Meeting Time: Monday 4:20pm - 7:00pm

3. Course Readings
3.1. Required Materials
• REQUIRED TEXT BOOK
  - Note that 6th, 5th and 4th editions are also acceptable.

• Course slides and readings listed on the course page.

3.2. Optional Materials
Another good optional textbook:

4. Course Prerequisites
Prerequisites for this course for undergraduates are:
• CS 270 – Computer Architecture
• STAT 330U - Intro to Probability and Statistics

Prerequisites for this course for all students are:
• Comfort programming in different programming languages (we may use either Java or Python)
• A working knowledge of the Unix program development environment.
• I expect you to be familiar with common Unix commands. If you need a refresher, see the CS 252 Introduction to Unix for Programmers.
5. Course Schedule

Table shows class meeting days, topics, and readings. Typically, a weekly assignment will be posted by next day of the class with a due date on Saturday. Dates and topics are subject to change during the course.

<table>
<thead>
<tr>
<th>Class Meeting Days</th>
<th>Topics</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday, August 29</td>
<td>Course Logistics: Course structure, grading, assignments, etc.</td>
<td>• Syllabus</td>
</tr>
<tr>
<td></td>
<td>Introduction to Computer Network and the Internet (I): What is Internet?</td>
<td>• Slides</td>
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<tr>
<td></td>
<td>The Network Edge, and The Network Core.</td>
<td>• Kurose &amp; Ross: Chapter 1, Sections: 1.1 - 1.3</td>
</tr>
<tr>
<td>Monday, September 5</td>
<td>No Lecture - Labor Day Holiday</td>
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<tr>
<td>Monday, September 12</td>
<td>Introduction to Computer Network and the Internet (II): Delay/Loss/Throughput, Protocol Layers, Networks Vulnerability, and History of Computer Networking.</td>
<td>• Slides</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Kurose &amp; Ross: Chapter 1, Sections: 1.4 - 1.7</td>
</tr>
<tr>
<td>Monday, September 19</td>
<td>Application Layer (I): Network Application Principles and Architecture, Client-Server Model, Socket Programming, and HTTP.</td>
<td>• Slides</td>
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<td></td>
<td>• Kurose &amp; Ross: Chapter 2, Sections: 2.1, 2.2.1-2.2.4, 2.7</td>
</tr>
<tr>
<td>Monday, September 26</td>
<td>Application Layer (II): FTP, Mail, and DNS.</td>
<td>• Slides</td>
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<td></td>
<td></td>
<td>• Kurose &amp; Ross: Chapter 2, Sections: 2.3 - 2.5</td>
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<td></td>
<td>• Kurose &amp; Ross: Chapter 8, Sections: 8.1 - 8.3</td>
</tr>
<tr>
<td>Monday, October 3</td>
<td>Transport Layer (I): Introduction, Mux/Demux, UDP, Reliable Data Transmission.</td>
<td>• Slides</td>
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<td></td>
<td></td>
<td>• Kurose &amp; Ross: Chapter 3, Sections: 3.1 - 3.4.1</td>
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<tr>
<td>Monday, October 10</td>
<td>No Lecture - Fall Holiday</td>
<td></td>
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<tr>
<td>Monday, October 17</td>
<td>Transport Layer (II): TCP, and Flow Control.</td>
<td>• Slides</td>
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<td></td>
<td>• Kurose &amp; Ross: Chapter 3, Sections: 3.4.2 - 3.5.5</td>
</tr>
<tr>
<td>Monday, October 24</td>
<td>Mid Term Exam</td>
<td></td>
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<tr>
<td>Monday, October 31</td>
<td>Transport Layer (III): TCP Connection Management and Congestion Control.</td>
<td>• Slides</td>
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<tr>
<td></td>
<td></td>
<td>• Kurose &amp; Ross: Chapter 3, Sections: 3.5.6 - 3.7</td>
</tr>
<tr>
<td>Monday, November 7</td>
<td>Network Layer (I): Virtual Circuit vs. Datagram Networks, Routers and Routing, and IP.</td>
<td>• Slides</td>
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<tr>
<td></td>
<td></td>
<td>• Kurose &amp; Ross: Chapter 4, Sections: 4.1 - 4.4</td>
</tr>
</tbody>
</table>
Monday, November 14 | Network Layer (II): Routing Algorithms, Routing in Internet, Broadcast ad Multicast Routing.  
• Slides  
• Kurose & Ross: Chapter 4, Sections: 4.5 - 4.7  
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Monday, November 21 | Link Layer (I): Introduction, Error Detection and Correction, Multiple Access, LAN, and Ethernet.  
• Slides  
• Kurose & Ross: Chapter 5, Sections: 5.1 - 5.4  
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Monday, November 28 | Link Layer (II): LAN, Link Virtualization, and a Day in the Life of a Web Page Request, Wireless Networks.  
• Slides  
• Kurose & Ross: Chapter 5, Sections: 5.4 - 5.7  
• Kurose & Ross: Chapter 6, Sections: 6.1 - 6.2 (exclude 6.2.1), 6.3 - 6.3.4, 6.3.6  
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Monday, December 5 | CS 555 Presentations  
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Monday, December 12 | Final Exam (3:45pm-6:45pm)  
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6. Course Grading Criteria

6.1. Grading

Your grade in this class will be based on the following:

(Note that these percentages are only approximate and are subject to change, but by no more than 10%.)

<table>
<thead>
<tr>
<th>Programming Assignments</th>
<th>20%</th>
<th>These are to be completed individually unless otherwise specified and are due before midnight on the due date.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written Homework Assignments</td>
<td>20%</td>
<td>These are to be completed individually and are due before midnight on the due date.</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>20%</td>
<td>This will be a closed-book and closed-Internet exam. The exam questions will be similar in style and complexity to the written homework assignments.</td>
</tr>
<tr>
<td>Undergraduate Report / Graduate Presentation</td>
<td>15%</td>
<td>Undergraduates will complete a report on a networking topic (to be approved by the instructor). Graduate students will complete a report on a networking topic and give a presentation on the topic to the class. More details about these will be given later in the semester.</td>
</tr>
<tr>
<td>Final Project</td>
<td>25%</td>
<td>This will be a closed-book and closed-Internet exam. Our final exam is scheduled for Monday, December 12, 2016 at 3:45pm in our regular classroom. The final will cover topics from the entire semester.</td>
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</tbody>
</table>
6.2. **CS 455 vs. CS 555**

Students enrolled in CS 555 will have additional problems on written homework assignments, will have more difficult questions on the exams, and will present a report on a networking topic to the class.

6.3. **Grading Scale**

The grading scale is as follows:
(+ and - modifiers will be applied as appropriate)

<table>
<thead>
<tr>
<th>CS 455</th>
<th>CS 555</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100 = A</td>
<td>90-100 = A</td>
</tr>
<tr>
<td>80-89 = B</td>
<td>80-89 = B</td>
</tr>
<tr>
<td>70-79 = C</td>
<td>70-79 = C</td>
</tr>
<tr>
<td>60-69 = D</td>
<td>0-69 = F</td>
</tr>
<tr>
<td>0-59 = F</td>
<td></td>
</tr>
</tbody>
</table>

6.4. **Programming Assignment Grading Guidelines**

- Programs that do not compile will receive a 0.
- Programming assignments will be graded based on how your program performs on a number of test cases. You are strongly encouraged to rigorously test your program before submitting it.
- Programming style (including code comments) and design will also be considered in grading. Sloppy programs that pass 100% of the tests will not receive a grade of 100.
- Include your name, assignment number, due date, and course in the comments of each file that you submit.

6.5. **Late Assignments**

Any assignment submitted after its deadline is considered late. The following penalties for late assignments apply:
- 0-24 hours late: -10%
- 25-48 hours late: -25%
- Over 48 hours late: not accepted, grade = 0

This time limit includes weekends -- they are counted just like weekdays. I reserve the right to specify that late submissions will not be accepted for particular assignments.

7. **Course Policies**
7.1. Attendance
I expect you to attend class and to arrive on time. Your grade may be affected if you are consistently tardy. If you have to miss a class, you are responsible checking the course website to find any assignments or notes you may have missed. Students may leave after 15 minutes if the instructor or a guest lecturer does not arrive in that time.

7.2. Computer Account and Email
Students should have an ODU OCCS account. This is the account associated with your @odu.edu email. It will allow you to log into the course's Blackboard site. All ODU students automatically receive this account, though you may need to activate yours, particularly if you are new to ODU.

Students should activate their @odu.edu e-mail accounts and check them every day. If a student chooses to have his/her messages forwarded to another account, it is the student's responsibility to take the necessary steps to have them forwarded.

All students in this course are responsible for making sure they have working accounts prior to the first assignment.

7.3. Getting Help
Please use the discussion forum (on Blackboard) to ask questions about the course material or ask clarifying questions about an assignment. Feel free to answer questions that other students have posted in the cs455 Café.

If you need to contact the instructor about a private matter, the best way is through email (nadeem@cs.odu.edu), but do not expect or rely on an immediate response.

7.4. Tests and Make-ups
If a situation has occurred that requires your time and attention which will prevent submitting your graded activities on time, please notify your instructor 24 hours before the scheduled due date. It is the student's responsibility to give the instructor a written excuse and to arrange for any makeup work to be done. A makeup exam may be different (and possibly more difficult) than the regularly scheduled exam.

7.5. Course Disclaimer
Every attempt is made to provide a syllabus that is complete and that provides an accurate overview of the course. However, circumstances and events may make it necessary for the instructor to modify the syllabus during the semester. This may depend, in part, on the progress, needs, and experiences of the students.

8. University Policies

8.1. College Classroom Conduct
Please be respectful of your classmates and instructor by minimizing distractions during class. Cell phones must be turned off during class.
8.2. Honor Pledge

By attending Old Dominion University, you have accepted the responsibility to abide by the honor code and honor pledge. This is an institutional policy approved by the Board of Visitors. If you are uncertain about how the honor code applies to any course activity, you should request clarification from the instructor. The honor pledge is as follows:

"I pledge to support the honor system of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism. I am aware that as a member of the academic community, it is my responsibility to turn in all suspected violators of the honor system. I will report to Honor Council hearings if summoned."

In particular, submitting anything that is not your own work without proper attribution (giving credit to the original author) is plagiarism and is considered to be an honor code violation. It is not acceptable to copy source code or written work from any other source (including other students), unless explicitly allowed in the assignment statement. In cases where using resources such as the Internet is allowed, proper attribution must be given.

Any evidence of an honor code violation (cheating) will result in a 0 grade for the assignment/exam, and the incident will be considered for further review. Evidence of cheating may include a student being unable to satisfactorily answer questions asked by the instructor about a submitted solution. Cheating includes not only receiving unauthorized assistance, but also giving unauthorized assistance.

Students may still provide legitimate assistance to one another. You are encouraged to form study groups to discuss course topics. Students should avoid discussions of solutions to ongoing assignments or exams and should not, under any circumstances, share solutions for an ongoing assignment or exam.

All students are responsible for knowing the rules. If you are unclear about whether a certain activity is allowed or not, please contact the instructor.

8.3. Special Needs

Old Dominion University is committed to ensuring equal access to all qualified students with disabilities in accordance with the Americans with Disabilities Act. The Office of Educational Accessibility (OEA) is the campus office that works with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you experience a disability that will impact your ability to access any aspect of my class, please present me with an accommodation letter from OEA so that we can work together to ensure that appropriate accommodations are available to you.
- If you feel that you will experience barriers to your ability to learn and/or testing in my class but do not have an accommodation letter, please consider scheduling an appointment with OEA to determine if academic accommodations are necessary.
The Office of Educational Accessibility is located at 1021 Student Success Center and their phone number is (757) 683-4655. Additional information is available at the OEA website: http://www.odu.edu/educationalaccessibility/

8.4. University Email Policy
The Old Dominion University e-mail system is the official electronic mail system for distributing course-related Communications, policies, Announcements and other information. In addition, the University e-mail user ID and password are necessary for authentication and access to numerous electronic resources (online courses, faculty Web pages, etc.) For more information about the policy, please visit: Electronic Messaging Policy for Official University Community Policy 3506 (pdf). For more information about student email, please visit http://occs.odu.edu/accounts/studemail/

8.5. Withdrawal
A syllabus constitutes an agreement between the student and the course instructor about course requirements. Participation in this course indicates your acceptance of its teaching focus, requirements, and policies. Please review the syllabus and the course requirements as soon as possible. If you believe that the nature of this course does not meet your interests, needs or expectations, if you are not prepared for the amount of work involved - or if you anticipate that the class meetings, assignment deadlines or abiding by the course policies will constitute an unacceptable hardship for you - you should drop the class by the drop/add deadline, which is located in the ODU Schedule of Classes. For more information, please visit the Office of the University Registrar.

8.6. Student Acknowledgement Options
“I, ______________, have completely read this syllabus and understand and agree to the course requirements.”