CS 431 Data Communications and Networking
Westminster College – Spring 2019
Tuesday/Thursday 11 – 12:30

Instructor: Kelly Hartner
Office: Hoyt 170
E-mail: khartner@westminster.edu
Office Hours: MW 12:00-1:00 or by appointment

COURSE DESCRIPTION:
An overview of networking, topic areas include LANs, WANs, TCP/IP, security, cabling, cloud computing and virtualization, wireless networking, network applications, and more. Hands-on labs give students a working knowledge of networking infrastructure resources and tools. This course can help to prepare students for the CompTIA Network+ Certification exam.

REQUIRED TEXT:

Structure:
Materials assigned for a particular class should be read before coming to class. The D2L course page will be used to post slides and handouts. The College’s email system will be used to send announcements. Please read your email and check D2L on a regular basis.

Topics:
The tentative schedule is attached. The instructor reserves the right to make changes.

GRADING:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 assignments (6@10 points, 2@20)</td>
<td>100</td>
</tr>
<tr>
<td>9 quizzes @ 30 points</td>
<td>270</td>
</tr>
<tr>
<td>3 examinations @100 points each</td>
<td>300</td>
</tr>
<tr>
<td>Final Exam</td>
<td>150</td>
</tr>
<tr>
<td>Class participation &amp; attendance</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>845</td>
</tr>
</tbody>
</table>

Typically, the grading scale is: 92-100% = A; 89 - 91.9=A-; 88-88.9 % = B+ and so on. However, I reserve the right to change the scale depending on how the final grades break.

ATTENDANCE, EXAMS, AND ASSIGNMENTS POLICY:

- Students are expected to attend all classes, participate in class discussions, and complete all labs, assignments, and activities.
- Exams and quizzes are to be taken on the assigned date and time.
- Assignments are due at the start of class on the assigned date and time. Points will be deducted for assignments turned in late. The submission of assignments a week or more late are not accepted without the express permission of the Instructor.
• If you must miss a class for any reason, you are responsible for making up the work and collecting any notes or assignments that you missed. "Makeup" exams and quizzes will be assignments will be accepted at the instructor’s discretion. On the first day that you return to class, it is your responsibility to check with the instructor.

• Class attendance is important to your understanding of the materials presented and you should make every effort to attend class. This is a project-based course and your participation is CRUCIAL. You will be expected to contribute to the class discussion and work!

• Occasionally, you may be asked to attend an event outside of class time. You will be informed about these activities as they occur.

• If you have questions about course content or course assignments, please feel free to email me, or stop by my office during scheduled office hours.

**Academic Integrity:**

Academic integrity is central to the purpose of any academic community. Please read the section in the catalog entitled "Academic Integrity." Of special concern is the issue of plagiarism, which is defined as leading your reader or listener to believe that what you have written or said is your own work, when, in fact, it is not. The range of plagiarism includes word-for-word copying of another's text without quotation marks and appropriate citation, to inappropriate paraphrasing of another's text, to even the unattributed borrowing of apt phrases or terms. All of these degrees of plagiarism are equally unethical and may be penalized with failure for the assignment, or, in extreme cases, failure for the course. Turn-it-in.com may be used during this course.

**Assistance:**

If you are having problems with this course, or any other, Westminster College provides several sources of help:

• The Learning Center (extension 6700)
• Disability Resources (extension 7192)
• Counseling Services (extension 7340).
COURSE OBJECTIVES:

Upon successful completion of readings, exercises, labs, and assignments, the student will be able to:

1. Describe models such as the OSI seven-layer model and the TCP/IP four-layer model; explain the major functions of network hardware and software; and relate each function to the appropriate OSI and TCP/IP model layer.

2. Explain the different types of network topologies; describe the different types of network cabling; and describe the IEEE networking standards.

3. Define and describe Ethernet and explain early Ethernet implementations; describe ways to extend and enhance Ethernet networks.

4. Distinguish among varieties of 100-megabit Ethernet; discuss copper- and fiber-based Gigabit Ethernet; and compare the competing varieties of 10-Gigabit Ethernet.

5. Recognize and describe the functions of basic components in a structured cabling system; explain the process of installing structured cable; install a network interface card; and perform basic troubleshooting on a structured cable network.

6. Describe how the Internet Protocol (IP) works; explain CIDR and subnetting; and describe the functions of static and dynamic IP addresses.

7. Explain how routers work; describe dynamic routing technologies; and install and configure a router successfully.

8. Describe common Transport layer protocols; explain the power of port numbers; and define common TCP/IP applications, such as HTTP, HTTPS, Telnet, e-mail (SMTP, POP3, and IMAP4), and FTP.

9. Describe the function and capabilities of DNS; configure and troubleshoot WINS; and use common TCP/IP utilities to diagnose problems with DNS and WINS.

10. Discuss the standard methods for securing TCP/IP networks; compare TCP/IP security standards; and implement secure TCP/IP applications.

11. Discuss the four logical topologies as defined by CompTIA; configure and deploy VLANs; and implement advanced switch features.

12. Discuss the fundamental concepts of IPv6; describe IPv6 practices; and implement IPv6 in a TCP/IP network.

13. Describe WAN telephony technologies, such as SONET, T1, and T3; compare last-mile connections for connecting homes and businesses to the Internet; and discuss and implement various remote access connections.

14. Explain wireless networking standards; describe the process for implementing Wi-Fi networks; and describe troubleshooting techniques for wireless networks.

15. Describe the concepts of virtualization; explain why PC and network administrators have widely adopted virtualization; describe how virtualization manifests in modern networks; and describe the service layers and architectures that make up cloud computing.

16. Explain the capabilities of different mobile networking technologies; describe common deployment schemes for mobile devices; and deal with sample security issues with mobile devices.

17. Explain the concepts of basic network design; describe unified communication features and functions; and describe the function and major components of an ICS/SCADA network.

18. Describe the industry standards for risk management; discuss contingency planning; and examine safety standards and actions.
19. Discuss common security threats in network computing; discuss common vulnerabilities inherent in networking; describe methods for hardening a network against attacks; and explain how firewalls protect a network from threats.

20. Explain how SNMP works, describe network monitoring tools, and discuss a scenario that uses management and monitoring tools.

21. Describe appropriate troubleshooting tools and their functions; analyze and discuss the troubleshooting process; and resolve common network issues.
COURSE OUTLINE:

1. Network Models
2. Cabling and Topology
3. Ethernet Basics
4. Modern Ethernet
5. Installing a Physical Network
6. TCP/IP Basics
7. Routing
8. TCP/IP Applications
9. Network Naming
10. Securing TCP/IP
11. Advanced Networking Devices
12. IPv6
13. Remote Connectivity
14. Wireless Networking
15. Virtualization and Cloud Computing
16. Mobile Networking
17. Building a Real-World Network
18. Managing Risk
19. Protecting Your Network
20. Network Monitoring
21. Network Troubleshooting
WEB RESOURCES:

This is a list of some recommended Web sites. You should add other useful sites as you find them and share the information with your classmates.

- McGraw-Hill Education
  www.mheducation.com
- CompTIA
  www.comptia.org
- Total Seminars (Mike Meyers)
  www.totalsem.com
- Cisco
  www.cisco.com
- PC Guide
  www.pcguide.com
- Computer dictionary
  www.webopedia.com
- Microsoft Technical support
  http://technet.microsoft.com
- PC Tech Guide
  www.pctechguide.com
- Hardware, especially for new components
- Computer magazines
**Course Schedule:**
*This tentative schedule is for planning purposes and is subject to change.*

<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Goals and Objectives</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chapter One: Network Models</td>
<td><strong>Chapter One</strong>&lt;br&gt;• Describe how models such as the OSI seven-layer model and the TCP/IP model help technicians understand and troubleshoot networks&lt;br&gt;• Explain the major functions of networks with the OSI seven-layer model&lt;br&gt;• Describe the major functions of networks with the TCP/IP model</td>
<td>• Read Chapter One&lt;br&gt;• Know and understand chapter key terms&lt;br&gt;• T(1/15): Start HOP 1</td>
</tr>
<tr>
<td>2</td>
<td>Chapter Two: Cabling and Topology</td>
<td><strong>Chapter Two</strong>&lt;br&gt;• Explain the different types of network topologies&lt;br&gt;• Describe the different types of network cabling and connectors&lt;br&gt;• Describe the IEEE networking standards</td>
<td>• Read Chapters Two and Three&lt;br&gt;• Know and understand chapter key terms&lt;br&gt;• R(1/24): Turn in HOP 1&lt;br&gt;• R(1/24): Start HOP 2</td>
</tr>
</tbody>
</table>

**Chapter Three: Ethernet Basics**

**Chapter Three**<br>• Define and describe Ethernet<br>• Explain early Ethernet implementations<br>• Describe ways to extend and enhance Ethernet networks
<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Goals and Objectives</th>
<th>Assignments</th>
</tr>
</thead>
</table>
| 3    | Chapter Four: Modern Ethernet | Chapter Four  
• Describe the varieties of 100-megabit Ethernet  
• Discuss copper- and fiber-based Gigabit Ethernet  
• Discover and describe Ethernet varieties beyond Gigabit | • Read Chapters Four and Five  
• Know and understand chapter key terms  
• R(1/31): Turn in HOP 2  
• R(1/31): Start HOP 3 |
|      | Chapter Five: Installing a Physical Network | Chapter Five  
• Recognize and describe the functions of basic components in a structured cabling system  
• Learn how to make network cables |  
| 4    | Guest Lecturer |  
• Network Engineer visit and IDF and Data Center tour  
• Review for Exam One |  
• Come to class prepared to ask guest Network Engineer questions about parallels between what we are learning in class and a real-world networking environment.  
• Study for Exam One  
• R(2/7): Turn in HOP 3 by end of class |
| 5    | Chapter Six: TCP/IP Basics | Chapter Six  
• Describe how the TCP/IP protocol suite works  
• Explain CIDR and subnetting |  
• Read Chapter Six  
• Know and understand chapter key terms  
• R(2/14): Start HOP 4 |

CS-431 Syllabus
<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Goals and Objectives</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Chapter Six: TCP/IP Basics (cont.)</td>
<td>Chapter Six (cont.)&lt;br&gt;• Describe how the TCP/IP protocol suite works&lt;br&gt;• Explain CIDR and subnetting</td>
<td>• Read Chapters Six and Seven&lt;br&gt;• Know and understand chapter key terms&lt;br&gt;• R(2/21): Turn in HOP 4&lt;br&gt;• R(2/21): Start HOP 5</td>
</tr>
<tr>
<td></td>
<td>Chapter Seven: Routing</td>
<td>Chapter Seven&lt;br&gt;• Explain how routers work&lt;br&gt;• Describe dynamic routing technologies</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Chapter Eight: TCP/IP Applications</td>
<td>Chapter Eight&lt;br&gt;• Describe common Transport and Network layer protocols&lt;br&gt;• Explain the power of port numbers&lt;br&gt;• Define common TCP/IP applications such as HTTP, HTTPS, Telnet, SSH, e-mail (SMTP, POP3, and IMAP4), and FTP</td>
<td>• Read Chapters Eight and Nine&lt;br&gt;• Know and understand chapter key terms&lt;br&gt;• R(2/28): Turn in HOP 5&lt;br&gt;• R(2/28): Start HOP 6</td>
</tr>
<tr>
<td></td>
<td>Chapter Nine: Network Naming</td>
<td>Chapter Nine&lt;br&gt;• Analyze and configure early name resolution solutions&lt;br&gt;• Describe the function and capabilities of DNS&lt;br&gt;• Use common TCP/IP utilities to diagnose problems with DNS</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Chapter Ten: Securing TCP/IP</td>
<td>Chapter Ten&lt;br&gt;• Discuss the standard methods for securing TCP/IP networks&lt;br&gt;• Compare TCP/IP security standards&lt;br&gt;• Implement secure TCP/IP applications</td>
<td>• Read Chapter Ten&lt;br&gt;• Know and understand chapter key terms&lt;br&gt;• R(3/7): Turn in HOP 6</td>
</tr>
<tr>
<td>Week</td>
<td>Chapter</td>
<td>Goals and Objectives</td>
<td>Assignments</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>----------------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| 9    | Chapter Eleven: Advanced Networking Devices | Chapter Eleven  
- Describe the features and functions of VPNs  
- Define the capabilities and management of managed switches  
- Configure and deploy VLANs  
- Implement advanced switch features |  
- Read Chapter Eleven  
- Know and understand chapter key terms  
- Study for Exam Two  
- R(3/21): Start HOP 7 (S1)  
- R(3/21): Start HOP 8 (S2, S3, S4, S5) |
| 10   | Chapter Twelve: IPv6  
Chapter Thirteen: Remote Connectivity | Chapter Twelve  
- Discuss the fundamental concepts of IPv6  
- Describe the IPv6 practices  
- Implement IPv6 in a TCP/IP network  
Chapter Thirteen  
- Describe WAN telephony technologies, such as SONET, T1, and T3  
- Compare last-mile connections for connecting homes and businesses to the Internet  
- Discuss and implement various remote access connection methods  
- Troubleshoot various WAN scenarios |  
- Read Chapters Twelve and Thirteen  
- Know and understand chapter key terms  
- R(3/28): Start HOP 7 (S2)  
- R(3/28): Turn in HOP7 (S1)  
- R(3/28): Start HOP 8 (S1)  
- R(3/28) Continue work on HOP 8 (S3, S4, S5) |
<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Goals and Objectives</th>
<th>Assignments</th>
</tr>
</thead>
</table>
| 11   | Chapter Fourteen: Wireless Networking | - Explain wireless networking standards  
- Describe the process for implementing Wi-Fi networks  
- Describe troubleshooting techniques for wireless networks | - Read Chapters Fourteen and Fifteen  
- Know and understand chapter key terms  
- R(4/4): Start HOP 7 (S3)  
- R(4/4): Turn in HOP7 (S2)  
- R(4/4) Continue work on HOP 8 (S1, S2 S4, S5) |
|      | Chapter Fifteen: Virtualization and Cloud Computing | - Describe the concepts of virtualization  
- Explain why PC and network administrators have widely adopted virtualization  
- Describe how virtualization manifests in modern networks  
- Describe the service layers and architectures that make up cloud computing |      |
| 12   |      | - Study for Exam Three  
- R(4/11): Start HOP 7 (S4)  
- R(4/11): Turn in HOP7 (S3)  
- R(4/11) Continue work on HOP 8 (S1, S2 S3, S5) |      |
<p>| | | |
|      |      |                      |</p>
<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Goals and Objectives</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Guest Lecturer</td>
<td>• Cisco Engineers Visit</td>
<td>• Come to class prepared to ask guest Cisco Engineers questions about parallels between what we are learning in class and a real-world networking environment.</td>
</tr>
</tbody>
</table>
| 14   | Chapter Sixteen: Mobile Networking | Chapter Sixteen  
- Explain the capabilities of different mobile networking technologies  
- Describe common deployment schemes for mobile devices  
- Deal with sample security issues with mobile devices  
| Chapter Eighteen: Managing Risk | Chapter Eighteen  
- Describe the industry standards for risk management  
- Discuss contingency planning  
- Examine safety standards and actions | • Reach Chapters Sixteen and Eighteen  
- R(4/25): Start HOP 7 (S5)  
- R(4/25): Turn in HOP7 (S4)  
- R(4/25) Continue work on HOP 8 (S1, S2 S3, S4) |
<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Goals and Objectives</th>
<th>Assignments</th>
</tr>
</thead>
</table>
| 15 T: 4/30 Lecture Ch. 18&19 R: 5/2 Quiz-Ch. 16&18&19 Last Class Exam Rally - Final | Chapter Eighteen: Managing Risk (cont.) | Chapter Eighteen (cont.)  
- Describe the industry standards for risk management  
- Discuss contingency planning  
- Examine safety standards and actions  
- Discuss common security threats in network computing |  
- Reach Chapters Eighteen and Nineteen  
- Study for Final  
- R(5/2): Turn in HOP7 (S5)  
- R(5/2): Turn in HOP8 (Everyone) |
| Chapter Nineteen: Protecting Your Network | Chapter Nineteen  
- Discuss common vulnerabilities inherent in networking  
- Describe methods for hardening your network against attacks  
- Explain how firewalls protect a network from threats | |  |
| 16 M: 5/6 3-5:30 p.m. | Final examination - Cumulative | |  |
| Assignment | Description | Rubric: Meets Expectations if ...
|------------|-------------|-------------------------------------------------------------------------------------------------------------------------|
| HOP 1      | - IPconfig /all  
- Ping  
- OSI Model  
- TCP/IP Model  
- Frames | - Clearly and concisely describes the what, why and how of the project.  
- Follows any other assignment instructions.  
- Submitted on time. |
| HOP 2      | - Network Topologies  
- Network Cable Types  
- Network Data Transfer  
- Managed vs. Unmanaged switches | - Clearly and concisely describes the what, why and how of the project.  
- Follows any other assignment instructions.  
- Submitted on time. |
| HOP 3      | - Network standards  
- Network Cable Connector Types  
- Make Network Cables | - Clearly and concisely describes the what, why and how of the project.  
- Follows any other assignment instructions.  
- Submitted on time. |
| HOP 4      | - Subnetting  
- Networking Organizations | - Clearly and concisely describes the what, why and how of the project.  
- Follows any other assignment instructions.  
- Submitted on time. |
| HOP 5      | - Routing Protocols  
- RFCs  
- ARP and NETSTAT | - Clearly and concisely describes the what, why and how of the project.  
- Follows any other assignment instructions.  
- Submitted on time. |
| HOP 6      | - Ports  
- Protocols  
- ipconfig | - Clearly and concisely describes the what, why and how of the project.  
- Follows any other assignment instructions.  
- Submitted on time. |
| HOP 7      | - Switch Configuration  
- Use Patch cables created in HOP 3 to connect laptops  
- Connect to patch panel and wall plate | - Clearly and concisely describes the what, why and how of the project.  
- Follows any other assignment instructions.  
- Submitted on time. |
| HOP 8      | - Net-Challenge | - Clearly and concisely describes the what, why and how of the project.  
- Follows any other assignment instructions.  
- Submitted on time. |