Course Outline

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Course Details

Course Code	COMP3331/9331
Course Title	Computer Networks and Applications
Units of Credit	6
Lecture	Salil Kanhere
Admin	Ayda Valinezhad Orang
Classes	Lectures: Mon 09:00-11:00 Hrs, Wed 12:00 -14:00 Hrs, On-line: Zoom Meeting (links on Lectures page) Timetable (https://webcms3.cse.unsw.edu.au/COMP3331/21T3/timetable) for all classes.
Consultations	Thursdays 4-5 pm Venue: Zoom Meeting (https://unsw.zoom.us/j/88622932212?pwd=REVZS3BYNldZM0lNdjdzVWQ0aGRWUT09) (password: 7empest)
Course Website	Course Website (https://webcms3.cse.unsw.edu.au/COMP3331/21T3/)
Course Contact Email	cs3331@cse.unsw.edu.au (mailto:cs3331@cse.unsw.edu.au)
Handbook Entry	Handbook Entry (http://www.handbook.unsw.edu.au/undergraduate/courses/current/COMP3331.html)

Course Summary

This course is an introductory course on computer networks, aimed at students with a computer science / electrical engineering background. We will focus on common paradigms and protocols used in present data communication. Through lectures, in-class activities, labs and assignments, you will learn the theory and application of:

(1) Medium access control, congestion control, flow control, and reliable transmission,

(2) Addressing and naming,

(3) Routing and switching,

(4) Widely used protocols such as Ethernet, IP, TCP, UDP, HTTP, etc.

(5) Security threats and common defensive techniques, and

(6) Special-purpose networks such as content delivery networks, peer-to-peer networks and wireless networks.

This is a combined undergraduate and postgraduate course.

Course Timetable

There will be 4 hours of lectures every week:

(i) 2-hour lecture on Monday 09:00 - 11:00 and

(ii) 2-hour lecture on Wednesday 12:00 - 14:00

We plan to run live online lectures through Zoom with the opportunity to ask questions via chat. Recording of all lectures will be made available. Links for the Zoom meetings will be posted on the Lectures page.

There will be 2-hour labs during 8 weeks (starting in Week 2). The detailed lab schedule will be posted on The detailed course timetable is available here (https://webcms3.cse.unsw.edu.au/COMP3331/21T3/timetable) (/COMP3331/19T2/timetable) (/COMP3331/19T2/timetable) (/COMP3331/19T2

(/COMP3331/19T2/timetable) (/COMP3331/19T2/timetable) (/COMP3331/19T2/timetable) (/COMP3331/19T2/timetable)

Student Learning Outcomes

After completing this course, students will:

- Have a working knowledge of computer networks, and will be able to demonstrate by describing aspects of the topics and by solving problems related to the topics
- Have a solid understanding of the current architecture of the Internet and the entities involved in its operations
- Be able to identify soundness or potential flaws in proposed protocols
- Be equipped with the necessary skills to design networked applications and protocols
- Implement and write protocols and applications in C, Java or Python
- Analyze and evaluate the performance of computer networks
- Be able to capture and network traffic
- Be able to understand and explain security and ethical issues in computer networking

This course contributes to the development of the following graduate capabilities:

Graduate Capability	Acquired in
Scholarship: of their discipline in its interdisciplinary context	Lectures, labs, assignment
Scholarship: Capable of independent and collaborative	Labs, assignment
Scholarship: rigorous in their analysis, critique, and reflection	Lectures, labs, exams, sample problems
Scholarship: able to apply their knowledge and skills to solving problems	Labs, assignment, exams, sample problems
Scholarship: capable of effective communication	Labs, assignment, lectures, exams
Scholarship: digitally literate	All aspects of the course
Scholarship: information literate	All aspects of the course
Leadership: collaborative team workers	Labs, assignment
Professionalism: capable of independent, self-directed practice	All aspects of the course
Professionalism: capable of lifelong learning	All aspects of the course
Professionalism: capable of operating within an agreed Code of Practice	Labs, assignment
Global citizens: culturally aware and capable of respecting diversity and acting in socially /responsible ways	Labs, course forums

Assumed Knowledge

Before commencing this course, students should:

- **Have a good understanding of data structures and algorithms, basic probability theory.**
- **Be able to write working programs in C, Java or Python. The course will include a programming assignment and lab exercises.**

Teaching Rationale

This course takes a top-down approach to teach computer networks. The rationale behind this is that most students have first-hand experience using applications running over the Internet. This allows them to relate to each layer of the stack as we travel down the layers. Once they are committed, they participate in appropriate cognitive aspects such as learning the details with a focus to understand them. Students get mentally prepared to answer questions. Very often there is no single answer or the answers can be unexpected. This results in deep learning and gives students a sense of accomplishment and confidence.

Learning will be largely facilitated through the delivery of lectures. The hands-on laboratories will provide an opportunity to gain a deeper understanding of the concepts discussed in the lectures. The sample problems, homework problem set, and tutorials will help develop problem-solving skills and prepare for the exams. The programming assignments are mainly geared to allow students to gain familiarity with basic network programming and designing network protocols.

Teaching Strategies

- **Lectures:** introduce theory demonstrate how they apply in practice
- **Lab Work:** reinforce concepts taught in lectures by conducting hands-on experiments and network performance
- **Assignment:** allow students to design and implement network evaluate network performance
- **Homework Problems:** allow students to solve problems based on content from lectures, develop problem-solving skills, assist with exam preparation
- **Consultations, Tutorials and Course Forum:** allow students an opportunity to ask questions and seek help.

Assessment

There will be four assessment components as listed below:

Component	Weight
Lab Exercises	20%
Programming Assignment	20%
Mid-term Test	20%
Final Exam	40%

To pass the course a student MUST receive at least 40% marks in the final exam. The following formula outlines precisely how the final mark will be computed:

```
lab = marks for lab exercises (scaled to 20)
assign = marks for the programming assignment (out of 20 marks)
midTerm = mark for the mid-term exam (out of 20 marks)
finalExamScaled = scaled mark for the final exam (out of 40 marks)
mark = lab + assign + midTerm + finalExamScaled
grade = HD|DN|CR|PS if mark >= 50 && finalExamScaled >= 16
      = FL          if mark < 50
<p>      = UF          finalExamScaled < 16</p>
```

In this course, the final and mid-term exams will be using the **Inspera platform** which you will get access to from a link in the course Moodle site. More information for students about Inspera can be found here: https://unsw.sharepoint.com/sites/Assessment-Platform-Pilot (https://unsw.sharepoint.com/sites/Assessment-Platform-Pilot) .
Plagiarism is defined as (https://student.unsw.edu.au/what-plagiarism) *using the words or ideas of others and presenting them as your own* UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Plagiarism and Academic Integrity (https://student.unsw.edu.au/plagiarism)
- Student Code Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)
- Student Misconduct Procedure (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- Plagiarism Policy (https://www.gs.unsw.edu.au/policy/documents/plagiarismpolicy.pdf)
- UNSW Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)
- Essential Advice for CSE students (https://www.engineering.unsw.edu.au/computer-science-engineering/about-us/organisational-structure/student-services/policies/essential-advice-for-cse-students)

Make sure that you read and understand the above. Ignorance is not accepted as an excuse for plagiarism. In particular, you are responsible for securely storing your assignment files such that they are not accessible by anyone but you by setting proper permissions on your CSE home directory and/or on online code repositories. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

Course Schedule

The following table lists the tentative weekly schedule. Students will be informed of any changes during the lecture and by announcements on the notices page.

Week	Lecture Dates	Lecture Topics	Labs	Assessment Tasks
1	13 & 15 Sept	Course Logistics Introduction: • What is the Internet? • Network edge and core • Performance of networks Introduction: • Layering and Encapsulation	Self-Study of Lab resources and tools (no submission and no marks)	
2	20 & 22 Sept	Application Layer: • Principles of networked applications • The Web & HTTP • Email • Domain Name Service (DNS) • Peer-to-Peer	Lab 1	Lab 1 submission deadline: 10:00 Tue 28 Sept

		Networks and DHT		
3	27 & 29 Sept	Application Layer: • Content Distribution Networks • Socket Programming Transport Layer: • Transport services	Lab 2	Lab 2 submission deadline: 10:00 Tue 5 Oct **Assignment Specs Released (Expected)**
4	4 & 6 Oct NOTE: 4th Oct is a **public holiday** . A recorded lecture will be available for viewing	Transport Layer: • Multiplexing & Demultiplexing • UDP • Principles of reliable data delivery • Pipelined Protocols	Lab 3	Lab 3 submission deadline: 10:00 Tue 12 Oct
5	11 & 13 Oct	Transport Layer: • TCP • Connection management & flow control • Congestion control • Fairness	Tutorial 1	
6	No lecture	No lecture	No Lab	No Lab
7	25 & 27 Oct	Network Layer, Data Plane: • Overview • IP	Lab 4	**Mid-term Test on 25th Oct during lecture hours** Lab 4 submission deadline: 10:00 Tue 2 Nov
8	1 & 3 Nov	Network Layer, Data Plane: • IP Addressing • NAT • IPv6	Lab 5	Lab 5 submission deadline: 10:00 Tue 9 Nov
9	8 & 10 Nov	Network Layer, Control Plane: • Routing algorithms • Link State and Distance Vector • Hierarchical routing • ICMP Link Layer: • Error detection	Lab 6	Lab 6 submission deadline: 10:00 Tue 16 Nov
10	15 & 17 Nov	Link Layer: • Multiple Access Protocols • Link Layer Addressing and ARP • Ethernet • Switches Wireless Networks	Tutorial 2	**Assignment Due**

		• Wireless characteristics • 802.11 • CSMA/CA A day in the life of a web request Network Security • Basic Cryptography • Message integrity & Digital signatures • Authentication	
Exam Period	26 Nov - 9 Dec	T3 Exams	**Final Exam**

Resources for Students

Course Textbook:

- Computer Networking - A Top-Down Approach Featuring the Internet, J. Kurose and K. Ross, Pearson, 7th Edition, 2017 (Sixth edition will suffice for most parts). UNSW Bookshop Links - Print Version (https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9781292153599) , E-book Version (https://unswbookshop.vitalsource.com/products/computer-networking-a-top-down-approach-global-james-kurose-v9781292153605)

Reference Texts:

- Unix Network 1 - Networking APIs: Sockets and XTI, W. Richard Stevens, Prentice Hall, Second Edition, 1998.
- Java Network Programming, E. R. Harold, O'Reilly, Third Edition, 2004.
- Learning Python, Mark Lutz, O'Reilly, Fifth Edition, 2013.
- Computer Networks: A Systems Approach, Larry Peterson and Bruce Davie, Morgan Kaufmann, Fifth Edition, 2011.
- Introduction to Computer Networks and Cybersecurity, John Wu and J. David Irwin, CRC Press, 2013.
- Computer Networks, Andrew Tanenbaum and David Wetherall, Fifth Edition, Pearson, 2010.

Links to additional reading material will be available on the lecture notes page.

Software:

For the labs, we will be using several Unix-based network utility programs. The purpose of these programs and information on how to use them will be provided in the lab handouts. We will also use a packet sniffing tool called Wireshark which has been widely deployed on CSE machines. In addition, we will also use Ns-2 a widely used network simulator for a few labs. Ns-2 is installed on the CSE lab machines. The simulator is written in C++. However, it uses OTcl (https://en.wikipedia.org/wiki/OTcl) as its command and configuration interface. In the lab exercises, we will use scripts written in OTcl. We will provide the necessary scripts for the lab exercises. You will be expected to run the scripts, make some changes in the scripts, and certain performance metrics. You will not be required to write C++ code. Detailed resources for all tools used will be made available on the lab exercises page.

The programming assignment is expected to be developed in **C, Java or Python** . Students are assumed to have sufficient expertise in one of these programming languages. Links to network programming resources in C, Java and Python will be available on the assignment page. Students will work on some simple client-server applications in two lab exercises which should be a useful starting point for the assignment.

Course Evaluation and Development

Student feedback on this course and the effectiveness of lectures in this course are obtained via the myExperience survey at the end of each term. Student feedback is taken seriously, and continual improvements are made to the course based in part on this feedback. Students are strongly encouraged to let the lecturer in charge know of any problems as soon as they arise. Suggestions and criticisms will be listened to openly, and every action will be taken to correct any issue or improve the students' learning experience. Some specific changes I will be incorporating this term based on the feedback I received in 2021 Term 2:

- Additional support for programming as it is not covered in lectures. We will arrange for some pre-recorded videos on programming.
- Provide more sample exam questions. I will make two sample exams available this term

Special Consideration

You can view the Special Consideration policy at the link here (https://student.unsw.edu.au/special-consideration) .
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