Course Outline Public

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Course Details

Course Code	COMP3331/9331
Course Title	Computer Networks and Applications
Units of Credit	6
Lecturer	Nadeem Ahmed
Admin	Ali Dorri
Classes	Lectures: Monday 1600 - 1800 Hrs, Wed 1300 -1500 Hrs CLB7 (Campus Map (https://student.unsw.edu.au/maps)) Timetable (/COMP3331/19T2/timetable) for all classes.
Consultations	Wednesday 1500 - 1700 Hrs Venue: CSE Consultation Room 403, Level 4
Course Website	https://webcms3.cse.unsw.edu.au/COMP3331/19T2 (https://webcms3.cse.unsw.edu.au/COMP3331/19T2)
Handbook Entry	http://www.handbook.unsw.edu.au/undergraduate/courses/current/COMP3331.html (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 background in computer science / electrical engineering. 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 16:00 - 18:00 and

(ii) 2-hour lecture on Wednesday 13:00 - 15:00

both in Central Lecture Block 7 (K-E19-104).

There will be 2-hour labs during 9 weeks (starting in Week 2). The detailed lab schedule will be posted on lab exercises page. The detailed course timetable is available here (/COMP3331/19T2/timetable) .

Course Aims

- To provide an in-depth introduction to a wide range of topics in the field of computer networks including the Internet.
- To get a hands-on understanding of the working of network protocols.
- To gain expertise in network programming, designing and implementing network protocols, evaluating network performance and problem-solving skills.
- To build the necessary foundational knowledge required in subsequent networking courses (COMP4335-4337, COMP9332-9337).

Student Learning Outcomes

After completing this course, students will:

- have a working knowledge of computer networks, and will be able to demonstrate their knowledge both 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
- analyse and evaluate the performance of computer networks
- be able to capture and analyse 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: understanding of their discipline in its interdisciplinary context	lectures, labs, assignment
scholarship: capable of independent and collaborative enquiry	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: information literate	all aspects of the course
scholarship: digitally 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 just/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 programming assignment and labs.**

Teaching Rationale

This course takes a top-down approach to teaching 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 protocol 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 where 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 deeper understanding of the concepts discussed in the lectures. The sample problems, homework problem set and tutorials will help in the development of problem-solving skills and in preparing 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 and concept and demonstrate how they apply in practice
- **Lab Work:** reinforce concepts taught in lectures by conducting hands-on experiments and analyse network performance

- **Assignment:** allow students to design and implement network protocols and 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 Exam	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
      = UF          finalExamScaled < 16
```

Academic Honesty and Plagiarism

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 on-line 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 these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are responsible for the safe-keeping of 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	3 & 5 June 2019	Course Logistics Introduction: • What is the Internet? • Network edge and core • Performance of networks	No Lab	
2	12 June 2019	Introduction: • Layering and Encapsulation Application Layer: • Principles of networked applications	Lab 1	
3	17 & 19 June 2019	Application Layer: • The Web & HTTP • Email • Domain Name Service (DNS)	Lab 2	Lab 1 and Lab 2 submission deadline: 12 noon 24th June 2019
4	24 & 26 June 2019	Application Layer: • Peer-to-Peer Networks and DHT • Content Distribution Networks • Socket Programming Transport Layer: • Transport services • Multiplexing & Demultiplexing • UDP • Principles of reliable data delivery	Lab 3	Lab 3 submission deadline: 12 noon 1st July 2019 **Assignment Released**
5	1 & 3 July 2019	Transport Layer: • Pipelined Protocols • TCP • Connection management & flow control	Tutorial 1 for Exam Prep	

Week	Lecture Dates	Lecture Topics	Labs	Assessment Tasks
6	8 & 10 July 2019	Transport Layer: • Congestion control • Fairness Network Layer, Data Plane: • Overview	Lab 4	**Mid-term Exam on 8th July 2019** Lab 4 submission deadline: 12 noon 15th July 2019
7	15 & 17 July 2019	Network Layer, Data Plane: • IP • Addressing • NAT • IPv6	Lab 5	Lab 5 submission deadline: 12 noon 22nd July 2019
8	22 & 24 July 2019	Network Layer, Control Plane: • Routing algorithms • Link State and Distance Vector • Hierarchical routing • ICMP Link Layer: • Error detection	Lab 6	Lab 6 submission deadline: 12 noon 29th July 2019
9	29 & 31 July 2019	Link Layer: • Multiple Access Protocols • Link Layer Addressing and ARP • Ethernet • Switches Wireless Networks • Wireless characteristics • 802.11 • CSMA/CA	Lab 7	Lab 7 submission deadline: 12 noon 5th August 2019
10	5 & 7 August 2019	A day in the life of a web request Network Security • Basic Cryptography • Message integrity & Digital signatures • Authentication	Tutorial 2 for Exam Prep	**Assignment Due**
11	12 August 2019	Revision/ Remedial Lecture if necessary		

Week	Lecture Dates	Lecture Topics	Labs	Assessment Tasks
Exam Period	16th August 2019 onwards	Exam Period		**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).

Reference Texts:

- Unix Network Programming Volume 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 (http://www.isi.edu/nsnam/ns/) , 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 some of the OTcl scripts for the lab exercises. You will be expected to run the scripts, make some changes in the scripts, and analyse 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.

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 in C, Java and Python will be available under the assignment link of the course webpage. Sample code demonstrating a simple client/server application will be supplied as a starting point for students.

Course Evaluation and Development

Student feedback on this course, and on the effectiveness of lectures in this course, is obtained via electronic survey (MyExperience) 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.

Special Consideration

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

UNSW handles special consideration requests centrally (in the Student Lifecycle division), so all special consideration requests must be submitted via the UNSW Special Consideration (https://iaro.online.unsw.edu.au/special_consideration/home.login) website. If your work in this course is affected by unforeseen adverse circumstances, you should apply for Special Consideration. Special consideration requests must be accompanied by documentation on how you have been affected, which will be verified by Student Lifecycle. Do not email the course convenor directly about special consideration. If your request is reasonable and your work has clearly been impacted, then

- for an assignment, you may be granted an extension
- for Mid Term Exam, you may be granted an opportunity to take the exam later
- for the Final Exam, you may be offered a Supplementary Exam

Note the use of the word "may". None of the above is guaranteed. It depends on you making a convincing case that the circumstances have clearly impacted your ability to work. Note that UNSW expects you to be available to sit Supplementary Exams, if required. If you are awarded a supplementary exam and do not attend, then your exam mark will be zero.

If you are registered with Disability Services, please forward your documentation to your Lecturer within the first two weeks of term.

Contacting LiC and Course Admin: No personal emails please.

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