UNSW Course Outline

COMP9334 Capacity Planning of Computer Systems and Networks - 2024

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General Course Information

Course Code : COMP9334
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Computer Science and Engineering
Delivery Mode : Multimodal
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate, Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

We live in a world that events do not happen instantly. It takes a certain amount of time to

download a video from a server to your own mobile device. It takes a certain amount of time for a computer to finish the execution of an algorithm. The time to completion (or response time in performance analysis terminology) is a performance metric that computer scientists and computer engineers should be concerned about because no one wants to wait unnecessarily. If you can understand the factors that determine the response time, then you can influence those factors so that the response time becomes acceptable. This course will take a mathematical modelling and analytical approach to understand response time in computer systems and networks. The primary goal is to explore how mathematical modelling and mathematical methods can be used to model, analyse and design computer systems and networks so that they have good performance. There are three major topics that will be covered by this course:

- Queuing analysis (Note: Queues are important because they give rise to waiting time.)
- Discrete event simulation
- Integer programming for network design

Course Aims

The time response of computer systems and networks is an important attribute of their performance measure. Students will learn about mathematical modelling and analysis of response time in computer systems and networks. These topics will be covered

- Modelling computer systems and networks to understand response time
- Analytical methods to determine response time
- Discrete event simulation
- Integer programming for network design

This is an elective course in the Networks majors in both undergraduate and postgraduate programs.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Use queueing networks to model computer systems
CLO2 : Use queueing theory to analyse the performance of computer systems
CLO3 : Develop discrete event simulation programs for computer systems and networks
CLO4 : Use statistical methods to analyse simulation data
CLO5 : Formulate integer programming optimisation problems for computer and network problems

Course Learning Outcomes	Assessment Item
CLO1 : Use queueing networks to model computer systems	• Assignment • Exam
CLO2 : Use queueing theory to analyse the performance of computer systems	• Assignment • Exam
CLO3 : Develop discrete event simulation programs for computer systems and networks	• Project • Exam
CLO4 : Use statistical methods to analyse simulation data	• Project • Exam
CLO5 : Formulate integer programming optimisation problems for computer and network problems	• Exam

Learning and Teaching Technologies

Moodle - Learning Management System | WebCMS3

Learning and Teaching in this course

Assumed Knowledge

Students are expected to have working knowledge in:

- Mathematical skills including: probability and statistics, calculus, linear algebra
- Basics overview of communications protocols; basic computer systems architecture;
- Programming

Teaching Rationale

Learning will be largely facilitated through the delivery of lectures. The sample problems and assignment will help in the development of problem-solving skills. The project will help the students to apply what they have learnt to solve problems.

Teaching Strategies

- The lectures are designed to facilitate learning and understanding of the important concepts within course syllabus focusing especially on the principles, concepts and methods behind the capacity planning of computer systems and networks. Lecture notes will be available at the course web site for download before the lecture.
- A number of sample problems will be issued each week. These sample problems give the students a chance to test whether they have understood the concepts introduced in the lectures. Solutions to all sample problems will be published on the course web site.

Student learning strategy

In order for students to do well, they need to demonstrate that they are able to solve problems that they have not encountered before. Their learning should be focused on understanding the course materials and the mathematical reasoning behind the methods discussed in the lectures. They should attempt the weekly sample problems in order to train their problem solving skills.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Assignment Assessment Format: Individual	20%	Due Date: 15/03/2024 05:00 PM
Project Assessment Format: Individual	30%	Due Date: 19/04/2024 05:00 PM
Exam Assessment Format: Individual	50%	Due Date: during Exam Period

Assessment Details

Assignment

Assessment Overview

The assignment tests the students' ability to use queueing theory to analyse computing systems. The students are given about 3 weeks to complete the assignment. The assignment will be marked according to the correctness. Marks and comments will be provided to the students after the assignment has been marked.

Course Learning Outcomes

- CLO1 : Use queueing networks to model computer systems
- CLO2 : Use queueing theory to analyse the performance of computer systems

Project

Assessment Overview

The project is an assessment on the discrete event simulation part of the course. The students are asked to develop a discrete event simulation program to evaluate the performance of a computer system and to use the data generated by the program to analyse the computer system in a statistically sound manner. The students are given about 5 weeks to complete the project. The project will be marked according to a set of marking criteria which will be provided to the students in the project specification. Marks and comments will be provided to the students after the project has been marked.

Course Learning Outcomes

- CLO3 : Develop discrete event simulation programs for computer systems and networks
- CLO4 : Use statistical methods to analyse simulation data

Exam

Assessment Overview

The final exam is of 2 hours in duration. The students will be evaluated on the correctness of their answers to exam questions.

Course Learning Outcomes

- CLO1 : Use queueing networks to model computer systems
- CLO2 : Use queueing theory to analyse the performance of computer systems
- CLO3 : Develop discrete event simulation programs for computer systems and networks
- CLO4 : Use statistical methods to analyse simulation data
- CLO5 : Formulate integer programming optimisation problems for computer and network problems

Detailed Assessment Description

The final exam is an in-person invigilated exam which will take place in the exam period for Term 1.

General Assessment Information

The overall mark for the course is given by the arithmethic mean of the three assessment components: Assignment (20%), Project (30%) and Exam (50%).

Grading Basis

Standard

Requirements to pass course

A student is required to achieve an overall mark of 50 or more to pass this course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	Introduction to capacity planning Queueing Models, Basic operational analysis
Week 2 : 19 February - 25 February	Lecture	Advanced operational analysis. Workload characterisation Single server queues with Poisson Arrival
Week 3 : 26 February - 3 March	Lecture	Multi-server queues with Poisson Arrival. Markov model (1) Markov chain
Week 4 : 4 March - 10 March	Lecture	Non-Markovian queues. Processor sharing. Discrete event simulation (1): Organising discrete event simulation Priority queues.
Week 5 : 11 March - 17 March	Lecture	Discrete event simulation (2): Analysing simulation data Discrete event simulation (3): Comparing two systems Discrete event simulation (4): Generating random numbers
Week 6 : 18 March - 24 March	Lecture	Flexibility Week. No lectures
Week 7 : 25 March - 31 March	Lecture	Queueing disciplines. Queueing applications Mean value analysis
Week 8 : 1 April - 7 April	Lecture	Fork-join queues Optimisation and network planning (1): Linear Programming
Week 9 : 8 April - 14 April	Lecture	Optimisation and network planning (2): Integer Programming Optimisation and network planning (3): Network flow
Week 10 : 15 April - 21 April	Lecture	Optimisation and network planning (4): Placement problem Optimisation and network planning (5). Revision

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

The following table lists the **tentative** schedule. Students will be informed of any changes during the lecture and by announcements on the notice page on WebCMS3.

Course Resources

Prescribed Resources

The course materials will be available at the WebCMS3 site of the course.

Lecture recordings will be available via the course Moodle site.

Recommended Resources

The WebCMS3 site contains a list of reference books which are useful for this course.

Course Evaluation and Development

This course is evaluated each session using the myExperience survey. Based on the feedback from 23T1, improvements will be made in the formulation of marking criteria and marks distribution for the project. Improvements will also be made on the course contents.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Chun Tung Chou					Yes	Yes

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable

Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures

can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School Contact Information

CSE Help! - on the Ground Floor of K17

- For assistance with coursework assessments.

The Nucleus Student Hub - https://nucleus.unsw.edu.au/en/contact-us

- Course enrolment queries.

Grievance Officer - grievance-officer@cse.unsw.edu.au

- If the course convenor gives an inadequate response to a query or when the course convenor does not respond to a query about assessment.

Student Reps - stureps@cse.unsw.edu.au

- If some aspect of a course needs urgent improvement. (e.g. Nobody responding to forum queries, cannot understand the lecturer)