

<https://courseoutline.auckland.ac.nz/dco/course/COMPSCI/335/1205>

COMPSCI 335 : Functional Programming and Distributed Services

Science

2020 Semester Two (1205) (15 POINTS)

Course Prescription

Covers functional programming concepts, with applications to data integration from heterogeneous and asynchronous collections. Building web and cloud clients and services, with emphasis on high-level declarative and functional techniques. Dynamic web applications. Security and performance as overarching factors of web application development.

Course Overview

This course is for students seeking to:

1. build the ability to design and create complex real-world web applications;
2. gain an appreciation of secure web application development;
3. extend their design space with another programming paradigm, functional programming concepts and techniques;
4. learn modern ways to integrate data from local and remote sources, using multi-paradigm techniques.

The required preparation mentions 15 points from COMPSCI 230 and 15 points from another COMPSCI stage 2 courses. COMPSCI 230 is needed because it introduces a complementary paradigm, object-oriented programming, and for its more general software development skills. For the other COMPSCI stage 2 course, we highly recommend COMPSCI 215, for its background in networking, and/or COMPSCI 225, for developing good abstraction capabilities (not for its actual contents).

For illustrations and practical work, this course mostly uses browser applications, HTML, CSS, Javascript, and C# as available in .NET Core; occasionally, concepts will also be illustrated in other languages, such as Python or F#.

Upon successful completion of this course, you will be prepared to take postgraduate courses such as COMPSCI 711, 732, and 734. This course also helps you with a number of fundamental development techniques and practices, so that you can be industry-ready and future-proof your career in the context of modern multi-paradigm languages.

Course Requirements

Prerequisite: COMPSI 230 and 15 points at Stage II in Computer Science

Capabilities Developed in this Course

- Capability 1: Disciplinary Knowledge and Practice
- Capability 2: Critical Thinking
- Capability 3: Solution Seeking
- Capability 4: Communication and Engagement
- Capability 5: Independence and Integrity
- Capability 6: Social and Environmental Responsibilities

Graduate Profile: [Bachelor of Science](#)

Learning Outcomes

By the end of this course, students will be able to:

1. Develop and demonstrate the building blocks of web development (Capability 1 and 2)
2. Demonstrate the ability to create complex real-world web applications (Capability 2, 3, 4, 5 and 6)
3. Demonstrate an appreciation of secure web application development (Capability 1, 2 and 3)
4. Demonstrate an appreciation of performance in the context of web application development (Capability 1, 2 and 3)
5. Explain and evaluate the design and development of web applications
6. Explain and apply fundamental functional concepts (Capability 1, 2 and 3)
7. Demonstrate and apply high-level operations on aggregates, including high-order functions that take and return functions (Capability 1, 2 and 3)
8. Explain and demonstrate dynamic code generation, code compilation and reflection, in the context of distributed applications (Capability 1, 2 and 3)
9. Describe and discuss lazy evaluation and infinite streams (Capability 1, 2 and 3)
10. Explain and illustrate how a computationally complete system can be defined solely in terms of anonymous functions (lambdas) (Capability 1, 2, 3 and 4)

Assessments

Assessment Type	Percentage	Classification
Assignments	50%	Individual Coursework
Quizzes	20%	Individual Coursework
Reflection	5%	Individual Coursework
Final Exam	25%	Individual Examination

4 types

100%

Assessment Type	Learning Outcome Addressed									
	1	2	3	4	5	6	7	8	9	10
Assignments	✓	✓	✓			✓	✓	✓		
Quizzes	✓	✓	✓	✓						
Reflection	✓	✓	✓	✓	✓					
Final Exam						✓	✓	✓	✓	✓

Key Topics

- Building blocks of web development: HTML, CSS, and JavaScript
- Scalable vector graphics
- XML schema
- Secure web development
- Web application performance
- First-class and higher-order functions, pure functions, immutability, lambdas
- Continuations, closures, memoisation
- Web frameworks based on functional and declarative techniques
- Functional data integration from heterogeneous and asynchronous collections (LINQ)
- A programming introduction to lambda calculus

Learning Resources

Required reading for the course will be based on material freely available online. A reading list will be made available with lectures.

Main software development: .NET Core. Some parts of assignments may require access to Windows OS.

Special Requirements

Must attain a pass grade overall.

Workload Expectations

This course is a standard 15 point course and students are expected to spend 10 hours per week involved in each 15 point course that they are enrolled in.

For this course, you can expect 3 hours of lectures, a 1 hour tutorial, 1-6 hours of reading and reflection, and 1-6 hours of work on assignments and/or test preparation.

Digital Resources

Course materials are made available in a learning and collaboration tool called Canvas which also includes reading lists and lecture recordings (where available).

Please remember that the recording of any class on a personal device requires the permission of the instructor.

Copyright

The content and delivery of content in this course are protected by copyright. Material belonging to others may have been used in this course and copied by and solely for the educational purposes of the University under license.

You may copy the course content for the purposes of private study or research, but you may not upload onto any third party site, make a further copy or sell, alter or further reproduce or distribute any part of the course content to another person.

Academic Integrity

The University of Auckland will not tolerate cheating, or assisting others to cheat, and views cheating in coursework as a serious academic offence. The work that a student submits for grading must be the student's own work, reflecting their learning. Where work from other sources is used, it must be properly acknowledged and referenced. This requirement also applies to sources on the internet. A student's assessed work may be reviewed against online source material using computerised detection mechanisms.

Sharing assignment solutions and source code does not help learning. Consequently, our academic integrity policy does not permit sharing of solutions or source code leading to solutions, nor does it allow sourcing solutions or source code from any third party. Violation of this will result in your assignment submission attracting no marks, and you may face further disciplinary action. Therefore, please do not share assignments, assignment solutions and/or source code leading to assignment solutions, or use material from others in your assignments. You must not publish assignments or solutions in any form online at any time. You will be liable if someone copies your solution. There are also copyright and IP issues. Please come talk to us if you have any doubt over what is legitimate and what is not.

You can refer to online tutorials and resources. However, please learn from them and implement the solutions yourself based on what you learnt from those sources. Do not blindly copy from online sources. If there is a real need to copy some code snippet, please ensure (a) you understand what the code snippet does, and (b) cite the source in a comment directly above the snippet.

Don't leave your computers, devices, and belongings unattended – you must secure these at all times to prevent anyone having access to your assignments or solutions.

Inclusive Learning

All students are asked to discuss any impairment related requirements privately, face to face and/or in written form with the course coordinator, lecturer or tutor.

Student Disability Services also provides support for students with a wide range of impairments, both visible and invisible, to succeed and excel at the University. For more information and contact details, please visit the Student Disability Services' website at <http://disability.auckland.ac.nz>

Special Circumstances

If your ability to complete assessed coursework is affected by illness or other personal circumstances outside of your control, contact a member of teaching staff as soon as possible before the assessment is due.

If your personal circumstances significantly affect your performance, or preparation, for an exam or eligible written test, refer to the University's aegrotat or compassionate consideration page: <https://www.auckland.ac.nz/en/students/academic-information/exams-and-final-results/during-exams/aegrotat-and-compassionate-consideration.html>.

This should be done as soon as possible and no later than seven days after the affected test or exam date.

Student Feedback

During the course Class Representatives in each class can take feedback to the staff responsible for the course and staff-student consultative committees.

At the end of the course students will be invited to give feedback on the course and teaching through a tool called SET or Qualtrics. The lecturers and course co-ordinators will consider all feedback.

Your feedback helps to improve the course and its delivery for all students.

Student Charter and Responsibilities

The Student Charter assumes and acknowledges that students are active participants in the learning process and that they have responsibilities to the institution and the international community of scholars. The University expects that students will act at all times in a way that demonstrates respect for the rights of other students and staff so that the learning environment is both safe and productive. For further information visit Student Charter (<https://www.auckland.ac.nz/en/students/forms-policies-and-guidelines/student-policies-and-guidelines/student-charter.html>).

Disclaimer

Elements of this outline may be subject to change. The latest information about the course will be available for enrolled students in Canvas.

In this course you may be asked to submit your coursework assessments digitally. The University reserves the right to conduct scheduled tests and examinations for this course online or through the use of computers or

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other electronic devices. Where tests or examinations are conducted online remote invigilation arrangements may be used. The final decision on the completion mode for a test or examination, and remote invigilation arrangements where applicable, will be advised to students at least 10 days prior to the scheduled date of the assessment, or in the case of an examination when the examination timetable is published.