CS 558: Software Foundations
Fall 2021

Matthew R. Lakin

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1 COVID-19 syllabus language

1.1 UNM Administrative Mandate on Required Vaccinations

All students, staff, and instructors are required by UNM Administrative Mandate on Required Vaccinations to be fully vaccinated for COVID-19 as soon as possible, but no later than September 30, 2021, and must provide proof of vaccination or of a UNM validated limited exemption or exemption no later than September 30, 2021 to the UNM vaccination verification site. Students seeking medical exemption from the vaccination policy must submit a request to the UNM verification site for review by the UNM Accessibility Resource Center. Students seeking religious exemption from the vaccination policy must submit a request for reasonable accommodation to the UNM verification site for review by the Compliance, Ethics, and Equal Opportunity Office. For further information on the requirement and on limited exemptions and exemptions, see the UNM Administrative Mandate on Required Vaccinations.

1.1.1 UNM Requirement on Masking in Indoor Spaces

All students, staff, and instructors are required to wear face masks in indoor classes, labs, studios and meetings on UNM campuses, see masking requirement. Qualified music students must follow appropriate specific mask policies issued by the Chair of the Department of Music and the Dean of the College of Fine Arts. Students who do not wear a mask indoors on UNM campuses can expect to be asked to leave the classroom and to be dropped from a class if failure to wear a mask occurs more than once in that class. Students and employees who do not wear a mask in classrooms and other indoor public spaces on UNM campuses are subject to disciplinary actions. UNM will periodically evaluate and update the mask policy relative to public health conditions.

1.1.2 Communication on change in modality

The President and Provost of UNM may direct that classes move to remote delivery at any time to preserve the health and safety of the students, instructor and community. Please check your email and UNM Learn regularly for updates about our class and please check `https://bringbackthepack.unm.edu` regularly for general UNM updates about COVID-19 and the health of our community.

1.1.3 Acceptable masks and mask wearing in class

A two-layer mask that covers the nose and mouth and that is cleaned regularly is acceptable, as are disposable medical masks, KN95, KF94, FFP1 and FFP2 masks. A face shield is not sufficient protection. It is vital that you wear your mask correctly, covering your nose and mouth. Removing your mask for an extended period to eat or drink in class violates the university mask requirement and endangers others.

1.1.4 Consequences of not wearing a mask properly

If you dont wear a mask, or if you do not wear a mask properly by covering your nose and mouth, you will be asked to leave class. If you fail to wear a mask properly on more than one occasion, you can expect to be dropped from the class. If you insist on remaining in the classroom while not wearing a mask, class will be dismissed for the day to protect others and you will be dropped from the class immediately.

The instructor will try to have a few disposable masks available on a first-come, first-served basis.

2 Course information

2.1 Lectures

Lecture day/time: Tuesdays and Thursdays 11:00–12:15
Lecture location: Dane Smith Hall room 233

2.2 Instructor

Matthew Lakin
Email: `mlakin@cs.unm.edu`
Office hours: Tuesdays 3–5pm
Office hours location: Farris 3240

2.3 Course delivery

This class will be offered via the "Face to Face" modality. However, the instructor will also live-stream his screen from the class on Zoom and upload video of that live-stream to UNM Learn for subsequent viewing. There will also be a Zoom option to join office hours during the time outlined above. Note that the quality of this live-stream cannot be guaranteed; for the best experience you should attend class in person. See the course UNM Learn page for Zoom links.

Logistical details of midterm and final examinations will be decided closer to the time, but note that these may be required to be sat in person (excepting any accommodations administered by the ARC).

2.4 Course topics and format

This course studies the theory used to describe and define programming languages and to guide their implementation. Our approach is type-based, in the spirit of our textbook, Pierce's Types and Programming Languages (TAPL). As a prelude, the course offers a brief overview of functional programming techniques and of programming language features found in the purely functional programming language Haskell.

The course is intended for first-year graduate students, but advanced undergraduates are welcome as well. No specific courses are prerequisites, but programming experience and mathematical maturity are necessary. Experience with functional programming (at the level of UNM CS357) and discrete mathematics is strongly recommended.

The course will provide students with the background they need for CS550.

The course consists of lectures, homework assignments (primarily programming based), quizzes, two mid-term examinations, and a final examination.

2.5 Assignments

There will be two midterm exams, and a final exam covering the entire course. These may be administered on paper or via UNM Learn.

Programming-based homework assignments may be given: in the early part of the course these tasks will be drawn from the general domains of mathematics, science, and engineering, to practice programming skills; in the later part of the course the tasks will correspond to implementation of programming language theory. Short written homework assignments may be given to consolidate lecture material; they may take the form of short algebraic proofs of program fragment equivalence, or consideration of small language extensions. Homework assignments will be submitted via UNM Learn.

There will also be regular quizzes administered online via UNM Learn.

2.6 Textbook (optional)

- Benjamin C. Pierce, Types and Programming Languages, MIT Press, 2002, ISBN-10: 0262162091.

2.7 Grading

You are expected to attend class regularly, read any assigned reading before class, and participate in class discussion. The grade will be determined as follows:

- Homeworks: 40% total
- Exams: 50% (15% for each midterm, 20% for the final)
- Quizzes: 10%

Note that no requests for grade changes will be considered after the final day of classes. There will also be no extra credit assignments or "do-overs" for homeworks, exams, or quizzes.

2.8 Communication

The Loboweb email list functionality will be used for administrative announcements. Lecture notes and homework assignments will be uploaded to the UNM Learn page for the class.

3 Topics

The topics covered in class will be a subset of the following:

- Topics in functional programming
  - functional programming and Haskell
  - prelude types and classes
  - functions and list comprehensions; unit testing; literate programming; interactive programs
  - recursive and higher-order functions
  - declaring types and classes
  - lists in depth: map, filter, and their algebraic laws
  - lists in depth: foldr, scanr, and their algebraic laws
  - trees with folds, binary heap trees, rose trees
  - efficiency: accumulating parameters, tupling, fusion, and deforestation
  - modules and abstract data types
  - lazy evaluation and infinite data structures; approximation ordering; cyclic structures; streams
  - monads
  - metaprogramming in a functional programming language
- Topics in programming language semantics
  - syntax
  - operational semantics
  - simple imperative languages
  - lambda calculus syntax and reduction
  - programming in the lambda calculus
  - combinators and combinator reduction
  - types
  - simply typed lambda calculus
  - simple extensions (ascription; let-bindings; records; variants; recursion)

- references
- exceptions
- subtyping
- recursive types
- type reconstruction
- unification
- universal polymorphism
- program transformations

4 Credit-hour statement

This is a three credit-hour course. Class meets for two 75-minute sessions of direct instruction for fifteen weeks during the Fall 2021 semester. Students are expected to complete a minimum of six hours of out-of-class work (or homework, study, assignment completion, and class preparation) each week.

5 Academic integrity statement

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

All students will be required to sign and submit a warning regarding issues of academic integrity and possible sanctions prior to any submissions being graded.

6 Accommodation statement

In accordance with University Policy 2310 and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructors attention, as I am not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow. Contact Accessibility Resource Center at 277-3506 or arcsrvs@unm.edu for additional information.

UNM is committed to providing courses that are inclusive and accessible for all participants. As your instructor, it is my objective to facilitate an accessible classroom setting, in which students have full access

and opportunity. If you are experiencing physical or academic barriers, or concerns related to mental health, physical health and/or COVID-19, please consult with me after class, via email/phone or during office hours. You are also encouraged to contact Accessibility Resource Center at arcsrvs@unm.edu or by phone 277-3506.

7 Title IX statement

In an effort to meet obligations under Title IX, UNM faculty, Teaching Assistants, and Graduate Assistants are considered "responsible employees". This designation requires that any report of gender discrimination which includes sexual harassment, sexual misconduct and sexual violence made to a faculty member, TA, or GA must be reported to the Title IX Coordinator at the Office of Compliance, Ethics, and Equal Opportunity. For more information on the campus policy regarding sexual misconduct, see: https://policy.unm.edu/university-policies/2000/2740.html