

CSC447 Concepts of Programming Languages Syllabus

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September 12, 2025

OVERVIEW

In this course, we build our understanding of programming language concepts from the bottom up, starting with the most basic building blocks of programs (expressions and statements) up to high-level concepts (structs, objects), with a focus on functional programming as a language paradigm. All these concepts shape our way of thinking about programming languages as tools to solve problems through decomposition into more manageable pieces. The course discusses functional programming as an alternative way of thinking in expressing function contracts to establish trust in auto-generated and AI-generated code. To build an auxiliary understanding of the non-functional properties (e.g., security, performance, maintainability) of programs, along the way we also study programming languages in terms of their interaction with the underlying execution platform and hardware, especially how the resulting programs interact with memory.

Programming paradigms and language concepts discussed: functional programming; comparison of object-oriented languages; type systems for functional and object-oriented languages; runtime systems for functional and object-oriented languages. A variety of programming languages will be used to illustrate concepts, e.g., C, C++, Scheme, Scala, JavaScript, Ruby, Rust.

The course follows the schedule below in Table 1, and is also listed on the web page with links to worksheets and assignments here: <https://reed.cs.depaul.edu/efredericks/csc447/schedule.html>

INSTRUCTOR AND CLASSROOM INFORMATION

- **Instructor** Eric J. Fredericks
- **Classroom/Loop Office** CDM 228, CDM Building, 243 S. Wabash Avenue
- **Live Zoom Classroom**
<https://depaul.zoom.us/j/95278916901?pwd=X56kManvjiaditc8iXDr1mkMvdIWfH.1>
- **Zoom Office Hours Link**
<https://depaul.zoom.us/my/eric.fredericks>
- **Email** eric.fredericks@depaul.edu
- **Instructor Homepage**
<https://reed.cs.depaul.edu/efredericks>
- **Course Homepage**
<https://reed.cs.depaul.edu/efredericks/csc447/>
(for lectures slides, assignments, reading schedules, examples, learning outcomes)
- **LMS Homepage**
<https://d2l.depaul.edu>
(for grades, quizzes, homework submission, video recordings, announcements)
- **Discord Server**
<https://discord.gg/WSAx8KtEPU>
(for discussions, homework help, etc.)
- **Office Hours**
🕒 MON 7:30pm-8:15pm (Zoom) or WED 4:50pm-5:35pm (Classroom)
Please send me a message on Discord if you intend to come to office hours.

PREREQUISITES

If you are not sure that you have satisfied the prerequisites, speak to the instructor before the second lecture.

PREREQUISITE COURSES

- **Data Structures II** (CSC403)
- **Computer Systems I** (CSC406)

PREREQUISITE SKILLS

- You *must* have programmed with Java and C before this course.
- Integrated Development Environment (IDE) support is unavailable for many tools, so you should be familiar with use of the command line:
 - Command Prompt or Powershell on Windows
 - a shell on Linux / OS X such as `bash` or `zsh`

TEXTBOOKS

There are two required textbooks:

- *Concepts in Programming Languages* by Mitchell.
Published by Cambridge University Press.
<https://doi.org/10.1017/CB09780511804175>
The first few chapters are partly available in a [preview](#).
- *Programming in Scala: A Comprehensive Step-by-step Guide* by Odersky, Spoon, and Venners, 5th edition. Published by Artima Press.
<https://www.artima.com>.

This is available in paperback and/or as a PDF ebook (for purchase). If you wish to buy the PDF ebook or you want to buy the paperback and PDF ebook combo, visit the Artima Press website (see link above).

The first edition is available for free online, but covers an old version of Scala with different syntax: <https://www.artima.com/pins1ed/>

The DePaul University Library (<https://library.depaul.edu>) provides access to authoritative information sources, such as scholarly articles, journals, and books, primary sources, and research databases. Research help is available daily in-person and via chat, email, phone, or text. You may also make an appointment (in-person, phone, or Zoom) with a librarian to discuss your research projects.

COURSE SCHEDULE

This schedule is subject to change. Lecture materials may change after class.

Table 1: Tentative Course Schedule (CPL: Concepts in Programming Languages; PS: [Programming in Scala 5th ed.](#)); worksheets and assignments are linked at [Course Website](#)

Week	Date	Topic	Reading	Worksheets after: complete quiz in D2L	Assignments submit on D2L
1	WED SEP 10	Overview Scala Introduction Scala Classes Scala Pragmatics Contracts	CPL Ch 1 PS Chs 1,2,4	Scala	Assgnmt. 1 due SEP 18
2	WED SEP 17	Statements and Expressions Strict and Nonstrict Evaluation Formal Semantics Pattern Matching	CPL Ch 4 PS Ch 3,5,13	Java and C	Assgnmt. 2 due SEP 25
3	WED SEP 24	Functional Programming with Lists Methods and Functions	CPL Ch 3 PS Ch 7,14	Functional Programming	Assgnmt. 3 due OCT 02
4	WED OCT 01	Folds Static/Dynamic Types	CPL Ch 6 PS Ch 9,24	-	Assgnmt. 4 due OCT 09
5	WED OCT 08	Undefined Behavior & Safety Option Types	CPL Ch 6	-	Assgnmt. 5 due OCT 16
6	WED OCT 15	Loops and Recursion Tail Recursion Algebraic Data Types L-Values & Argument Passing Midterm Exam @ 5:45pm	CPL Ch 7 PS Chs 19	Algebraic Data Types Argument Passing	-
7	WED OCT 22	Scope and Lifetime Nested Classes Closures	CPL Ch 7 PS Ch 8	Runtime Storage Closures	Assgnmt. 6 due OCT 30
8	WED OCT 29	Dynamic Dispatch and Inheritance Delegation-based OOP	CPL Ch 10,13 PS Ch 10,11,20	OOP	Assgnmt. 7 due NOV 06
9	WED NOV 05	Parametric Polymorphism Subtyping	PS Ch 17,18	Subtyping	Assgnmt. 8 due NOV 13
10	WED NOV 12	Surprising Design Decisions Exam Review	-	JavaScript	-
11	WED NOV 19	Final Exam @ 5:45pm			

ASSESSMENT

The course grade will be based on:

Item	Weight
Worksheets (10 total)	5%
Quizzes (6 total)	15%
Homework assignments (8 total)	20%
Midterm Exam	25%
Final Exam	35%

- Worksheets provide guided instruction through simple problems, and should be completed before homework assignments and quizzes. Worksheet completion is self-reported, but may be audited by asking for a demonstration of the completed source code / work.
- Homework assignments must compile. Homework submissions with source code that does not compile with the build/test system will receive 0 points. Homework assignments must be programmed in Scala 3 (new syntax), submissions in Scala 2 will receive 0 points.
- The exams are multiple choice.
- The final exam is comprehensive, i.e., requires knowledge of the material covered in the entire course.
- To provide the same testing environment for in-class and Online Learning students, the instructor will not answer questions during the exams.

WEEKLY CHECKLIST

- Attend lecture (see D2L for recordings)
- Reading from textbooks (see Table 1 Course Schedule)
- Worksheet (see Table 1 Course Schedule)
- Worksheet confirmation quiz (this is just a checkbox in D2L)
- Homework submission (in D2L)
- Quiz (in D2L)

CHANGES TO SYLLABUS

This syllabus is subject to change as necessary during the quarter. If a change occurs, it will be thoroughly addressed during class or posted under Announcements in D2L.

ATTENDANCE

1. Students are expected to attend class or watch the online recording within 48 hours of the live class.
2. The midterm exam and final exam dates are posted on the schedule on the [course homepage](#). You must attend the midterm and final exams. There are no makeup exams. Business trips or vacations are not valid reasons for missing the exam. Please register for the exam as soon as possible.
3. **Lecture slides are a supplement to lectures only.** The slides are not intended to be read in lieu of listening to the lecture. Slides may change after the live class meeting.

HOMEWORK ASSIGNMENTS

1. Students must keep backup copies of all submitted homework.
2. Homework assignments will be distributed via the [course website](#) and submitted via D2L.
3. Students must only submit source code.
4. Submitted source code must compile correctly with the build/test system (or be parsed without error in the case of non-compiled languages). Homework submissions with source code that does not compile with the build/test system will receive 0 points. Homework assignments must be programmed in Scala 3 (new syntax), submissions in Scala 2 will receive 0 points.
5. Students must verify that homework has been submitted correctly. NOTE: the D2L interface requires confirmation of the homework submission after the file has been uploaded.
6. All deadlines are on D2L. **Late submissions will not be accepted**, except as outlined by policy on **Flex Days**, below. **Deadlines are not generally not individually negotiable.**

7. Homework submissions must be submitted online via D2L. **Email submissions will not be accepted at all.**
8. Submitted work must be worked on individually. You must not use or look at anyone else's solution, and you must clearly acknowledge any code that you obtain from other sources (such as books, magazines, the Internet, or AI-supported coding tools). If you are in any doubt, contact the instructor well before the submission date for advice. You may use as much code as you like (without acknowledgement) from the examples discussed in class. **Plagiarism will result in penalties up to and including failing the course.**

LATE WORK AND FLEX DAYS

1. Due dates for every homework and quiz are provided on D2L. Unless otherwise stated, assignments are due on those days. Homeworks must be submitted on D2L and emailed homework or project deliverables will not be accepted.
2. Every student is allotted up to two Flex Days that can be used to submit late homeworks and get extended time to take quizzes. I recognize that sometimes life happens. In these instances, you may use one of your allotted Flex Days. A Flex Day allows you to submit any homework and/or quiz due on a previous day up to one day late without penalty. You can use these days for any deadline (except for exams) and for any reason.
3. Flex Days apply to a deadline day. For example: if you use one Flex Day, both your homework and your quiz deadline will be extended to 24 hours after the original deadline, and you still have one more Flex Day you can use in the future. Note that you may not use more than one flex day for any given deadline day.
4. You do not need to provide me with the reason for using a Flex Day: simply send me a message on Discord or email me and tell me you are using a Flex Day. **Flex Days are not automatic. You must send me a message before the original Submission folder in D2L closes so I know you are using a Flex Day.** When submitting late homework when using a Flex Day, please make sure to submit it to the correct folder on D2L. Do not simply note in the submission that you are using a Flex Day. I do not always read those messages, so I may not see it.
5. Once you've exhausted your two flex days, late work will not be accepted.
6. **Late quizzes outside of the use of a flex day are not accepted.** Flex days cannot be used for quizzes you have already completed.
7. **Flex days cannot be used for exams.**

8. If you experience extenuating circumstances (e.g., family emergency, you are hospitalized) that prohibit you from completing your quizzes and homework, please contact me. You may be required to provide documentation substantiating your request. If your request pertains to a disability situation, you must work with the Center for Students with Disabilities, and I will consult with them when considering your request.

EXPECTATIONS

1. Several languages and tools will be used. Students are expected to learn these languages and tools without the level of guidance that would be available for 100 and 200 level classes.
2. The course requires that students actively engage the material on your own. Students should not only read the notes and example programs, but also do self-tests, modify code, and run it. As always, figure out what you can definitely code, code it, try it, and then consider extending the boundaries.
3. Students must keep up with the assigned textbook reading.
4. Students are strongly encouraged to ask questions and offer comments relevant to the day's topic.
5. All electronic interactions are an extension of the classroom and should be treated as such. While disagreement can be part of the discourse, online communication should remain respectful and appropriate rather than demeaning and/or unprofessional.
6. Classroom use of a laptop or tablet must normally be restricted to class-related tasks such as note taking, checking references, testing code examples, etc.

POLICIES II

RETRO-ACTIVE WITHDRAWAL

CDM understands certain extenuating circumstances can hinder one's ability for academic success and completion of course work. Please see <https://www.cdm.depaul.edu/Current%20Students/Pages/Enrollment-Policies.aspx> for additional information.

ABSENCE NOTIFICATIONS

In order to petition for an excused absence, students who miss class due to illness or significant personal circumstances should contact the professor. The professor reserves the sole right whether to offer an excused absence and/or academic accommodations for an excused absence.

ACADEMIC INTEGRITY AND PLAGIARISM

All students are expected to abide by the University's Academic Integrity Policy which prohibits cheating and other misconduct in student coursework. Publicly sharing or posting online any prior or current materials from this course (including exam questions or answers), is considered to be providing unauthorized assistance prohibited by the policy. Both students who share/post and students who access or use such materials are considered to be cheating under the Policy and will be subject to sanctions for violations of Academic Integrity.

More information can be found at <https://academicintegrity.depaul.edu/>. If you have any questions be sure to consult with your professor.

ACADEMIC POLICIES

All students are required to manage their class schedules each term in accordance with the deadlines for enrolling and withdrawing as indicated in the University Academic Calendar. Information on enrollment, withdrawal, grading and incompletes can be found at: <https://cdm.depaul.edu/enrollment>

INCOMPLETE GRADES

An incomplete grade is defined in the Student Handbook as follows (note that the policy in the undergraduate student handbook applies to both undergraduate and graduate students): A temporary grade indicating that the student has a satisfactory record in work completed, but for unusual or unforeseeable circumstances not encountered by other students in the class and acceptable to the instructor is prevented from completing the course requirements by the end of the term. Please see <https://www.cdm.depaul.edu/Current%20Students/Pages/Grading-Policies.aspx> for additional information.

STUDENTS WITH DISABILITIES

Students seeking disability-related accommodations are required to register with DePaul's Center for Students with Disabilities (CSD) enabling you to access accommo-

dations and support services to assist your success. The CSD loop campus location can be reached at:

- Lewis Center 1420, 25 East Jackson Blvd.
- Phone number: 312 362 8002
- Fax: 312 362 6544
- TTY: 773 325 7296

Students can also email the office at csd@depaul.edu Students who are registered with the Center for Students with Disabilities are also invited to contact me privately to discuss how I may assist in facilitating the accommodations you will use in this course. This is best done early in the term (preferably within the first week of class). Our conversation will remain confidential to the extent possible.

UNIVERSITY COUNSELING & PSYCHOLOGICAL SERVICES

[University Counseling & Psychological Services](#) (UCAPS) helps remove barriers to learning and support academic success by providing free, goal-focused, collaborative, short-term, confidential, individual, and group counseling services for DePaul's students. UCAPS has a diverse multi-disciplinary staff that includes licensed mental health professionals in psychology, counseling, and social work. Students¹ can talk to a therapist or schedule a brief screening and consultation appointment in the following ways:

- To speak directly to a therapist 24 hours a day, 7 days a week, students should call 773-325-CARE (2273) and Press "1" when prompted.
- To schedule a brief screening and consultation (BSC) appointment, students should call 773-325-CARE (2273) during regular business hours and Press "2" when prompted.
- Students can visit go.depaul.edu/ucaps and click the 'Schedule a Consultation' button to use online scheduling for a Brief Screening & Consultation (BSC) appointment. Online scheduling is available Monday through Friday from 8:00 am to 4:30 pm. All BSCs scheduled online are for phone appointments. To schedule an in-person or telehealth BSC, please call 773-325-CARE (2273) and Press "2" when prompted.

¹Services are provided based on student eligibility. For full eligibility details please visit go.depaul.edu/ucaps.

DEAN OF STUDENTS' OFFICE

The Dean of Students' Office (DOS) helps students navigate the university experience, particularly during difficulty situations such as personal, financial, medical, and/or family crises. For a list of support services and advocacy information, please visit <https://studentaffairs.depaul.edu/dos/>.

ONLINE COURSE EVALUATIONS

Evaluations are a way for students to provide valuable feedback regarding their instructor and the course. Detailed feedback will enable the instructor to continuously tailor teaching methods and course content to meet the learning goals of the course and the academic needs of the students. The evaluations are anonymous; the instructor and administration do not track who entered what responses. A program is used to check if the student completed the evaluations, but the evaluation is completely separate from the student's identity. Since 100% participation is our goal, students are sent periodic reminders over three weeks. Students do not receive reminders once they complete the evaluation. Students complete the evaluation online in CampusConnect.