Georgia State University — CSC 4330 / 6330

Course Syllabus for CSC 4330 / 6330: *Programming Language Concepts*

Fall 2023

Time

5:30pm–7:15pm on Mondays and Wednesdays

Room

Langdale Hall, Room 215

Instructor

Name: Murray Patterson
Email: mpatterson30@gsu.edu
Office: 1 Park Place, Room 948E
Zoom: `https://gsu-edu.zoom.us/my/mpatterson30`

Office Hours

- Fridays from 1pm–3pm in my office or via Webex (I will also be online during this time)
- After class: I will remain in the classroom
- By appointment: please discuss with me or send me an email to arrange a time

Teaching Assistants (TAs)

Name: Eunice Olorunshola
Email: eolorunshola1@student.gsu.edu

Name: Venkata Sri Apurva Dasari
Email: vdasari1@student.gsu.edu

Prerequisites

CSC 2720, CSC 3210 and CSC 3320 with a grade of C or better

Reference Materials

- Programming in Haskell, *2nd Edition*. Graham Hutton, Cambridge University Press, 2016.

ISBN-13: 978-1316626221

- Prolog Wikibook: `https://en.wikibooks.org/wiki/Prolog`
- Other online resources will be provided as the course proceeds

Course Content

Georgia State University iCollege — `https://icollege.gsu.edu`

Course Overview

Welcome to CSC 4330 / 6330 at Georgia State University! The objective of this course is to provide a better understanding of programming languages and their design. Various concepts and principles underlying the design and use of modern programming languages are considered, mainly functions and logic, but also regular languages (and regular expressions), grammars, parsing, and concurrency. Among other languages, we will take a detailed look into a pure functional programming language called *Haskell*, and a logic programming language called *Prolog*. The course will have a theoretical and mathematical nature, but will also involve a practical component, namely writing programs in the above two languages, among others.

Course Objectives and Student Learning Outcomes

The main objective of this course is to introduce the student to the fundamental concepts and principles underlying high level computer programming languages. This main objective will be approached from three different angles in the following "mini" objectives, which correspond to four modules in this course:

1. **Objective** (*Modules 1 & 2*): To achieve the main objective using a comparative approach: learning other high level computer programming languages based on other (less common) programming paradigms, namely functional (Haskell, *Module 1*) and logical (Prolog, *Module 2*).

   Learning Outcome: The student should be able to design and implement in Haskell and Prolog, a solution to a given computational problem.

2. **Objective** (*Module 3*): To achieve the main objective using a low level approach: moving to simpler languages (*e.g.*, regular languages) where the connection between the language and the corresponding model of computation is easier to grasp.

   Learning Outcome: The student should understand the connection between, *e.g.*, regular languages, and the corresponding model of computation, and be able to use, *e.g.*, regular expressions, to solve a given computational problem.

3. **Objective** (*Module 4*): To achieve the main objective by studying how a programming language can be extended (or generalized) to solve a more difficult computational problem: namely, handling concurrent processes.

   Learning Outcome: The student should understand how to model a concurrent process, both theoretically, but also using Java Threads, and how this interestingly connects back to the first objective (*e.g.*, what advantages does Prolog have in modeling concurrent processes?).

Course Structure

- **Lecture** — Classes will be conducted in a traditional lecture format.

- **Homework** — Weekly assignments will build on the lecture content of the week.
- **Readings** — Course textbook pages, relevant articles and additional supporting content will be assigned for students to read.
- **Discussions** — Opportunities to share questions about key concepts, homework assignments, and more.

Exams

There will be a midterm and a final exam in this course. The exams will involve questions, problems, or programming assignments which cover lectures, homework assignments, and readings.

Grade Scale

Grade	**Point Equivalent**
A+	≥ 97
A	≥ 90
B+	≥ 87
B	≥ 80
C+	≥ 77
C	≥ 70
D	≥ 60
F	< 60

Grading (*subject to change*)

- Homework Assignments (50%)
- Midterm Exam (25%)
- Final Exam (25%)

Course Schedule (*subject to change*)

	Topic	Reading	Homework*
	Module 1		
Week 1	Syllabus and Introduction	Ch. 1[†]	
Week 2	Haskell: First steps, types and classes	Ch. 2/3	HW 1
Week 3	Haskell: Defining functions and list comprehensions	Ch. 4/5	HW 2
Week 4	Haskell: Recursive functions and higher-order functions	Ch. 6/7	HW 3
	Module 2		
Week 5	Prolog: Introduction and rules	Wikibook[‡]	HW 4
Week 6	Prolog: Recursive rules and lists	Wikibook	HW 5
Week 7	Prolog: Variables and math	Wikibook	HW 6
Week 8	Review and **Midterm Exam**		
	Module 3		
Week 9	Regular languages and regular expressions	Slides[§]	HW 7
Week 10	Regular expressions in practice and context-free languages	Slides	HW 8
Week 11	Lexical analysis and parsing	Slides	HW 9
	Module 4		
Week 12	Threads and concurrency	Slides	HW 10
Week 13	Synchronization and interthread communication	Slides	
Week 14	Wrap-up and exam review		
Finals	Final Exam		

* Here, "Week" essentially means two consecutive class days (to allow a shift forward in the case of a holiday, for example), and homework will be assigned on the *second day* of this two-day series, and will be due at the beginning of class on the second day of the following "Week"

[†] Programming in Haskell, *2nd Edition*. Graham Hutton, Cambridge University Press, 2016.

[‡] Prolog Wikibook: `https://en.wikibooks.org/wiki/Prolog`

[§] Slides that will be provided as the course proceeds

Make-up Policy

Exams

There are no make-up exams unless the student missed the exam due to a pre-arranged excused absence *e.g.*, participation in a GSU sports event, observance of a religious holiday (see `https://belonging.gsu.edu/religious-observances/`), or an emergency, etc. In all cases, documentation needs to be provided before or after, *e.g.*, a note from the coach, a mention of the religious holiday, or a slip from the doctor, etc. — only official excuses will be accepted. **Any uncoordinated, unexcused missed exam will result in a score of zero for that exam**.

Homework

Each homework assignment is due at the beginning of class on the due date.

Academic Honesty Policy

In academics, intellectual property is extremely important. This is one reason we hold students to the tenets of the Academic Honesty Policy — other topics related to student conduct are available at

https://codeofconduct.gsu.edu/. But intellectual property goes beyond that when it comes to the materials created by your instructor and the publisher of your textbook. Your instructor has spent a great deal of time and energy developing materials for this course, and the publisher holds a copyright to all materials associated with the textbook. Please be aware that the GSU community takes this very seriously.

It is for this reason that GSU has a special policy regarding copyright, found at https://cetl.gsu.edu/services/instructional-support/constructing-a-syllabus/. This policy implies that the selling, sharing, publishing, presenting, or distributing of instructor-prepared course lecture notes, videos, audio recordings, or any other instructor-produced materials from any course for any commercial purpose is strictly prohibited unless explicit written permission is granted in advance by the course instructor (note that this includes homework assignments, labs, exams or their solutions). This includes posting any such materials on websites such as Chegg, Course Hero, OneClass, Stuvia, StuDocu and other similar sites, or using them as prompts in AI tools such as ChatGPT. Unauthorized sale or commercial distribution of such material is a violation of the instructor's intellectual property and the privacy rights of students attending the class, and is prohibited.

Sharing of any materials from the textbook, such as questions from publisher provided quizzes, is likewise prohibited.

Course Evaluations

Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take the time to fill out the online course evaluation.

Extended Absences

For students, the Dean of Students' Office will continue to provide faculty with notifications when students file **Professor Notification of Absences (PNAs)**. This notification indicates that the Dean of Students office has reviewed the documentation related to a student's medical circumstances. For more information about this, and how to submit such a notification, see https://deanofstudents.gsu.edu/student-assistance/#professor.

Students with Disabilities

Students who wish to request accommodation for a disability may do so by registering with the Access and Accommodation Center. Students may only be accommodated upon issuance by the Access and Accommodation Center of a signed **Accommodation Plan** and are responsible for providing a copy of that plan to instructors of all classes in which accommodations are sought.

Basic Needs Statement

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable us to provide resources that we may possess. The Embark program at GSU provides resources for students facing homelessness and Panther's Pantry provides resources for students facing food insecurity.

Disclaimer

The course syllabus provides a general plan for the course — deviations may be necessary.