**COURSE SYLLABUS**

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**YEAR COURSE OFFERED:** 2021

**SEMESTER COURSE OFFERED:** Spring

**DEPARTMENT:** Computer Science

**COURSE NUMBER:** COSC4315

**NAME OF COURSE:** Programming Languages and Paradigms

**NAME OF INSTRUCTOR:** Carlos Ordonez

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The information contained in this class syllabus is subject to change without notice. Students are expected to be aware of any additional course policies presented by the instructor during the course.

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**Learning Objectives**

Students will understand the theory and computer systems aspects to design and evaluate programming languages. Students will learn it is necessary to develop specialized programming languages and why one language cannot be a universal solution. The course will explain imperative (traditional), procedural (old), functional (theory) and object-oriented (dominating) approaches, with an emphasis on functional programming, and how they can interoperate. From a systems perspective, this course will explain compiler and interpreter phases including lexical, syntax analysis, data types and code generation. The course will make emphasis on which design and theory principles are essential on any language, but also which practical features have made some languages more successful than others (e.g. why C and C++ have survived).

**Major Assignments and Exams**

This is a course that gives more weight to programming homeworks. Grading is as follows:

- **70%**: 2 individual programming assignments, each in a different language. HW1 is 30% and HW2 40%. HW1: functional programming in either JavaScript or Python using lists and recursion, HW2: in C++ (including plain C) evaluating JavaScript or Python source code (a short program 10-20 lines). Each HW will be delivered in 2 phases and a score will be assigned based on test cases of varying difficulty and checking source code originality. There will be an opportunity for quick resubmission with 10%-20% penalty.
- **30%**: midterm exam. The exam will be open-everything (open book, Google OK, notes) and written (10 questions, short answers).
- Up to 6 points out of 100, towards final grade, based on participation.
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**Required Reading**

The following textbooks are recommended:


**List of lecture topics**

1. Taxonomy of languages
2. Data types (simple, data structures, inference, dynamic vs static, ADTs, pattern matching)
3. Programming: OO vs functional decomposition, assignment vs function calls
4. Recursion (types, functions, tail, fixed points, stack manipulation)
5. Evaluation (translation, macros, lazy, memoization, promises, exceptions, garbage collection)
6. Functional aspects (lambda calculus, closures, higher order functions, currying, mutation avoidance)
7. Contrasting procedures/functions with object-oriented aspects (classes, polymorphism, containers, multiple inheritance, subtyping, extensibility, templates)
8. Optional: Concurrent vs parallel programming (shared memory, distributed memory)
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Synchronous Online Course:

This course is being offered in the Synchronous Online format. Synchronous online class meetings will take place according to the class schedule. There is no face-to-face component to this course. In between synchronous class meetings, there may also be asynchronous activities to complete (e.g., discussion forums and assignments). This course may have a final exam per the University schedule. The exam would be delivered in the synchronous online format, and the specified date and time will be announced during the course. Prior to the exam, descriptive information, such as the number and types of exam questions, resources and collaborations that are allowed and disallowed in the process of completing the exam, and procedures to follow if connectivity or other resource obstacles are encountered during the exam period, may be provided.

Excused Absence Policy

Regular class attendance, participation, and engagement in coursework are important contributors to student success. Absences may be excused as provided in the University of Houston Undergraduate Excused Absence Policy and Graduate Excused Absence Policy for reasons including: medical illness of student or close relative, death of a close family member, legal or government proceeding that a student is obligated to attend, recognized professional and educational activities where the student is presenting, and University-sponsored activity or athletic competition. Additional policies address absences related to military service, religious holy days, pregnancy and related conditions, and disability.

Interim Undergraduate Grading Policy

Due to the unique and unprecedented challenges associated with the COVID-19 pandemic, the University of Houston has implemented an Interim Undergraduate Grade Policy for undergraduate grades which applies to all undergraduate students in courses offered in all sessions during fall 2020. Under this policy, students have the option of converting final assigned letter grades to S (Satisfactory, applicable to any letter grade from A to D-) or NCR (No Credit Reported COVID-19, applicable to grades of F) on their transcripts. Please visit FAQs for additional information.

Recording of Class

Students may not record all or part of class, livestream all or part of class, or make/distribute screen captures, without advanced written consent of the instructor. If you have or think you may have a disability such that you need to record class-related activities, please contact the Center for Students with DisABILITIES. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Classes may
be recorded by the instructor. Students may use instructor’s recordings for their own studying and notetaking. Instructor’s recordings are not authorized to be shared with anyone without the prior written approval of the instructor. Failure to comply with requirements regarding recordings will result in a disciplinary referral to the Dean of Students Office and may result in disciplinary action.

Syllabus Changes

Due to the changing nature of the COVID-19 pandemic, please note that the instructor may need to make modifications to the course syllabus and may do so at any time. Notice of such changes will be announced as quickly as possible through (specify how students will be notified of changes).

Webcams

Access to a webcam is recommended for students participating remotely in this course, but participation with other devices is acceptable (smartphone).