

# CMPSC 230 – Theory of Computation and Formal Languages

Fall 2016

## Course Instructor

Dr. Oliver Bonham-Carter

Classroom: Alden Hall 101

Office Location: Alden Hall 104

Office Phone: +1 814-332-2880

Email: [obonhamcarter@allegheny.edu](mailto:obonhamcarter@allegheny.edu)

Web Site: <http://www.cs.allegheny.edu/sites/obonhamcarter/>

Slack Team: [cs230Fall12016.slack.com](https://cs230Fall12016.slack.com)

## Instructor's Office Hours

- Monday, Wednesday *and* Friday: 11:00 am – 12:00 am (10 minute time slots)
- Tuesday: 2:30pm – 4pm (15 minute time slots)
- Thursday: 1:30pm – 3pm (15 minute time slots)

To schedule a meeting with me during my office hours, please visit my Web site and click the “Schedule” link in the top right-hand corner. Now, you can view my calendar or by clicking “schedule an appointment” link browse my office hours and schedule an appointment by clicking the correct link to reserve an open time slot.

## Course Meeting Schedule

Lecture, Discussion, Presentations, and Group Work:

Monday, Wednesday *and*, Friday 10:00 am – 10:50 am

## Academic Bulletin Description

An introduction to the theories of finite-state machines, pushdown automata, and Turing machines, as well as the relation between automata and the formal languages they recognize. Students explore computational theory and its practical applications in lexical analysis and language parsing. Prerequisites: Computer Science 112 and Mathematics 205, or permission of instructor. Offered in alternate years. Distribution Requirements: QR, SP.

## Course Objectives

- To learn the fundamentals of automata theory and formal language theory (as listed in the course description), both the concepts and the practical algorithms used.
- To examine the questions of decidability and “what things can be computed?” Study the Halting Problem as the primary example of an undecidable problem.
- To examine the P vs NP problem and NP-completeness. Know the formulations of several fundamental NP-complete problems.
- To learn basic applications of computer science: not just parsing and compiling, but also regular expressions in programming languages, modeling network protocols, and others.

## Required Textbooks

- *Introduction to the Theory of Computation*, Michael Sipser, 2nd or 3rd Edition.

## Teaching and Learning Methods

The main mode of learning in this class is reading the textbook and working assigned homework exercises. Students are responsible for reading assigned portions of the textbook, whether or not the topics are discussed in class. Lectures will provide explanation and emphasis for material and examples in the textbook. The instructor will ask questions to stimulate thinking and participation. Students' comments and questions are highly encouraged. Some Internet resources will also be used to supplement lectures and discussions.

## Class Policies

### Grading

The grade that a student receives in this class will be based on the following categories. All percentages are approximate and, if the need to do so presents itself, it is possible for the assigned percentages to change during the academic semester.

Class Participation	10%
First Quiz	5%
Second Quiz	5%
First Examination	15%
Second Examination	15%
Homework Assignments	30%
Final Project	20%

These grading categories have the following definitions:

- *Class Participation:* All students are required to actively participate during all of the class sessions. Your participation will take forms such as answering questions about the required reading assignments, completing in-class exercises, asking constructive questions of the other members of the class, giving presentations, and leading a discussion session in class and in the course's Slack channels.
- *First and Second Quizzes:* The quizzes are designed to permit the student to know whether he or she is ready for the exam. Although the exams will contain new material, the quizzes will contain some of the concepts which the student may expect to see on the exam. Poor scores on quizzes will alert the student to approach the subject material with more focus.
- *First and Second Examinations:* The first and second interim examinations will cover all of the material in their associated module(s). While the second examination is not cumulative, it will assume that a student has a basic understanding of the material that was the focus of the first examination. The date for the first and second examinations will be announced at least one week in advance of the scheduled date. Unless prior arrangements are made with the course instructor, all students will be expected to take these examinations on the scheduled date and complete the tests in the stated period of time.
- *Homework Assignments:* These assignments invite students to explore the concepts, tools, and techniques associated with the theoretical concepts behind computation. Unless specified otherwise, each assignment will be due at the beginning of class on the due date. Some of the assignments in this course will expect students to give a short presentation of a solution. Assignments involving presentations will be discussed in class.
- *Final Project:* This project will present you with the description of a problem and ask you to implement a full-featured solution using one or more programming languages and available tools. The final project in this class will require you to apply all of the knowledge and skills that you have accumulated during the course of the semester to solve a problem and, whenever possible, make your solution publicly available as a free and open-source tool. The project will invite you to draw upon both your problem solving skills and your knowledge of formal languages and theory of computation.

### Assignment Submission

All assignments will have a stated due date. The electronic version of the assignment is to be turned in at the beginning of the class on that due date with the Honor Code pledge of the student(s) completing the work which is embedded in the header of the code itself. Late assignments will be accepted for up to one week past the assigned due date with a 15% penalty. All late assignments must be submitted at the beginning of the session that is scheduled one week after the due date. Unless special arrangements are made

with the course instructor, no assignments will be accepted after the late deadline. For any assignment completed in a group, students must also turn in a one-page reflection that describes each group member's contribution to the submitted deliverables.

### Attendance

It is mandatory for all students to attend the class and laboratory sessions. If you will not be able to attend a session, then please see/email the course instructor at least one week in advance to describe your situation. Students who miss more than five unexcused classes, laboratory sessions, or group project meetings will have their final grade in the course reduced by one letter grade. Students who miss more than ten of the aforementioned events will automatically fail the course.

### Use of Laboratory Facilities

Throughout the semester, we will experiment with many different tools that computer scientists use for analyzing theoretical computational concepts. The course instructor and the department's systems administrator have invested a considerable amount of time to ensure that our laboratories support the completion of both the laboratory assignments and the final project. To this end, students are required to complete all assignments and the final project while using the department's laboratory facilities. The course instructor and the systems administrator will only be able to devote a limited amount of time to the configuration of a student's personal computer.

### Class Preparation

In order to minimize confusion and maximize learning, students must invest time to prepare for class discussions and lectures. During the class periods, the course instructor will often pose demanding questions that could require group discussion, the creation of a program or test suite, a vote on a thought-provoking issue, or a group presentation. Only students who have prepared for class by reading the assigned material and reviewing the current assignments will be able to effectively participate in these discussions. More importantly, only prepared students will be able to acquire the knowledge and skills that are needed to be successful in both this course and the field of data management. In order to help students remain organized and effectively prepare for classes, the course instructor will maintain a class schedule with reading assignments and presentation slides. During the class sessions students will also be required to download, use, and modify programs, diagrams, and data sets that are made available through the course Web site.

### Email

Using your Allegheny College email address, I will sometimes send out class announcements about matters such as assignment clarifications or changes in the schedule. It is your responsibility to check your email at least once a day and to ensure that you can

reliably send and receive emails. This class policy is based on the following statement in *The Compass*, the college's student handbook.

“The use of email is a primary method of communication on campus. . . . All students are provided with a campus email account and address while enrolled at Allegheny and are expected to check the account on a regular basis.”

### Disability Services

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. Students with disabilities who believe they may need accommodations in this class are encouraged to contact Disability Services at 332-2898. Disability Services is part of the Learning Commons and is located in Pelletier Library. Please do this as soon as possible to ensure that approved accommodations are implemented in a timely fashion.

### Honor Code

The Academic Honor Program that governs the entire academic program at Allegheny College is described in the Allegheny Course Catalogue. The Honor Program applies to all work that is submitted for academic credit or to meet non-credit requirements for graduation at Allegheny College. This includes all work assigned for this class (e.g., examinations, laboratory assignments, and the final project). All students who have enrolled in the College will work under the Honor Program. Each student who has matriculated at the College has acknowledged the following pledge:

I hereby recognize and pledge to fulfill my responsibilities, as defined in the Honor Code, and to maintain the integrity of both myself and the College community as a whole.

Additionally, we expect that you will adhere to the following Department Policy:

#### **Department of Computer Science Honor Code Policy**

It is recognized that an important part of the learning process in any course, and particularly in computer science, derives from thoughtful discussions with teachers, student assistants, and fellow students. Such dialogue is encouraged. However, it is necessary to distinguish carefully between the student who discusses the principles underlying a problem with others, and the student who produces assignments that are identical to, or merely variations on, someone else's work. It will therefore be understood that all assignments submitted to faculty of the Department of Computer Science are to be the original work of the student submitting the assignment, and should be signed in accordance with the provisions of the Honor Code. Appropriate action will be taken when assignments give evidence that they were derived from the work of others.