# Syllabus for COMP/MATH 314, Computability and Complexity

Spring 2021

Dickinson College

Instructor: John MacCormick

### Learning goals

* understand what types of computations can be performed in theory and in practice
* understand abstract computational models (such as Turing machines and finite automata), elementary notions of universality and undecidability, and their significance for practical computing
* understand elementary notions of complexity theory, including complexity classes P, EXP, NP, and the concept of NP-completeness
* [Writing in Discipline goal] increase mathematical maturity by making rigorous written mathematical arguments about computations

Teaching methods

* Required reading in advance of most lectures
* Lectures and class discussions
* Homework and exams to reinforce understanding of concepts

When and where

* Classes: Tuesday and Thursday 10:30–11:45am
  + Most or all class sessions will take place online via Zoom..
  + Some class sessions may take place in our physical classroom (Tome 231) with remote students also participating.
  + Real-time attendance and interaction are expected for all class sessions.
  + Classes will be recorded so that those who are genuinely unable to attend in real time are able to view the material.
* Office hours: see the instructor's [office hour webpage](http://users.dickinson.edu/~jmac/office-hours.html).

### Books

The following textbook is required

* *What Can Be Computed?: A Practical Guide to the Theory of Computation*, John MacCormick (2018).

Electronic or printed versions are equally suitable.

In addition, the following books provide useful content for those who are interested in additional background:

* Linz, *An Introduction to Formal Languages and Automata*
* Moore and Mertens, *The Nature of Computation*
* Sipser, *Introduction to the Theory of Computation*
* Lewis and Papadimitriou, *Elements of the Theory of Computation*
* Fortnow, *The Golden Ticket: P, NP, and the Search for the Impossible*

Please consult with the instructor for guidance on which parts of the above books would best suit your background reading goals.

### Assessment and grading

* Final grade will comprise:

|  |  |
| --- | --- |
| Homework assignments (about 10 x 4% each) | 40% |
| Midterm exams (2 x 15% each) | 30% |
| Final exam | 30% |

* **Homework assignments:** There will be approximately 10 homework assignments, due at the start of class on the dates specified on the class schedule. All homework assignments must be submitted electronically to Moodle. Any reasonable format may be used; in particular, digitized handwritten solutions are acceptable. ***Questions must be numbered very clearly, and they must be written in the same order as in the assignment. The objective is that the instructor can quickly and easily find any given question. Assignments without clear question numbers or with incorrectly ordered questions will be rejected.*** Only a random subset of homework questions will be graded for correctness; the remainder of questions will be graded on completeness only. The weighting of homework assignments is not equal. The weight of a homework assignment will be proportional to the total number of points of the questions graded on that assignment, plus a completeness component. In all cases, it is the responsibility of the student to consult the provided solutions and understand the correct approach to every question, whether or not it was graded. As explained on the course webpages, you can recover 50% of the points lost on any assignment by resubmitting a corrected version.
* **Midterm exams:** There will be two midterm exams, beginning in class on 3/11 and 4/27. Arrangements for these exams will be explained later.
* **Final exam:** The final exam will begin on May 13 at 2pm. Arrangements for this exam will be explained later.
* The midterm and final exams are open note and open web. Students may consult any printed or digital materials and may perform web searches. However, no communication with other humans is permitted.
* Final scores will be converted to grades according to the following thresholds (or possibly more generous thresholds): 93%=A; 90%=A-; 87%=B+; 83%=B; ...; 60%=D-.

### What will be on the exam?

Technically speaking, any material covered in any lecture, reading, or homework assignment is eligible to appear in the midterm or final exams. In practice, a strong majority of exam questions will be similar to a homework question, an example done in class, or other assigned practice questions.

### Amount of work

College policy recommends approximately 3 hours of independent work for every hour of class time. Our class meets for 2.5 hours per week. Therefore, you should expect to spend 7-9 hours per week (outside of class time) on this course.

### Plagiarism, copying, and collaborating

The College's standard policy on plagiarism applies and you should be familiar with it, but here are some key points that apply particularly to this course:

* All work must be your own.
* Never copy work from someone else or allow your own work to be copied.
* You may not copy or consult assignment solutions from any source, including online repositories or solutions provided for previous instances of the course. Exception: after submitting a given homework assignment, you may consult the solutions to that assignment provided for this instance of the course, after they have been posted to Moodle.
* If you use exact words taken from any source, you must use quotation marks and cite the source.
* Students are encouraged to help each other understand concepts, including concepts that apply to homework and programming assignments. However, all work must still be your own. So if you discuss a problem with someone, you must destroy any written or electronic material that results from the discussion, and re-create it later on your own.
* Be especially careful not to copy computer code from another student, or from the Internet (unless an assignment question specifically states that it is permitted—and even then, state the origin of any copied code clearly using a comment in your source code). Sharing or copying computer code is easy and often tempting, but it is not permitted and will suffer the same penalties as any other form of cheating.

### Accommodations

The instructor will follow college policy on [Accommodating Students with Disabilities](http://users.dickinson.edu/~jmac/accommodations.html).

Late Work Policy

Each student is permitted a total of four no-penalty days of lateness for submitted work over the entire semester; every subsequent day of lateness incurs up to a 25% penalty for the late assignment. Late days can be used only in whole day units. Accounting for late days is mostly via an honor system: students should keep count of their late day usage. To use one or more late days on a given assignment, state clearly at the start of your submission how many days you are using, and the total used so far in the semester.

Recording and posting of class content

All class meetings will be recorded, and the content will be made available only to members of the class. Do not share or repost class recordings or other content; doing so would be a breach of Dickinson’s [Community Standards](https://www.dickinson.edu/info/20273/dean_of_students/867/community_standards). Classes may also be recorded for accommodation purposes.