UNIVERSITY OF MIAMI
COLLEGE of ENGINEERING

# Computability, Complexity, and Algorithms - ECE 511

Syllabus and Schedule of Classes
Spring 2024 - Dr. Murrell

Credit and contact hours:

Prerequisite knowledge:

| | | | |
|---|---|---|---|
| Instructor: | Stephen Murrell | Term: | Spring 2024 |
| Teaching Assistant: | | | |
| Office: | EB 516 | Class Meeting Days and Time: | M, W: 5:05 - 6:20 |
| Office Hours: | Email me when you want me and we'll set up a convenient time. | Class Location: | MM 209 |
| E-Mail: | Instructor Email: s.murrell@miami.edu | | |

## Course Description & Objectives

Advanced programming techniques: dynamic programming, fast data retrieval and sorting, enumerators, data structures, and data management. The limits of software engineering, computability and models of computation, complexity analysis.

## Learning Objectives

By the end of this course, students will be able to:

1. Analyze complex problems and rationally plan and implement a software solution
2. Make effective use of known algorithms and data representations, and adapt and develop new ones as necessary
3. Understand the limitations on software designs and computational power.

## Diversity & Inclusion Statement

The College of Engineering embraces a notion of intellectual community enriched and enhanced by diversity along a number of dimensions, including race, ethnicity and national origins, gender

and gender identity, sexuality, class and religion. In order to create a learning environment for my students that supports a diversity of thoughts, perspectives and experiences:

- If you have a name and/or set of pronouns that differ from those that appear in your official UM records, please let me know!
- If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you. You can also notify me of the issue through another source such as your academic advisor, a trusted faculty member, or a peer. If for any reason you do not feel comfortable discussing the issue directly with me, I encourage you to seek out another, more comfortable avenue to address the issue.
- I (like many people) am still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to me about it.

## Required Texts, Materials, and/or Resources

Recommended text: Algorithms in C++ parts 1-5. Robert Sedgewick, Addison-Wesley, ISBN 020172684X, 2002

## Teaching Strategies

Traditional in-person lectures.

## Topical Course Outline

1. Dynamic programming
2. Essential NP complete problems and algorithms
3. Advanced and application specific sorting and searching
4. Essential graph algorithms
5. Heaps, AVL trees, red-black trees, hashing, enumerators
6. Efficient data storage and retrieval techniques
7. Countability, Non-enumerable data types, Uncomputable numbers
8. Integer decision functions, Uncomputable functions
9. The halting problem, Turing's thesis.

## Major Assignments & Projects

Will be announced as they are set. Details will be posted on-line.

## Grading/Evaluation

| Assessment | Percent of Final Grade |
|---|---|
| Attendance | 10% |
| Assignments | 45% |
| Mid-terms and final | 45% |
| Total | 100% |

## Grading Scale

Grades are somewhat curved, but as an approximate rule of thumb:
90 - 100 = A
75 - 89 = B
60 - 74 = C
50 - 59 = D
below 50 = F

## Course Policies: Coursework & Assignments

**Late Work Policy**: If, for some reason, you'll be unable to complete an assignment on time, let us know **before** the due date.

We're likely to be accommodating to any real troubles you're having,

but otherwise max late assignment grade = 0.9 to the power of (number of days late). For the first seven days after the due date, your maximum grade is calculated using that formula. After the first week, your maximum grade **will remain** at 0.9^7 (48%) for three days.

Ten days after the due date, late assignments will not be accepted for grading.

**Grades of "Incomplete"**: Are awarded only very rarely, and with a good reason.

**Group Work Policy**: Group work on assignments is permitted only when specifically announced.

## Course Policies: Technology & Media

**Email**: Occasionally, class related material will be communicated to you at your U.M. email address. The T.A.s and I monitor our emails, but not obsessively: allow a reasonable time for responses.

**Laptop Usage**: Acceptable.

**Classroom Devices**: Calculators are not allowed. Any other technology must be used unobtrusively.

## Course Policies: Student Expectations

**Attendance Policy**: You are required to attend, but allowance is made for emergencies.

**Phone Usage**: No phone use or web surfing during class. It is disruptive.

**Academic Ethics**: Academic dishonesty in any form will not be tolerated. The instructor of this course supports the University of Miami Honor Code. Cheating, plagiarism, or other forms of academic dishonesty in this course is subject to the provisions of the Honor Code.

## Resources

**Disability Access**: Students in need of academic accommodations for a disability may consult with Office of Disability Services (ODS) to arrange appropriate accommodations. Students are required to give reasonable notice prior to requesting an accommodation.

The Office of Disability Services (ODS) is located in the Camner Center for Academic Resources in Whitten University Center 2400. ODS staff can be reached at 305-284-2374 (Voice) or 305-284-1999 (Fax). Office hours are 8:30 am to 5:00 pm, Monday through Friday. Individuals may email the office staff for quick responses to questions.

**Sexual Misconduct/Sexual Harassment Reporting**: The University of Miami seeks to maintain a safe learning, living, and working environment free from all types of sex-based and gender-based discrimination prohibited by state and federal laws, including Title IX and Title VII, and in keeping with the University's culture of belonging, DIRECCT values and expected behaviors.

The University's ***Sexual Misconduct Policy*** applies to all members of the University community, including students, faculty, staff, and visitors. The procedures for investigation and adjudication of complaints is determined by the status of the individual who is alleged to have engaged in sexual misconduct ("Respondent").

**Free Tutoring at University of Miami**: On-campus tutoring and writing assistance is available for students at University of Miami. The Learning Commons supports learning at the University of Miami through the co-location, coordination and enhancement of existing academic services. The University of Miami Libraries' Learning Commons is the result of collaboration with campus partners including the Camner Center for Academic Resources, Academic Technologies, Writing Center, and Math Lab. To learn more at the Learning Commons, please visit the Richter Library, call 305-284-4722, or e-mail learningcommons@miami.edu.

**University Writing Center**: If needed, please provide information about the University's writing center.

## Important Dates to Remember

Add a short statement that describes that all the dates and assignments are tentative, and can be changed at the discretion of the professor.

**Drop/Add Deadline**: 31st January / 24th January

**Withdrawal Deadline (with a W)**: 12th April

**Final Examination**: Not yet released.

**Religious Observances**: All students have a right to expect that the University of Miami will reasonably accommodate their religious observances, practices and beliefs. If you observe religious holidays, you should plan your allowed absences to include those dates. Students are expected to notify their instructor **in advance** if they intend to miss class to observe a holy day of their religious faith.