

Course Information

Course Number: MATH 679

Course Title: Mathematical Algorithms and their Implementations

Section: 600

Time: (courses) T-Th 1:30 – 2:45 pm, (labs) F 12:40-13:40

Location: Online

Credit Hours: 3

Instructor Details

Instructor: Andrea Bonito

Office: Blocker 505C

E-Mail: bonito@math.tamu.edu

Office Hours: by appointment

TA: Matthew Hielsberg

E-Mail: hielsber@tamu.edu

Course Description

Mathematical theory and implementation with Python of modern algorithms; project based.

Course Prerequisites

None.

Course Learning Outcomes

The students will learn about several fundamental algorithms along with their analysis and implementation in Python. At the end of the class, the students will be able to design, analyze and implement in Python their own algorithms.

Textbook and/or Resource Materials

Lecture notes and Jupyter notebooks will be distributed.

Grading Policy

This is a project-based class. The final grade consists of the average of the project grades with the lowest one being dropped. Letter grades are given according to the following table.

A	B	C	D	F
$\geq 90\%$	80%-89%	70%-79%	60%-69%	$< 60\%$

If time permits, we will have oral presentations (by teams) of one project at the end of the class.

Late Work Policy

10% will be taken off on late work. Late work will not be accepted 2 weeks after the due date or the end of the semester, whichever comes first.

Course Schedule (subject to change)

- *Module 1*
 - (Course) Introduction to algorithms, dynamic programming.
 - (Python) Introduction, Calculator, Strings
 - (HW) Lists
- *Module 2*
 - (Course) Divide and Conquer, Computation Complexity
 - (Python) Control Flow, Functions
 - (Project) Quick Sort
- *Module 3*
 - (Course) Greedy Algorithms, local search
 - (Python) Name resolution, module and packages
 - (Project) Hanoi Tower
- *Module 4*
 - (Course) Randomized Algorithms
 - (Python) Tuples
 - (Project) Escape Rate for Brownian motion
- *Module 5*
 - (Course) Linear Programming
 - (Python) Sets, Dictionaries, Looping conditions and Comparisons
- *Module 6*
 - (Course) Semi-Definite Programming
 - (Python) Stack queues and comprehensions
 - (HW) Computing Euclidian metric Distortions
- *Module 7*
 - (Course) Nearest Neighbor
 - (Python) Numpy
 - (Project) Brute Force and kd-tree nearest neighbor

- *Module 8*
 - *(Course) Dimension Reduction*
 - *(Python) Scipy*
 - *(Project) Dimension reduction for nearest neighbor*
- *Module 9*
 - *(Course) Compressive Sensing*
 - *(Python) Pandas*
 - *(Project) Image Processing*
- *Module 10*
 - *(Course) Data Assimilation*
 - *(Project) Approximating the earth's average temperature from station data*
- *Module 11*
 - *(Course) Traveling Salesman problem*
 - *(Project) Visit strategic locations in College Station to warn about social distancing*
- *Module 12*
 - *(Course) Sparsest Cut*
 - *(Project) Sparsest Cut*

Preparation for the Course

The Jupyter notebooks will be given in advance. It is strongly recommended that the student go over them before they are discussed in class / lab.

Optional Course Information Items

The lecture notes and projects and due dates will be available on canvas (canvas.tamu.edu). The courses and labs will be given synchronously. Jupyter notebooks will be used for the Python instruction. It is recommended that you install anaconda on your personal device (see additional pdf document).

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to [Student Rule 7](#) in its entirety for information about excused absences, including definitions, and related documentation and timelines.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to [Student Rule 7](#) in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor” ([Student Rule 7, Section 7.4.1](#)).

“The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence” ([Student Rule 7, Section 7.4.2](#)).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See [Student Rule 24](#).)

Academic Integrity Statement and Policy

“An Aggie does not lie, cheat or steal, or tolerate those who do.”

“Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one’s work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case” ([Section 20.1.2.3, Student Rule 20](#)).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

NOTE: Faculty associated with the main campus in College Station should use this Academic Integrity Statement and Policy. Faculty not on the main campus should use the appropriate language and location at their site.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu. Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

NOTE: Faculty associated with the main campus in College Station should use this Americans with Disabilities Act Policy statement. Faculty not on the main campus should use the appropriate language and location at their site.

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](#)):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, you will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with [Counseling and Psychological Services](#) (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's [Title IX webpage](#).

NOTE: Faculty associated with the main campus in College Station should use this Title IX and Statement on Limits of Liability. Faculty not on the main campus should use the appropriate language and location at their site.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in proper self-care by utilizing the resources and services available from Counseling & Psychological Services (CAPS). Students who need someone to talk to can call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the National Suicide Prevention Hotline (800-273-8255) or at suicidepreventionlifeline.org.

COVID-19 Temporary Amendment to Minimum Syllabus Requirements

The Faculty Senate temporarily added the following statements to the minimum syllabus requirements in Fall 2020 as part of the university's COVID-19 response.

Campus Safety Measures

To promote public safety and protect students, faculty, and staff during the coronavirus pandemic, Texas A&M University has adopted policies and practices for the Fall 2020 academic term to limit virus transmission. Students must observe the following practices while participating in face-to-face courses and course-related activities (office hours, help sessions, transitioning to and between classes, study spaces, academic services, etc.):

- Self-monitoring—Students should follow CDC recommendations for self-monitoring. **Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction.**
- Face Coverings—[Face coverings](#) (cloth face covering, surgical mask, etc.) must be properly worn in all non-private spaces including classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource and support offices, and outdoor spaces where 6 feet of physical distancing is difficult to reliably maintain. Description of face coverings and additional guidance are provided in the [Face Covering policy](#) and [Frequently Asked Questions \(FAQ\)](#) available on the [Provost website](#).
- Physical Distancing—Physical distancing must be maintained between students, instructors, and others in course and course-related activities.
- Classroom Ingress/Egress—Students must follow marked pathways for entering and exiting classrooms and other teaching spaces. Leave classrooms promptly after course activities have concluded. Do not congregate in hallways and maintain 6-foot physical distancing when waiting to enter classrooms and other instructional spaces.
- To attend a face-to-face class, students must wear a face covering (or a face shield if they have an exemption letter). If a student refuses to wear a face covering, the instructor should ask the student to leave and join the class remotely. If the student does not leave the class, the faculty member should report that student to the [Student Conduct office](#) for sanctions. Additionally, the faculty member may choose to teach that day's class remotely for all students.

Personal Illness and Quarantine

Students required to quarantine must participate in courses and course-related activities remotely and **must not attend face-to-face course activities**. Students should notify their instructors of the quarantine requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities.

Students experiencing personal injury or illness that is too severe for the student to attend class qualify for an excused absence (See [Student Rule 7, Section 7.2.2](#).) To receive an excused absence, students must comply with the documentation and notification guidelines outlined in Student Rule 7. While Student Rule 7, Section 7.3.2.1, indicates a medical confirmation note from the student's medical provider is preferred, **for Fall 2020 only, students may use the Explanatory Statement for Absence from Class form in lieu of a medical confirmation. Students must submit the Explanatory Statement for Absence from Class within two business days after the last date of absence.**