

## SYLLABUS

**Instructor:** Dr. Sid Nadendla

**Email:** nadendla@mst.edu

### 1 Course Information

|  |   |
|--|---|
| <b>Course Website:</b>                         | <a href="https://sid-nadendla.github.io/teaching/SP2024_Alg/index.html">https://sid-nadendla.github.io/teaching/SP2024_Alg/index.html</a> |
| <b>Lecture venue and hours:</b>                | Comp Sci 120, T/Th 3:30-4:45 PM   |
| <b>Instructor:</b>                             | Dr. Venkata Sriram Siddhardh (Sid) Nadendla   |
| <b>Instructor's Office Hours and Location:</b> | Comp Sci 313, W 2:00PM - 3:00PM, or by appointment  |
| <b>Instructor's E-mail and Office Phone:</b>   | nadendla@mst.edu, (573) 341-4090  |
| <b>Graders:</b>                                | Grader 1, Grader 2, Grader 3  |
| <b>Graders' Office Hours:</b>                  | TBD   |
| <b>Grader Email:</b>                           | TBD   |

**Required Textbook:** Tim Roughgarden, *Algorithms Illuminated*, **Omnibus Edition**, Cambridge University Press, 2022. ISBN 978-0-9992829-8-4. (URL: <https://algorithmsilluminated.org/>)

### 2 Description

The goal of this course is to help undergraduate students become proficient in solving basic computational problems using algorithms. Students will develop the skill to analyze both correctness and efficiency (in terms of memory usage and runtime complexity) of diverse algorithms using asymptotic notation, recurrence relations, mathematical proof techniques and programming. Furthermore, students will gain expertise in a gamut of design techniques such as incremental algorithms, divide-and-conquer, dynamic programming and greedy algorithms. Both design and analysis skills are honed by exposing students to diverse problems such as integer multiplication, sorting and graph algorithms. This is a writing-intensive course, i.e. quality of technical writing will also be accounted in grading and assessment of homework assignments and exams.

### 3 Course Objectives

This course has the following five objectives:

- Be proficient in analyzing the correctness and run-time performance of a given algorithm,
- Be fluent in the following algorithm design paradigms: incremental design, recursion, divide and conquer, greedy algorithms, and dynamic programming.
- Be proficient in domain-specific technical writing/communication skills within the field of computer science, such as fluently writing algorithms using pseudocodes and flowcharts, articulating complexity analysis using asymptotic notation, and presenting design approaches in a clear and comprehensive manner.

- Be thoroughly knowledgeable with a collection of core algorithms (e.g. sorting, graph algorithms, Knapsack, job scheduling).
- Be familiar with complexity classes and reduction, P vs. NP, and some known intractable problems (e.g. traveling salesman problem)
- Be able to apply these techniques to real-world problems.

## 4 Intended Audience & Prerequisites

This course is aimed at undergraduate students in any science or engineering degree program who are proficient in a procedural programming language, have a solid understanding of data structures, and have a basic proficiency in calculus. If in doubt, contact the instructor! Python is the programming language adopted for this course; under extraordinary circumstances, students may obtain instructor's approval to adopt other programming languages. The prerequisites for this course are (i) "C" or better grade in both Comp Sci 1200 and Comp Sci 1575; (ii) preceded by "C" or better grade in either Math 1208 or Math 1214, or accompanied by either Math 1208 or Math 1214.

## 5 Tentative Schedule

| Topic                          | Subtopics   | # Lectures |
|--------------------------------|---|------------|
| T1: Foundations                | Asymptotic Notation, Divide-and-Conquer, Runtime Analysis | 5          |
| T2: Sorting                    | Insertion, Mergesort, Heapsort, Quicksort                 | 5          |
| <b>Exam 1</b>                  | Topics T1 and T2  | <b>1</b>   |
| T3: Graph Search               | BFS, DFS  | 3          |
| T4: Greedy Algorithms          | Huffman codes, Minimum Spanning Trees, Shortest Path      | 4          |
| <b>Exam 2</b>                  | Topics T3 and T4  | <b>1</b>   |
| T5: Dynamic Programming        | 0-1 Knapsack, Bellman-Ford, Floyd-Warshall                | 4          |
| T6: NP Completeness            | P vs. NP, Reducibility, Heuristics, Traveling Salesman    | 2          |
| T7: Special Topics (Tentative) | Linear Programming, Simplex Algorithm                     | 2          |
| <b>Final</b>                   |   | <b>1</b>   |

## 6 Grading Information

Grading will depend on student's performance across six homework assignments<sup>1</sup>, two midterm examinations and a final comprehensive exam. All the grades will be posted and maintained on Canvas. However,

<sup>1</sup>These topic-wise assignments could be further split into sub-assignments, if it helps students to better learn concepts.

the best five homework grades shall only be considered for the sake of calculating the final grade, as shown below:

|                           |  |
|---------------------------|--|
| <b>Assignments (5/6):</b> | 50% of total grade   |
| <b>Midterm Exams (2):</b> | 30% of total grade   |
| <b>Final Exam (1):</b>    | 20% of total grade   |
| <b>Final Grade:</b>       | [90 – 100]: A, [80 – 90): B, [70 – 80): C, [60 – 70): D, < 60: F |

## 7 Course Policies & Requirements

### 7.1 Required Materials and Homework Submissions

Students will submit all of their homework assignments via Gitlab, regarding which the instructor will discuss in the first class. Feedback will be uploaded back into the respective Gitlab folders privately, and the grades will be maintained on CANVAS. Late submissions will only be considered at the discretion of the instructor and the responsible teaching assistant/grader, only under valid circumstances. All other submissions will be disregarded and will be treated as a no submission.

In order for this plan to work successfully, students are mandated to have laptops, web cams, scanners<sup>2</sup> (if submitting a hand-written assignment), headsets, microphones, or other resources to learn effectively. Most of these items are available for checkout from the Service Desk in the library.

### 7.2 Lecture Format and Contingency Plans

All students are expected to attend the class lectures in-person. If the instructor has travel plans in the midst of the semester, alternative lecture arrangements (if any) will be communicated with the students well in advance. Any changes in the class schedule will be reported on the schedule page maintained on the course website.

All students are strongly encouraged to get vaccinated (and with a booster shot) against COVID-19 and Flu. If a student is unable to attend class in-person due to any illness, it is their responsibility to report their illness to Student Health Services (mstshs@mst.edu), 573-341-4284, to receive an absence note. The student should forward this absence note to the instructor so that appropriate arrangements can be made for the student to attend the class remotely.

## 8 Campus Policies and Resources

### 8.1 Artificial Intelligence

Unauthorized use of artificially generated content violates University Student Academic Standards without consent of the instructor. Although strongly discouraged, students are allowed to learn using ChatGPT and/or other generative AI systems only under the following condition. Assignments will be given credit only when students clearly compare the automatically generated content with their own work, in addition to citing the tool used, stating the specific input provided, and including the automatically generated content.

<sup>2</sup>There are several mobile applications available in different platforms that can use the camera in smart devices to scan documents.

## 8.2 Accessibility and Accommodations

It is the university's goal that learning experiences be as accessible as possible. Student Accessibility and Testing provides services and accommodations that facilitate full participation in Missouri S&T's learning experience for students with disabilities. If you anticipate or experience physical, academic, and/or digital barriers due to a disability, please contact Student Accessibility and Testing at (573) 341-6655, email [dss@mst.edu](mailto:dss@mst.edu), or visit <https://saat.mst.edu/> for information.

## 8.3 Student Veterans Resource Center

The Student Veterans Resource Center (SVRC) is the nexus of resources and support for student veterans at S&T. The SVRC provides student veterans with a "safe space" and a familiar atmosphere. The center's Veteran Consuls provide one-on-one consultations to guide students to various resources on campus, while its advisor provides students with VA health and benefits resources. Visit the SVRC at Harris Hall, Suite G10, and contact us at [svrc@mst.edu](mailto:svrc@mst.edu).

## 8.4 Statement about Copyright, FERPA, and Use of Video

It is vitally important that our classroom environment promote the respectful exchange of ideas. This entails being sensitive to the views and beliefs expressed during discussions, whether in class or online. Please obtain instructor permission before recording any class activity. It is a violation of University of Missouri policy to distribute such recordings without authorization and the permission of all who are recorded. More information is provided online at this link: <https://www.umsystem.edu/ums/elearning/policies>

## 8.5 Student Well-Being

**Link:** <https://wellbeing.mst.edu/>

Your well-being is important, and it contributes to your success in this course. At S&T, we provide resources to support your mental, physical, and social well-being. Any of us can experience challenges that make learning difficult. If you are struggling, take advantage of the following resources offered by the university: The Department of Student Well-Being provides counseling services, health promotion initiatives, and prevention programs to empower the S&T community to thrive and enhance personal, academic, and professional success. Department office hours are Monday-Friday, 8 a.m. – 5:00 p.m. On the website, you can find information related to confidential individual and group counseling, wellness consultations and trainings, resources for many health and wellness topics, and help for mental health crisis situations.

For the National Suicide Prevention Lifeline, call or text 988, or visit [missouri988.org](https://missouri988.org).

## 8.6 Student Support and Community Standards

**Link:** <https://studentsupport.mst.edu/>

Student Support and Community Standards is your "Google Maps" for support. During your time at S&T, you or a friend may need help navigating their student experience, facing a barrier, or experiencing a challenge. You are not alone!

Student Support has a dedicated team and numerous resources such as UCARE and the student emergency fund to help you navigate the S&T experience and support your success. This includes support to address

barriers related to academic, personal, emotional, medical, financial, or any other needs. All students can learn and grow from challenges or setbacks, they are stepping stones to success and we are here to help.

## 8.7 Student Veterans Resource Center

**Link:** <https://svrc.mst.edu/>

The Student Veterans Resource Center (SVRC) is the nexus of resources and support for student veterans at S&T. The SVRC provides student veterans with a “safe space” and a familiar atmosphere. The center’s Veteran Consuls provide one-on-one consultations to guide students to various resources on campus, while its advisor provides students with VA health and benefits resources. Visit the SVRC at Harris Hall, Suite G10, and contact us at [svrc@mst.edu](mailto:svrc@mst.edu).

## 8.8 Student Honor Code and Academic Integrity

- All students are expected to follow the Honor Code, which can be found at this link: <https://stuco.mst.edu/documents/honor-code/>
- Student Academic Regulations (Ref. <https://registrar.mst.edu/academicregs/conductofstudents/>) describes the student standard of conduct relative to the University of Missouri System’s Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism and sabotage, any of which will be reported to the Vice Provost for Undergraduate Education.
- Other resources for students regarding academic integrity can be found at <https://undergrad.mst.edu/academicintegrity/studentresources-ai/>

## 8.9 Health and Well-Being CANVAS Course

**Link:** <https://umsystem.instructure.com/enroll/G3LY3G>

The Health and Well-Being Canvas Course features trainings, presentations, and other health and well-being resources for students. The course is free for all students, is non-credit, and students can enroll at any point in the semester.

## 8.10 Nondiscrimination, Equity, and Title IX

Missouri S&T is committed to the safety and well-being of our campus community, and to creating an environment free from discrimination and harassment.

The University prohibits discrimination and harassment on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, and any other status protected by applicable state or federal law. As used in this policy, the word “sex” is also inclusive of the term “gender.”

Additionally, US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Sexual harassment violations of this law include quid pro quo, hostile environment, sexual assault, dating/domestic violence, and stalking. The U.S. Department of Education has stated the prohibition on discrimination on the basis of sex includes sexual orientation and gender identity.

Students who are experiencing pregnancy or pregnancy-related conditions, including the birthing parent and non-birthing parent, have rights protected under Title IX. Students should contact the Office of Equity and Title IX to learn more about their rights and pregnancy-related assistance/accommodations provided by the University to ensure equitable access to University educational programs and activities.

In accordance with the University of Missouri's Collected Rules and Regulations, all faculty and staff are required to report any information concerning discrimination disclosed through communication including, but not limited to, direct conversation, email, social media, classroom papers and homework exercises to the Equity Officer/Title IX Coordinator.

For more information regarding support for those that have been impacted or to report an incident of discrimination or harassment as defined by Chapter 600 of the University's Collected Rules and Regulations, visit the Office of Equity and Title IX or visit their website at [equity.mst.edu](http://equity.mst.edu).

**Office of Equity and Title IX:**

Equity Officer and Title IX Coordinator: Dr. Paul Hirtz

Phone: (573) 341-7734

Location: 900 Innovation Drive, Suite 500

E-mail: [equity@mst.edu](mailto:equity@mst.edu)

**8.11 Classroom Egress Maps**

For all in-person instruction, faculty should explain where the classroom emergency exits are located. Classroom egress maps are posted at <http://designconstruction.mst.edu/floorplan/>.