UNIVERSITY OF ILLINOIS SPRINGFIELD

# CSC 482: Algorithms and Computation

4 Credit hours

Online


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|---|---|
| **Instructor:** | Xiang Huang |
| **Email:** | xhuan5@uis.edu |
| **Zoom Link for office hour** | https://uis.zoom.us/j/4392296692?pwd=cGc0QjRyMFlJc2V2Zm50UzkzRTdjdz09 |
| **Personal Homepage** | xianghuang.org |


The syllabus is not a contract and may change at the instructor's discretion.

## Live Recording

We do not have an official class meeting time since this is an online course. ~~However, I will be recording Zoom course lectures every **Wednesday 10:00 – 11:40.** Zoom link available through Canvas/Zoom~~. **We will not have live recording this semester.**

While you are not required to join the recording, I hope at least some of you can show up, to make the recording more nature.

## Course Description

The course covers methods and techniques for designing efficient algorithms, analyzing their complexity and applying these algorithms to well-known practical problems and applications. Methods for recognizing and dealing with hard problems are studied. You are expected to spend a significant amount of time on the problems.

## Course Objectives

Upon completion of the course, students will:

- Be able analyze a problem and its solutions using asymptotic notations Big-O, Big-Omega, and Big-Theta

- Understand how to show proofs of completeness
- Have a set of algorithms to draw from for solving problems
- Identify problems with no known efficient solutions
- Be able to apply the algorithms described

## Prerequisites

CSC 385, CSC 302, MAT 113 or MAT 115, MAT 121

## Course Expectations

Students will use the internet to access the Canvas course site. The course has a modular structure, which is easily navigable. The course materials contain required readings, videos and other materials, and weekly discussion questions and projects.

By registering for this online course, students commit to self-motivated study, participation in online course activities, and the submission of all assignments on time. Furthermore, they commit to accessing the course Web site and checking email at least four times a week and to devoting at least as much time to this online course as to a comparable traditional class on campus. For example, for a three (3) credit hour course offered during a 16-week semester, students would have to commit a minimum of 9 hours per week on readings, class assignments, discussions, etc.

## UIS Academic Integrity Policy

I support the UIS policy on Academic Integrity, which states, in part: "Academic integrity is at the heart of the university's commitment to academic excellence. The UIS community strives to communicate and support clear standards of integrity, so that undergraduate and graduate students can internalize those standards and carry them forward in their personal and professional lives. Living a life with integrity prepares students to assume leadership roles in their communities as well as in their chosen profession. Alumni can be proud of their education and the larger society will benefit from the University's contribution to the development of ethical leaders. Violations of academic integrity demean the violator, degrade the learning process, deflate the meaning of grades, discredit the accomplishments of past and present students, and tarnish the reputation of the university for all its members."

Academic sanctions range from a warning to expulsion from the university, depending on the severity of your violation and your history of violations. Whatever the sanction, I will file a report of academic dishonesty to the Office of the Provost.

You are responsible for understanding and complying with the UIS Academic Integrity Policy available at http://www.uis.edu/academicintegrity .

Academic dishonesty in an online learning environment may include the following scenarios:

- Having a tutor or friend complete a portion of your assignments
- Having a reviewer make extensive revisions to an assignment
- Copying work submitted by another student to a public class meeting
- Using information from online information services without proper citation
- Posting any work as your own that has been written by another author(s)

In addition to the UIS academic integrity policy, you should also read the Computer Science Department's academic Honesty policy.

https://csc.uis.edu/Honesty

If you have any questions regarding these policies, then please contact the course instructor.

## Academic Accommodations

If you are a student with a documented temporary or ongoing disability in need of academic accommodations, please contact the Office of Disability Services at 217-206-6666.

Disabilities may include, but are not limited to: Psychological, Health, Learning, Sensory, Mobility, ADHD, TBI and Asperger's syndrome. In some cases, accommodations are also available for shorter term disabling conditions such as severe medical situations. Accommodations are based upon underlying medical and cognitive conditions and may include but are not limited to extended time for tests and quizzes, distraction free environment for tests and quizzes, a note taker, interpreter and FM devices.

Students who have made a request for an academic accommodation that has been reviewed and approved by the ODS will receive an accommodation letter which should be provided by the student to the instructor as soon as possible, preferably the first week of class.

For assistance in seeking academic accommodations please contact the UIS Office of Disability Services (ODS) in the Human Resources Building, Room 80, phone number 217-206-6666.

## Textbooks

| Algorithm Design (Required) | Algorithm Illuminated (main reference, recommanded) |
|---|---|
| **Author: Kleinberg**<br>**Publisher: Addison Wesley**<br>**Bookstore Link:**<br>**https://www.bkstr.com/illinoisspringfieldstore/home** | **Author: Tim Roughgarden**<br>**Publisher:** SOUNDLIKEYOURSELF PUBLISHING<br>**Booksite:**<br>https://www.algorithmsilluminated.org/<br>**Omnibus Version:** link |

**I will use materials from both of the two books (videos, lecture notes, assignments and tests), plus some of my own notes.**

**Some videos can be found at** https://www.algorithmsilluminated.org/

# UIS Resources

University of Illinois at Springfield

Information Technology Services (ITS) (Canvas and other technology support for students)

University Webmail

Blackboard

The Learning Hub

Documentation Style Guides (from The Learning Hub)

Brookens Library

The Career Development Center

# Course Requirements

1. Use **UIS email and Canvas** for communicating with the instructor and peers. If you want to send message to me, **please use UIS email instead of Canvas message**.
2. Complete **all assigned readings** covered in the materials.
3. **Access the course materials and complete assignments** within the guidelines as established in the course.
4. **Adhere to assignment deadlines**, which are firm unless a student is given special permission by the instructor. Late submissions are subject to partial or no credit.
5. **Contact the instructor immediately** if special circumstances cause interruption of course activities.
6. **Keep backup copies** of all of work.
7. **Submit only original work**. Any form of **plagiarism** is strictly prohibited, as required by University policy. Violation of this rule will result in "no credit" for an assignment or "no credit" for the course and may result in dismissal from the program. I will issue a“challenge”of your work if I have any doubt on it. You will need to response to my challenge in a given amount of time, say, three workdays, in the form of a Zoom meeting. During the meeting I will ask questions to make sure that you show good understanding of the work. You might receive partial credits

# Course Communication

Please contact the instructor via email or the discussion board if you have questions at any time. Online chat sessions can be arranged. Specific details about communication within our course follow.

### Zoom Meetings

Feel free to set up meeting with me through Zoom. I understand that many of you have daytime job and/or family to take care. I will try to be very flexible on meeting time: evening and/or weekend meeting can be arranged.

### Announcements

The Announcements, linked our course menu, serve as a way for me to make announcements within our online learning environment. Announcements may also email to student’s UIS email addresses.

### Email

Students may use **email** to communicate with the instructor and one another about matters they wish to be kept private. Please copy the instructor on all communications using email.

**Netiquette**

In any social interaction, certain rules of etiquette are expected and contribute to more enjoyable and productive communication. The following tips for interacting online in e-mail and/or Discussion Board messages are adapted from guidelines originally compiled by Chuq Von Rospach and Gene Spafford.

- Remember that the person receiving your message is someone like you, someone who deserves and appreciates courtesy and respect.
- Be brief; succinct, thoughtful messages have the greatest impact.
- Your messages reflect on YOU; take time to make sure that you are proud of their form and content.
- Use descriptive subject headings in e-mail messages.
- Think about your audience and the relevance of your messages.
- Be careful with humor and sarcasm; without the voice inflections and body language of face-to-face communication, Internet messages can be easily misinterpreted.
- When making follow-up comments, summarize the parts of the message to which you are responding.
- Avoid repeating what has already been said; needless repetition is ineffective communication.
- Cite appropriate references whenever using someone else's ideas, thoughts, or words.

**Peer Feedback**

This course is designed along the principles of synergy and collaborative learning. Therefore, it is important that all students understand how to provide quality feedback to their peers. Here are a few tips for providing, positive, constructive, and useful feedback to peers:

- Be empathetic and remember that this environment is a safe place for making mistakes.
- Use nonjudgmental language and phrases that do not attack an individual. One way of doing this is to ask the individual to discuss his/her process for making the final decision he/she made.
- Use specific questions, examples, and research as a way of making your point.
- Make your feedback useful by providing suggestions that the individual can understand and use to improve her/his work

**Instructor Feedback**

As your instructor, I am committed to providing a quality learning experience through thoughtful planning, implementation, and assessment of course activities. I am also committed to being readily available to students throughout the semester by returning e-mails and phone calls within 24 to 48 hours. Within our Discussion Board, it is the instructor's job to initiate thoughtful, on-topic discussions, encourage student-to-student communication, and mediate when necessary. Therefore, it is not the instructor's responsibility to respond to every post but encourage students to take ownership of the learning process by responding to each other.

**E-mail Policy**

I welcome emails from students regarding class policies, assignments & readings. In general I respond to all emails within 24 hours; however, it may take me longer to do so on the weekends. In addition, it is unlikely that I will be able to respond very quickly before deadlines such as exams (which don't have in this course) and papers, so please provide at least one day for a response if you need an issue clarified about an assignment. It is also unlikely I can reply your email during 6:00-9:00 pm night time due to family obligation.

I am open to taking questions about the readings and class discussions via email, but I prefer to have substantive discussions in person at my office hours.

# Grading

**Final grade breakdown**

| Assignment/Category | Points |
|---|---|
| **Homework (Coding Projects)** | 30 to 100 each, depending on the difficulty |
| **Quizzes** | 5 each |
| **Labs** | 5 each |
| **Final** | 100 |

**Homework** will consist of programming assignments geared toward the topics covered. An assignment may be given a minimum of 2 weeks to a maximum of 3 weeks to complete depending on the amount of work and difficulty of the material. You are not required to write in a specific language for any of the assignments. You may use what you are comfortable with. **Homework projects require original codes.** However, you can use things like ChatGPT to generate useful code pieces/snippets. It is my responsibility to make make sure tools like ChatGPT can not generate the full solution for my homework assignment. That is, I will add requirements so the homework becomes ChatGPT-proof. So it is important that my requirements are fulfilled in your code.

The following practices are not allowed:

1. Use a whole GitHub/Stack Overflow solution as your homework.
2. Copy other students' work.
3. Submit codes that totally disregard my requirement.

**Labs** are coding experiments. It does not require **original codes.** The purpose of labs is to play with code examples. So the code will usually be given, or very easy to find (you know how to use Google), or generated by ChatGPT. Usually, you will just need to submit a few screenshots of the experimental results. Labs will not be graded very strictly and they are only worth 5 points each.

**Homwork/Lab Report: You need to write reports for every homework assignment and lab using the structure as provided in a template.**

**Quizzes** are given for every topic covered. They will be posted at the top of the week and will be due before the following week. Quizzes are untimed and you may take them as many times as you like, however, they must be completed in one sitting. This means you cannot close a quiz and come back to it later to complete it.

**The final is a cumulative test that covers all topics in the course**. It will be given on Blackboard and is NOT proctored. The final is open book/open notes. It will not be timed but can only be taken once. It will contain 50 random questions that cover all topics in the course.

**Grading Scale**

| Percent Range | Letter Grade |
|---|---|
| **100-93** | A |
| **92-90** | A- |
| **89-87** | B+ |
| **86-83** | B |
| **82-80** | B- |
| **79-77** | C+ |
| **76-73** | C |
| **72-70** | C- |
| **69-67** | D+ |
| **66-63** | D |
| **62-60** | D- |
| **59 and below** | F |
| | |

**Automatic Testing Platforms**

For Labs, most problems are taken from leetcode.com. Please understand that all the answers/sources codes are widely available on the site, so I **can not** use it to assign homework. If you like the site over the next one, Beecrowd, be my guest to practice your programming skill on Leetcode.

We will use an automatic testing (online judge) platform Beecrowd for some of the homework assignments. Addition instructions on Beecrowd can be found in the course materials.

Please note that the **anti-plagiarism** feature will be turn on. The code you submit will be compared with your classmates' codes, or some code repositories online.

Every semester I have students complain me using Beecrowd. It might ask about extra information, but that is for freelancer, not for basic student. If you refuse to you Beecrowd, I will provide test cases to you and you can test it manually.

**Late Work**

Professional adults often have more free time on weekends, and I have taken that into consideration in organizing the course. However, students unable to complete an assignment by the scheduled deadline should notify the instructor **prior to the assignment's due date**.

Late work will be accepted up to a week after the due date with a 20% penalty. That is, if your work is submitted after the due date, the maximum grade you can receive is an 80% or a B-. If the homework assignment is submitted after the 1-week late period, then it will be an automatic 0.

For homework assignment that needs to be submitted to Beecrowd. You should make sure you pass all the tests. Otherwise, the maximum grade you can receive is an 80% or a B-, since that indicates your program is mathematically wrong.

Quizzes will NOT be accepted late. The final will NOT be accepted late.

**Incompletes**

Incompletes generally will be given if a significant portion of the assignments has been completed, but not enough to qualify for a passing grade; incompletes are subject to approval by the instructor.

# Expected Topics and Chapters

Review of Data Structures and Recursion

- Stacks
- Queues
- Lists
- Trees
- Dictionary Types
- Sets
- And their respective efficiencies

Chapter 1 - Introduction: Some Representative Problems

- Problems which lay the foundation for the rest of the semester.

Chapter 2 - Basics of Algorithm Analysis

- Why analyze algorithms
- The notation used for the behavior of algorithms as the input grows
- Common running times

Chapter 3 – Graphs

- Basic definitions
- Implementation details
- Usages of graphs

Chapter 4 - Greedy Algorithms

- What is a greedy algorithm
- When should we greedy algorithms
- When might a greedy algorithm not be beneficial

Chapter 5 - Divide and Conquer

- What is a divide-and-conquer strategy
- How does divide-and-conquer improve upon a brute force search
- How to analyze divide-and-conquer

Chapter 6 - Dynamic Programming

- What is dynamic programming
- What kind of problems is dynamic programming good for
- How to implement dynamic programming solutions

Chapter 7 - Network Flow

- What is Network flow
- What is a network flow problem
- Solving network flow problems
- Measuring network flow solutions

Chapter 8 - NP and Computational Intractability

- What are the class of problems in P, NP, and NP-Complete
- Techniques used to show a problem may not have an efficient solution
- Problems currently known to not have a known polynomial time solution

**If time permits**

Chapter 11 - Approximation Algorithms