UNIVERSITY of HOUSTON

DEPARTMENT OF COMPUTER SCIENCE

COURSE TITLE: COSC 3320 - Algorithms and Data Structures

TIME: T/Th 10:00 AM - 11:30 AM **LOCATION:** D2 LECT2

FACULTY: Gopal Pandurangan **OFFICE HOURS:** TBA

E-MAIL: gopal@cs.uh.edu **PHONE:** (713) 743 - 5556 **FAX:** (713) 743 - 3589

Teaching Assistants

Name	E-Mail	Office Hours
Khalid Hourani	kmhourani@uh.edu	TBA
Krishnamoorthy Iyer	krishnaiyerv2@gmail.com	TBA
Shaoshuai Zhang	szhang36@uh.edu	TBA

I. **Course:** COSC 3320 - Algorithms and Data Structures

A. **Catalog Description:** Algorithm analysis and design, heuristics; advanced tree structures; advanced hashing techniques; sorting and searching; graphs, sets. NP-Completeness, Time and Space complexities.

B. **Prerequisites:** MATH 3336, and COSC 2320 or 2430. Declared Computer Science majors and minors only.

II. **Course Objectives:** The student will learn

- to think algorithmically
- various techniques for designing efficient algorithms
- data structures and their efficient implementations and the role they play in algorithm design
- mathematical techniques for analyzing and reasoning about algorithms

III. **Course Content:** The idea is to expose students to a variety of algorithmic problems that are related through one or more of the following themes: problem domain, algorithmic technique, analysis technique.

- Algorithm design and algorithmic thinking (especially induction and recursion)
- Mathematics of algorithm analysis
- Algorithms for numbers
- Recursion
- Divide and Conquer
- Algorithms for searching, sorting, and various other problems
- Hashing and its applications
- Data Structures: Heap, Queue, Stack, Union-Find, binary search trees, data structures for range queries
- Greedy method
- Dynamic programming
- Graph algorithms
- Matrix algorithms

- Algorithms for Big Data and Data Science

IV. **Course Structure:** TBA

V. **Textbook:** Algorithms by *G. Pandurangan*

VI. **Course Requirements:**

- Programming assignments must be completed in one of the following languages: Python, C, C++, Java, JavaScript. Additional languages will be considered upon request. The programming portion of these assignments must be submitted as source files (e.g., a .py file in the case of Python). More detail on these assignments will be provided in class.
- All assignments must be submitted through the **Assignments** tab of MS Teams.
- All assignments must follow the naming convention `lastname_firstname_assignment.ext`. For example, Jane Doe would submit her Homework 1 as `doe_jane_homework1.pdf`.

VII. **Evaluation and Grading:**

Homeworks	20%
Programming Assignments	20%
Midterm	30%
Final Exam	30%

Homeworks and programming assignments can be submitted **up to two days late for a penalty of 10% per day.** A submission more than **two days late** will receive a **zero**.

The grades are scaled in such a fashion that the average class score corresponds *roughly* to a B.

NOTE: The Interim Grade Policy WILL NOT be applicable for the Spring 2022 semester.

Policy on grades of I (Incomplete): The grade of "I" (Incomplete) is a conditional and temporary grade given when a student, for reasons beyond their control, has not completed a relatively small portion of all requirements. Sufficiently serious, documented situations include illness, death in the family, etc.

VIII. **Consultation:** Office hours and consultation will be held via MS Teams. My office hours will be **Tu/Th 3:00 PM - 4:00 PM**. If you would like to schedule a meeting at a different time, please reach out by email. **Content questions should be asked on Zulip.**

IX. **Tutoring:** Students can take advantage of tutoring through the following:

- LAUNCH – www.uh.edu/ussc/launch
  At LAUNCH, students can:
  - Drop in for individual Peer Tutoring on over 100 different courses—no appointment necessary! LAUNCH is located in Cougar Village 1, room N109. http://www.uh.edu/ussc/launch/index.php.
  - Attend a **Success Workshop**: http://www.uh.edu/ussc/launch/index.php.
  - Set up an individual appointment with an **Academic Counselor: 713-743-5411**
- Scholar Enrichment Program (SEP) provides online/remote tutoring services using Microsoft Teams - https://uh.edu/nsm/scholar-enrichment/tutoring/

Addendum: Whenever possible, and in accordance with 504/ADA guidelines, the University of Houston will attempt to provide reasonable academic accommodations to students who are registered and approved through the Center for Students with Disabilities. Students are responsible for communicating with the faculty to be sure appropriate arrangements are made. Registering with CSD is not sufficient. Communication is critical. Please call 713-743-5400 for more assistance.

Academic Honesty: It is each student's responsibility to read and understand the Academic Honesty Policy found at http://catalog.uh.edu/content.php?catoid=6&navoid=1025. There will be no tolerance towards academic dishonesty, and cheating can lead to report of a violation of the Academic

Honesty policy to the UH Office of Undergraduate Academic Affairs.

All submitted work should be your own. Copying or using other people's work (including from the Web) will result in $-$`MAX` points, where `MAX` is the maximum possible number of points for that assignment/homework/exam. Repeat offenses will result in a failing grade for the course and will be reported to the Chair. If you have any questions, please reach out to the professor and the TAs. The best way to ask is on Zulip.

By submitting your work or exam, you affirm that you have followed the Academic Honesty Policy and the Honor Code.

> **Honor Code**
> Students may be asked to sign an honor code statement as part of their submission of any graded work including but not limited to projects, quizzes, and exams: "*I understand and agree to abide by the provisions in the University of Houston Undergraduate Academic Honesty Policy. I understand that academic honesty is taken very seriously and, in the cases of violations, penalties may include suspension or expulsion from the University of Houston.*"

NOTE: The materials provided by the instructor in this course are for the use of the students enrolled in the course only. Copyrighted course materials (including homeworks, assignments, exams, and their solutions) should not be further disseminated without instructor permission. This includes sharing content to commercial course material suppliers such as Course Hero or Chegg. Students are also prohibited from sharing materials derived from the instructor's content (e.g., a student's lecture notes).

Face Covering Policy: To reduce the spread of COVID-19, the University strongly encourages everyone (vaccinated or not) to wear face coverings indoors on campus including classrooms for both faculty and students.

Presence in Class:
Your presence in class each session means that you:

- Are NOT exhibiting any Coronavirus Symptoms (https://www.uh.edu/covid-19/information/coronavirus-symptoms/) that makes you think that you may have COVID-19
- Have NOT tested positive or been diagnosed for COVID-19
- Have NOT knowingly been exposed to someone with COVID-19 or suspected/presumed COVID-19

If you are experiencing any COVID-19 symptoms that are not clearly related to a pre-existing medical condition, do not come to class.
Please see Student Protocols (https://www.uh.edu/covid-19/guidelines-protocols/diagnosis-symptoms/#students) for what to do if you experience symptoms and Potential Exposure to Coronavirus (https://www.uh.edu/covid-19/information/potential-exposure-coronavirus/) for what to do if you have potentially been exposed to COVID-19. Consult the Undergraduate Excused Absence Policy (http://catalog.uh.edu/content.php?catoid=36&navoid=13956) for information regarding excused absences due to medical reasons.

COVID-19 Information Students are encouraged to visit the University's COVID-19 (https://www.uh.edu/covid-19/information-for/students/) website for important information including on-campus testing, vaccines, diagnosis and symptom protocols, campus cleaning and safety practices, report forms, and positive cases on campus. Please check the website throughout the semester for updates.

Vaccinations Data suggests that vaccination remains the best intervention for reliable protection against COVID-19. Students are asked to familiarize themselves with pertinent vaccine information (https://www.uh.edu/covid-19/information/vaccine/), consult with their health care provider. The University strongly encourages all students, faculty and staff to be vaccinated.

Reasonable Academic Adjustments/Auxiliary Aids The University of Houston complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, pertaining

to the provision of reasonable academic adjustments/auxiliary aids for disabled students. In accordance with Section 504 and ADA guidelines, UH strives to provide reasonable academic adjustments/auxiliary aids to students who request and require them. If you believe that you have a disability requiring an academic adjustments/auxiliary aid, please contact the Justin Dart Jr. Student Accessibility Center (https://uh.edu/accessibility/) (formerly the Justin Dart, Jr. Center for Students with DisABILITIES).

UH Email Please check and use your Cougarnet email for communications related to this course. To access this email, login to your Microsoft 365 account with your Cougarnet credentials.

Excused Absence Policy
Regular class attendance, participation, and engagement in coursework are important contributors to student success. Absences may be excused as provided in the University of Houston Undergraduate Excused Absence Policy for reasons including: medical illness of student or close relative, death of a close family member, legal or government proceeding that a student is obligated to attend, recognized professional and educational activities where the student is presenting, and University-sponsored activity or athletic competition. Under these policies, students with excused absences will be provided with an opportunity to make up any quiz, exam or other work that contributes to the course grade or a satisfactory alternative. Please read the full policy for details regarding reasons for excused absences, the approval process, and extended absences. Additional policies address absences related to military service, religious holy days, pregnancy and related conditions, and disability.

Recording of Class
Students may not record all or part of class, livestream all or part of class, or make/distribute screen captures, without advanced written consent of the instructor. If you have or think you may have a disability such that you need to record class-related activities, please contact the Center for Students with DisABILITIES. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Classes may be recorded by the instructor. Students may use instructor's recordings for their own studying and notetaking. Instructor's recordings are not authorized to be shared with anyone without the prior written approval of the instructor. Failure to comply with requirements regarding recordings will result in a disciplinary referral to the Dean of Students Office and may result in disciplinary action.

Syllabus Changes Due to the changing nature of the COVID-19 pandemic, please note that the instructor may need to make modifications to the course syllabus and may do so at any time. Notice of such changes will be announced as quickly as possible through (specify how students will be notified of changes).

Religious Holy Days
Students whose religious beliefs prohibit class attendance or the completion of specific assignments on designated dates may obtain an excused absence. To do so, please make a written request for an excused absence and submit it to your instructor as soon as possible, to allow the instructor to make arrangements. For more information, see the Student Handbook.

http://catalog.uh.edu/index.php

Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless. You can reach CAPS (www.uh.edu/caps) by calling 713-743-5454 during and after business hours for routine appointments or if you or someone you know is in crisis. Also, there is no appointment necessary for the "Let's Talk" program, which is a drop-in consultation service at convenient locations and hours around campus. http://www.uh.edu/caps/outreach/lets_talk.html#hours

Resources for Online Learning
The University of Houston is committed to student success, and provides information to optimize the online learning experience through our Power-On website. Please visit this website for a comprehensive set of resources, tools, and tips including: obtaining access to the internet, AccessUH, and Blackboard;

requesting a laptop through the Laptop Loaner Program; using your smartphone as a webcam; and downloading Microsoft Office 365 at no cost. For questions or assistance contact UHOnline@uh.edu.

Standard Disclaimer: This syllabus is subject to change at the discretion of the instructor. Due to the changing nature of the COVID-19 pandemic, please note that the instructor may need to make modifications to the course syllabus and may do so at any time. Notice of such changes will be announced as quickly as possible through Zulip or Blackboard.

Course Topics

This is a sample list of topics that will be covered and is not exhaustive. Additional topics may be added at the discretion of the instructor depending on the amount of time available. Chapters refer to the textbook Algorithms by *G. Pandurangan*.

MODULE 1: Introduction to Algorithms	
Course Introduction	Chapter 1
Problem Solving	Chapter 2.1 & 2.2
Big-$\mathcal{O}$ Notation	Chapter 2.5
Mathematical Induction	Chapter 3
Recursion	Chapter 4
MODULE 2: Divide and Conquer	
Sorting	Chapter 5.1
Selection	Chapter 5.2
Karatsuba's Algorithm	Chapter 5.3
MODULE 3: Dynamic Programming	
Matrix Chain Multiplication	Chapter 6.4
Sequence Alignment	Chapter 6.5
Knapsack Problem	Chapter 6.6
MODULE 4: Greedy Algorithms	
Fractional Knapsack	Chapter 7.1
Huffman Encoding	Chapter 7.3
Set Cover	Chapter 7.4
MODULE 5: Graph Algorithms	
Representing a Graph	Chapter 11.1
Depth-first Search	Chapter 11.2
Breadth-first Search	Chapter 11.3
Minimum Spanning Trees	Chapter 12.1
Shortest Paths	Chapter 12.2