

COSC 40403 065 - Analysis of Algorithms

Dr. XXX

Fall 20XX

Note for students: The syllabus is your first course reading. It provides an orientation to, overview of the flow, and expectations of the course. You should turn to the syllabus for details on assignments and course policies.

1 Course & Instructor Information

1.1 Course

- Course Title, Prefix, Number, Section: COSC 40403 065 - Analysis of Algorithms
- Semester and Year: Fall 20XX
- Number of Credits: 3
- Course Component Type: In person lecture
- Webpage: TCU Online

1.2 Instructor

1.3 Final Evaluative Exercise and Important Dates

- Monday, September 1: Labor Day Holiday (no classes)
- Fall Break: 22:00 on Wednesday, October 8 through 8:00 on Monday, October 13.
- Last Day to Drop: Monday, November 3
- Thanksgiving Break: 22:00 on Friday, November 21 through 8:00 on Monday, December 1.
- P/NC Date: Monday, December 1.
- Study Days: Thursday and Friday, December 4-5
- Final Exam: Tuesday, December 9, 14:00 - 16:30
- Final Exam Details: According to the Faculty/Staff Handbook [“Final Evaluative Exercise Policy”](#) TCU requires a “final evaluative exercise in all classes” during the designated finals period.

- **POLICY STATEMENT:** There are only two reasons for rescheduling finals:
 1. If the published final examination schedule would require a student to take more than two final examinations in a 24-hour period, the student can arrange to take one of the exams at another time. The student shall determine which final examination is to be rescheduled. The rescheduled exam shall be given at a time mutually agreeable to the student and the faculty member. A final exam may not be rescheduled so as to violate the 24-hour rule. Rescheduling arrangements must be made one week prior to the last day of classes. Unless the student is graduating, the exam must be taken during the final exam week.
 2. Students for whom a final examination conflicts with a major religious holiday or custom. Students who, in the first two weeks of the semester, notified faculty or staff of their intention to be absent from class or event, as required in the TCU Religious Holiday Policy, may reschedule a final exam within final examination week if it compromises their ability to fully celebrate a religious holiday. For example, students may reschedule late afternoon or evening examinations to that morning or at an alternate time during final examination week so they are not being tested after fasting for many daylight hours. A final exam may not be rescheduled so as to violate the 24-hour rule.

1.4 Student Resources & Policy Information

Click or scan QR code for resources to support you as a TCU student. Please note section on [Student Access and Accommodation](#) and [Academic Conduct & Course Materials Policies](#).



2 Course Description

2.1 Catalog Description

This course covers basic approaches for designing and analyzing for a variety of problems. Algorithm design techniques such as divide-and-conquer, greedy, dynamic programming will be covered. Other topics include worst, best, and average case analysis, graph algorithms, string matching, and complexity.

2.2 Prerequisites & Concurrent Enrollment

Prerequisite: COSC 20803 - Data Structures, Prequisite or Corequisite: MATH 30123; all with C- or better, and a basic knowledge of probability and statistics would be helpful.

3 Course Materials

3.1 Required Materials

Goodrich, Tamassia, and Goldwasser, *Algorithm Design and Applications*, Zybooks, 2024, ISBN: 979-8-203-08802-4

1. Sign in or create an account at learn.zybooks.com
2. Enter zyBook code: TCUCOSC40403SchergerFall2025
3. Subscribe

4. A subscription is \$64. Students may begin subscribing on Aug 04, 2025 and the cutoff to subscribe is Nov 30, 2025. Subscriptions will last until Dec 29, 2025.

3.2 Supplemental Materials

Cormen, Leiserson, Rivest, and Stein, *Introduction to Algorithms*, 4th ed., MIT Press, Cambridge, MA, 2022, ISBN: 978-0262046305.

4 Learning Outcomes

4.1 Course Outcomes

1. Argue the correctness of algorithms using inductive proofs and invariants.
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
5. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analyze them.
6. Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.
7. Compare between different data structures. Pick an appropriate data structure for a design situation.
8. Analyze and effectively use various sorting algorithms and understand algorithms for sorting in linear time.
9. Compare and contrast problems of type P and NP. Explain concepts and terms such as polynomial reduction, NP-hardness, and NP-completeness. Synthesize standard NP-Complete problems and their interrelationship.

Course outcomes will be measured by using homework assignments, programming projects, and exams.

5 Course Requirements

5.1 Assignments

There will be regularly assigned homework and programming contests/challenges to complete. Students will be required to write solutions to homework problems using $\text{\LaTeX}$. Solutions to programming problems must be completed using Python 3 (Jupyter notebooks/labs using Python 3 are also suggested) and also on [HackerRank](#) or on [LeetCode](#). Students will submit assignments via the appropriate dropbox created in TCU Online or on [Gradescope](#).

5.1.1 Quizzes & Exams

There will be regularly assigned quizzes to complete. Some quizzes will be in-class. Other quizzes can be completed outside of class. Quizzes will be administered using TCU Online.

There will be two equally weighted exams on approximately the 8th week and finals week. Proper exam etiquette will be enforced (no talking, no cheating/copying answers, no leaving the exam room to use the restroom or get a drink of water, etc).

5.2 Grading Philosophy

5.2.1 Late Work

Late homework assignments are not accepted.

Late quizzes are not accepted.

Requests for re-evaluation of points on exams, assignments, and projects must be returned to the instructor within one week, and accompanied by a brief written description of the grading error you believe was made. After this time, grades are final. Re-evaluations will not be done in the classroom, before, during, or after class. Resubmission for re-evaluation subjects the entire assignment for review. This means that if an error was made in your favor, you may lose points when re-submitting.

5.2.2 Participation, Engagement, and Attendance

Formal attendance will not be taken, however...

- **you are expected to attend lecture during our regularly scheduled class times.**

You will be considered responsible for all material presented during the lectures. Due to the nature of this course, this course will require that your mind and body show up to every lecture. As the semester progresses, I will begin to recognize students attending (or not attending) lecture. At times, lectures will cover a mathematical or theoretical analysis of algorithms. Other times lectures will cover more applied “how-to’s” and high level concepts. In addition to simply being in class, you should come prepared to ask questions about the material being covered that day.

Your participation in the course will involve the following forms of activity:

1. Attending the lectures.
2. Reading the textbook(s) and other assigned articles.
3. Completing the homework, quizzes, and projects.
4. Taking the exams.

Because it is considered an infringement on student privacy for me to have access to student medical records, I cannot accept medical documentation to justify absences. If you have a legitimate reason for your absence and want to provide verification, please access the Absence Documentation Form [here](#).

Distinction between Excused Absences and Verified Absences: Excused Absences or Official University Absences are absences described in the Official University Absence Policy and include the following: Title IX related issues, military leave, holy days, and university related absences. As faculty we may not penalize students for these absences and must allow for the completion of assignments and exams within a reasonable amount of time after the absences. Beyond these, faculty retain all discretion for consideration of a student's absence, including verified absences.

5.3 Course Requirements & Policies

- 40% Homework, Quizzes, Programming Assignments
- 30% Midterm
- 30% Final Exam

5.4 Undergraduate Grading Scale

Final course grades are rounded to the nearest integer prior to assigning a letter grade.

≥93	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	<60
A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

6 Course Schedule and Topics (always subject to change)

WEEK	DATES	TOPIC	READING
INTRODUCTION			
1	8/19	Introduction, Peak Finding, Insertion Sort	Zybooks: 1 CLRS: 1
	8/21	Growth of Functions, Complexity, Asymptotic Notation	Zybooks: 1 CLRS: 2
DATA STRUCTURES			
2	8/26	Priority Queues, Heaps, Heapsort	Zybooks: 5 CLRS: 6
	8/28	Priority Queues, Heaps, Heapsort	Zybooks: 5 CLRS: 6
3	9/2	Graphs, Representations, Traversals	Zybooks: 13 CLRS: 20
	9/4	Graph Traversals, Topological Sort, Connected Components	Zybooks: 13 CLRS: 20
SORTING			
4	9/9	Merge Sort	Zybooks: 8 CLRS: 2
	9/11	Quicksort, Randomized Quicksort	Zybooks: 8 CLRS: 7
5	9/16	Lower Bounds on Sorting, Sorting in Linear Time	Zybooks: 9 CLRS: 8
DIVIDE AND CONQUER			

	9/18	Intro. Divide and Conquer, Recurrences and the Master Theorem	Zybooks: 11 CLRS: 4
6	9/23	Maximum Subarray Problem	Zybooks: 1.3
	9/25	Strassen's Matrix Multiplication	Zybooks: 11 CLRS: 4
7	9/30	TBA / Review	
	10/2	Midterm Exam - Part I	
8	10/7	Midterm Exam - Part II	
	10/9	No Lecture	Fall Break
GREEDY ALGORITHMS			
9	10/14	Intro. Greedy Algorithms, Huffman Codes	Zybooks: 10 CLRS: 15
	10/16	Fractional Knapsack Problem	Zybooks: 10 CLRS: 15
10	10/21	Task Scheduling	Zybooks: 10 CLRS: 15
DYNAMIC PROGRAMMING			
	10/23	Intro. Dynamic Programming, Rod Cutting Problem	Zybooks: 12 CLRS: 14
11	10/28	Matrix-chain Multiplication	Zybooks: 12 CLRS: 14
	10/30	Longest Common Subsequence	Zybooks: 12 CLRS: 14
12	11/4	TBA / Dynamic Programming Examples	Zybooks: 12 CLRS: 14
GRAPH ALGORITHMS			
	11/6	Minimum Spanning Trees	Zybooks: 15 CLRS: 21
13	11/11	Single-Source Shortest Path Algorithms	Zybooks: 14 CLRS: 22, 23
	11/13	Maximum Flow	Zybooks: 16 CLRS: 24
NP-COMPLETENESS			
14	11/18	NP-Completeness	Zybooks: 17 CLRS: 34
	11/20	NP-Completeness	Zybooks: 17 CLRS: 34
	11/25	No Lecture	Thanksgiving
	11/27	No Lecture	Thanksgiving
15	12/2	TBA / Review	
	12/4	No Lecture	Study Day
16	12/9	Final Exam - Parts I, II	14:00 - 16:30