School of Electrical Engineering and Computer Science

UND Engineering & Mines

CSci 242. Algorithms and Data Structures

Term: Fall 2019.
Class Hours: 9:30 – 10:45 AM, TR
Room: Education 109

Instructor: Dr. M. Eunjin Kim
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Office: 366P, Upson II
Phone: (701)777-3338
Office Hours: 1:00 – 3:30 PM, (Wed)

TA & Office Hour: Ananth Chandra Ramaseri (ananthnag.ramaserich@und.edu)
10:00 AM – 12:00 PM, MW, Harrington 223

Recitation Class: Optional, TBD

Prerequisites: Csci 161 Computer Science II: Python (or Java)
Math 208: Discrete Mathematics

Required Textbook: ***Algorithm Design and Applications***
Michael T. Goodrich, Roberto Tamassia
Wiley, October 2014.

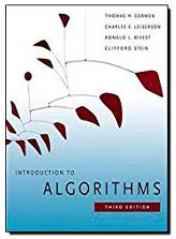
zyBook : https://www.zybooks.com

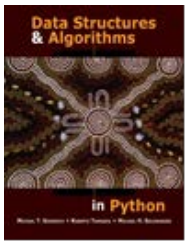
Instruction to use the zyBook:

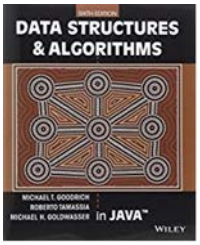
1. Sign in or create an account at learn.zybooks.com
2. Enter zyBook code: **UNDCSCI242KimFall2019**
3. Subscribe ($58)

Recommended Book: ***Introduction to Algorithms, 3rd ed.***
Thomas H. Cormen et.al.
The MIT Press, 2009.

Data Structures and Algorithms in Python (1/e).
or ***Data Structures and Algorithms in Java (6/e)***
Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser
Wiley, March 2013 or Wiley, January 2014.







Course Webpage: https://blackboard.und.edu

Grade Policy:

Midterm	Part 0 & I	: 20 - 25 %
Exam 2	Part II & III	: 20 - 25 %
Final Exam	Part 0 – III & IV & V	: 20 - 25 %
Assignments & Quizzes		: 30 % (offline), 35% (online)
Attendance		: 5 % (offline)

Among Midterm and exam 2, the test with the higher score will get 25% while that of lower score gets 20%.

Final Grade Policy:

Midterm = y_1;	Your Midterm Score = x_1;
Exam 2 = y_2;	Your Exam 2 Score = x_2;
Final Exam = y_3;	Your Final Exam Score = x_3;
HW/Q Total = y_4:	Your Total HW Score = x_4:
Attendance = y_5.	Your Attendance = x_5.

After the normalization, $\frac{x_i}{y_i}$ for $i = 1, 2, 3$

sort them in the descending order, $z_1 \geq z_2 \geq z_3$.

Then, the best test z_1 will get 25% while z_2 and z_3 get 20%.

z_1: 25%, z_2: 25%, z_3: 20%

Your Total $= z_1 \cdot 250 + z_2 \cdot 200 + z_3 \cdot 200 + \frac{x_4}{y_4} \cdot 300 + \frac{x_5}{y_5} \cdot 50$

A ∈ [900, 1000]
B ∈[800, 900)
C ∈ [700, 800)
D ∈ [600, 700)
F ∈ [0, 600)

FINAL EXAM: 8:00 – 10:00 AM, December 17th (Tue.) 2019.

COURSE DESCRIPTION:

The data structures and algorithms are the basic elements for problem solving and further build the large and complex software artifacts. This course provides the students with the basic theory/implementation of algorithms, the fundamental data structures, algorithm design techniques, and the analysis of algorithms in their time/space complexity. The topics include: ***data structures*** such as trees, priority queue, heap, hash table and graph; ***the advanced algorithms*** such as sorting algorithms, the operational algorithms and graph algorithms; ***the algorithm design techniques*** such as divide-and-conquer, dynamic programming and greedy method; and ***the asymptotic analysis of algorithm for its time/space complexity*** in terms of the order of growth of the function such as upper bound (O), lower bound (Ω) and tight bound (Θ). Thus, the students are expected to have a good understanding of various data structures, algorithms for problem solving, algorithm design techniques and its analysis skill enough to design the ***correct and efficient algorithms*** for complex software artifacts.

ABET Outcome:

a) An ability to apply knowledge of computing and mathematics appropriate to the discipline.
i) An ability to use current techniques, skills, and tools necessary for computing practice.
j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.

Program Outcomes:

2) Knowledge of the Software development principles
6) Proficiency in Programming and Software development
7) The ability to conduct sound scientific investigation and analysis

GENERAL POLICY

Reading:

Reading of Textbook is required.

Late Submission:

Exams and due dates of assignments/projects will be scheduled in advance. A grade of zero will be recorded for missed exams and late assignments unless prior arrangements are made with a valid written excuse. Assignments turned in after the due date, but by the beginning of the next scheduled class will be penalized 30%. After one class, it will not be accepted.

Academic Dishonesty:
All work, in class or out of class, must be done ***independently***. In any/all cases of plagiarism, your work will be graded as ***ZERO***. The students might discuss the ideas for assignment or/and project, however, please ***do not copy*** the solution or the program codes of your classmate or any online source in the internet.
http://und.edu/student-affairs/code-of-student-life/_files/codepdfs/appendix/iiia/iiia-3.pdf

Attendance:

Attendance ***is required*** and a student is responsible for all material presented in class. If you know you will miss a class ahead of time, email the instructor. Your attendance is applied to your final grade.

Etiquette of Email Communication:

In any type of communication between the students and an instructor, a proper etiquette with the mutual respect is expected.

Your email with the instructor is not a chatting but a (semi) formal communication in regard to the course. A proper format is recommended with mutual respect.

Subject:	e.g.) Question 1 in HW 2
Salutation:	e.g.) Hi Dr. Kim,
Body:	e.g.) Question 1 in HW 2 states ….....
Closing:	e.g.) Thank you.
Your Full Name:	e.g.) Paul Smith

Your email should be sent from your UND email (your_name@und.edu), not your personal email account such as gmail, yahoo, etc.

Classroom Etiquette:

To maintain a proper atmosphere for learning, the following standards of classroom behavior will be observed.

- Students will be **on time** for class. The latecomers will be considered being disrespectful of those who manage to be on time.
- If a student decides to attend class, he/she will not disrupt class by leaving before the period has ended. If you have a circumstance to leave the class early, inform the instructor of it before the class.
- Students will show courtesy and respect to others in the classroom by not talking and by **not coming in and out of the classroom**.
- All cellular phones and tablets are to be turned off in the classroom.

Dropping a Course:

Dropping a course is a responsibility of a student. Non-attendance of the class, without the formal dropping of the course, may result in an 'F' on the student's final grade. Drops should be completed by the student on Campus Connection.

Disclaimer:

This syllabus is ***not absolute***. It will be announced in class if *any change* occurs.

Disability Statement:

If you need accommodations in this course because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible.
If you plan to request disability accommodations, you are expected to register with the Disability Services for Students (DSS) office (Room 190 McCannel Hall, 777-3425).

SELECTED TOPICS:

0. Preface

Chap. 1. Algorithms Analysis	(zyBook: 1, 2)

I. Data Structures

Chap. 2. Basic Data Structures	(zyBook: 4, 13.4 – 13.5)
Chap. 3. Binary Search Trees	(zyBook: 6)
Chap. 4. Balanced Binary Search Trees	(zyBook: 7)
Chap. 5. Priority Queues and Heaps	(zyBook: 8)
Chap. 6. Hash Tables	(zyBook: 5)
Chap. 7. Union-Find Structures	(zyBook: 12)

II. Sorting and Selection

Chap. 8. Merge-Sort and Quick-Sort	(zyBook: 3, 2.6 – 2.9, 13.1 – 13.2)
Chap. 9. Fast Sorting and Selection	(zyBook: 3.7, 3.8, 13.2 – 13.3)

III. Fundamental Techniques

Chap. 10. The Greedy Method	(zyBook: 10.2)
Chap. 11. Divide-and-Conquer	(zyBook: 2.7 – 2.9,
Chap. 12. Dynamic Programming	(zyBook: 10.3)
Chap. 13. Graphs and Traversals	(zyBook: 9.1 – 9.8)

IV. Graph Algorithms

Chap. 14. Shortest Paths	(zyBook: 9.9 – 9.10)
Chap. 15. Minimum Spanning Trees	(zyBook: 9.11 – 9.12)

V. Additional Topics & Computational Intractability

Chap. 20. B-Trees and External Memory	(zyBook: 11)
Chap. 17. NP-Complete	