COP 5536 Advanced Data Structures

Class Periods: M,W,F (12:50 PM – 1:40 PM)
Location: NRN 1020
Academic Term: Spring 2024

Instructor:
Dr. Sartaj K Sahni
sahni@cise.ufl.edu
352-294-6666

Office Hours: M, W 9 am to 10 am, Zoom Link

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- Jayetri Bardhan (jayetri.bardhan@ufl.edu): Monday 2pm-4pm and Thursday 3pm-5pm at MH 5200, Zoom Link
- Srikruth Reddy Puram (s.puram@ufl.edu): Tuesday 2pm-4pm (Location TBA), Zoom Link
- Vanshika Mehrotra (vmehrotra@ufl.edu): Thursday 12pm-2pm (Location TBA), Zoom Link
- Rohith Kalwa (kalwarohith@ufl.edu): Wednesday 2:30pm–4:30pm (Location TBA), Zoom Link
- Shamitha Narra (shamitha.narra@ufl.edu): Monday 2pm–4pm (Location TBA), Zoom Link

Course Description
Development of efficient data structures used to obtain more efficient solutions to classical problems, such as those based on graph theoretical models, as well as problems that arise in application areas of contemporary interest. (3 credits)

Course Pre-Requisites / Co-Requisites
You should know the following:
1.C, C++, Java, or Python.
2.Algorithm analysis methods (in particular asymptotic complexity).
3.Basic data structures such as stacks, queues, linked lists, trees, and graphs. Basic sorting methods such as insertion sort, heap sort, merge sort, and quick sort.

Course Objectives
This graduate course seeks to build upon what is normally covered in an undergraduate data structures class and expose students to a variety of data structures with wide application. Additionally, programming and problem solving skills are enhanced via a project.

Course Materials
Course slides and sample exam papers with solution can be found on Dr. Sahni's website - Link

Required Textbooks and Software
None

Recommended Materials
None

Course Schedule
Week 1 (Jan 08 – Jan 12) : Lecture 1 - Lecture 3
Week 2 (Jan 17 – Jan 19) : Lecture 4 - Lecture 5 Holiday : Jan 15
Week 3 (Jan 22 – Jan 26) : Lecture 6 - Lecture 8

Week 4 (Jan 29 – Feb 02) : Lecture 9 - Lecture 11
Week 5 (Feb 05 – Feb 09) : Lecture 12 - Lecture 14
Week 6 (Feb 12 – Feb 16) : Lecture 15 - Lecture 17 **Exam 1: Feb 13 (Lecture 1-13)**
Week 7 (Feb 19 – Feb 23) : Lecture 18 - Lecture 20
Week 8 (Feb 26 – Mar 01) : Lecture 21 - Lecture 23
Week 9 (Mar 04 – Mar 08) : Lecture 24 - Lecture 26 Holiday : Mar 09-Mar 17
Week 10 (Mar 18 – Mar 22) : Lecture 27 - Lecture 29
Week 11 (Mar 25– Mar 29) : Lecture 30 - Lecture 32 **Exam 2: Mar 26 (Lecture 14-28)**
Week 12 (Apr 01 – Apr 05) : Lecture 33 - Lecture 35
Week 13 (Apr 08 – Apr 12) : Lecture 36 - Lecture 38
Week 14 (Apr 15 – Apr 17) : Lecture 39 – Lecture 40 **Exam 3: April 30th (Lecture 29-40)**

Final exam - 04/30/2024 @ 3:00 PM - 5:00 PM (Lecture 29-40)

Note:- The exam dates are tentative. All exams will be online using Honorlock. Exams 1 and 2 will be held in the evening; Exam 3 is as per the University's schedule for final exams.

Lecture number and corresponding content

1 Amortized complexity.
2 Amortized Complexity.
3 Introduction to external sorting.
4 Introduction to external sorting.
5 Selection trees & k-way merging.
6 Run generation.
7 Optimal merging of runs.
8 Buffering.
9 Double-ended priority queues. General methods.
10 Double-ended priority queues. Interval heaps.
11 Leftist trees.
12 Binomial heaps.
13 Binomial heaps.
14 Fibonacci heaps.
15 Pairing heaps.
16 Dictionaries.
17 Optimal binary search trees.
18 AVL trees.
19 AVL trees
20 Red-black trees.
21 Red-black trees.
22 B-Trees.
23 B-trees.
24 B+ and B*-trees.
25 Splay Trees.
26 Splay Trees.
27 Binary Tries.
28 Compressed Binary Tries.
29 High-order Tries.
30 Tries and Packet Forwarding.
31 Suffix Trees.
32 Bloom Filters.
33 Segment Trees.

34 Interval Trees.
35 Priority Search Trees.
36 Priority Search Trees.
37 Multidimensional Search Trees.
38 Quad Trees.
39 BSP Trees.
40 R-trees.

Attendance Policy, Class Expectations, and Make-Up Policy

1. Attendance is not monitored.
2. Students are expected to follow the University of Florida Honor Code. http://www.dso.ufl.edu/STG/default.html)
3. Handouts, assignments, solutions, and others will be posted on Canvas. Students should check Canvas regularly, at least once per week.
4. When submitting homework for grading, your answers should be written neatly and contain an explanation that is clear and reasonably concise.
5. All exam submissions should be made within time.
6. All requests for re-grading must be made to a teaching assistant within 1 week of the date that scores are posted.
7. Makeup exam will be provided for those getting prior instructor approval in case of an emergency or health issue.

Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations) and require appropriate documentation. Additional information can be found here: https://gradcatalog.ufl.edu/graduate/regulations/

Evaluation of Grades

Assignment	**Total Points**	**Percentage of Final Grade**
Exam1	50	25%
Exam2	50	25%
Exam3	50	25%
Assignment 1 (Project)	100	20%
Assignment 2	50	5%
		100%

Grading Policy

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Percent	**Grade**	**Grade Points**
85- 100	A	4.00
81 - 84.9	A-	3.67
77 - 80.9	B+	3.33
72 - 76.9	B	3.00
67 - 71.9	B-	2.67
63 - 66.9	C+	2.33
60 - 62.9	C	2.00
55 - 59.9	C-	1.67
50 - 54.9	D+	1.33
45 - 49.9	D	1.00
40 - 44.9	D-	0.67
0 - 39.9	E	0.00

More information on UF grading policy may be found at:

UF Graduate Catalog
Grades and Grading Policies

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
- Your academic advisor or Graduate Program Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:
Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/getting-help/; https://distance.ufl.edu/state-authorization-status/#student-complaint.*