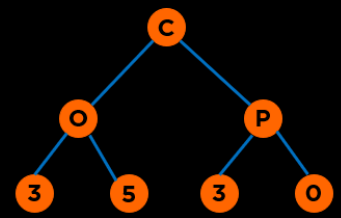
Data Structures & Algorithms

COP 3530 : Summer 2022



Data Structures & Algorithm

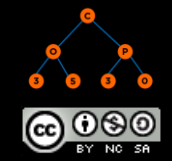
About Me: Amanpreet Kapoor

- Educator
- CS Education Researcher
- Mentor
- Software Engineer
- Lifelong Learner

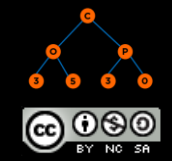
kapooramanpreet@ufl.edu

Course Staff

- Anik Chattopadhyay
- Hoda Shajari
- Sajid Rahman



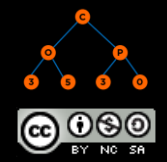
Course Objectives



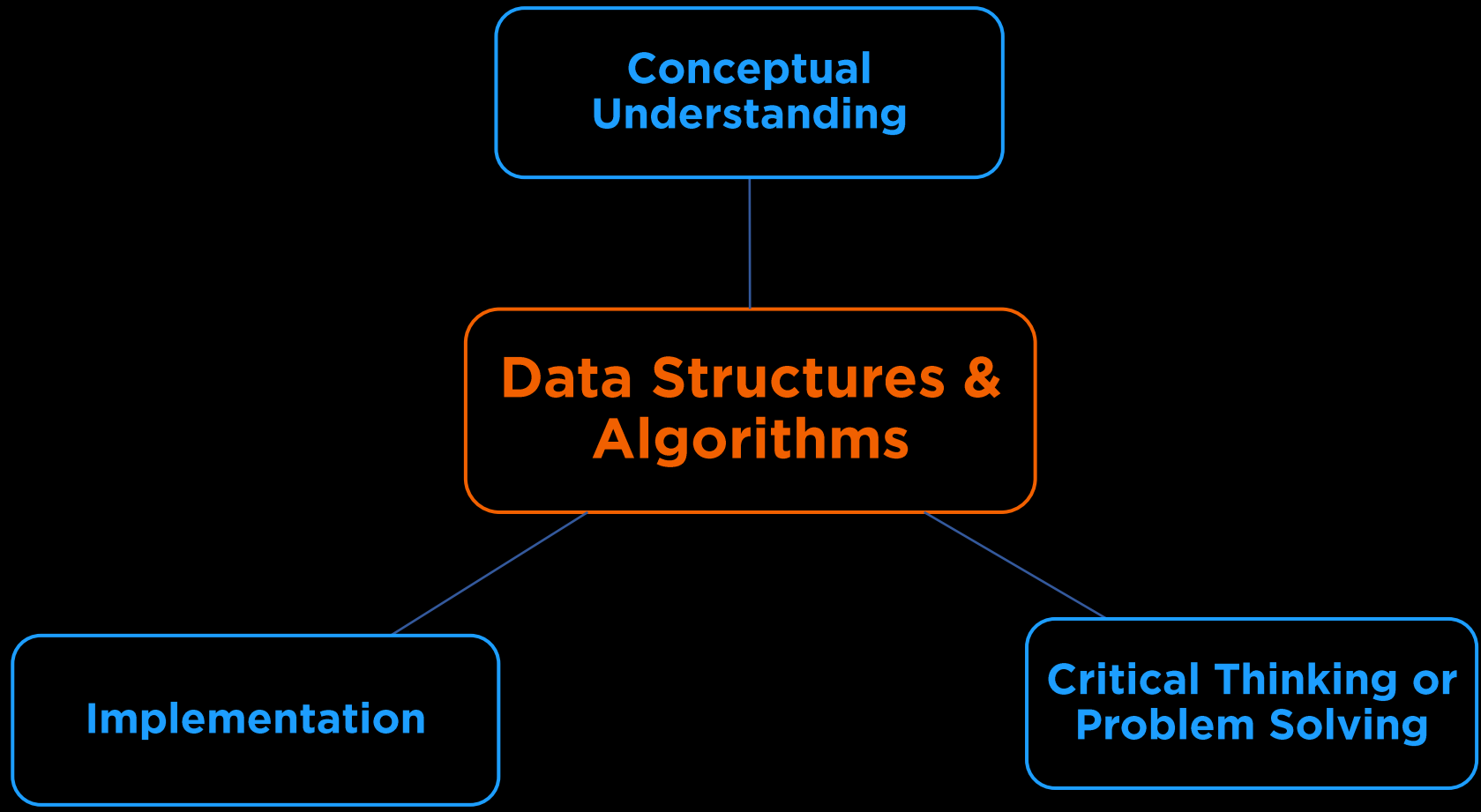
What is this Course About?

This course covers algorithm development using

- pseudo languages
- basic program structures
- program design techniques
- storage and manipulation of basic data structures
- 3 Credit Hours

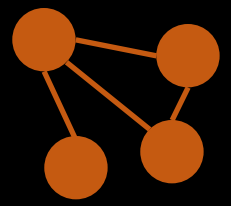


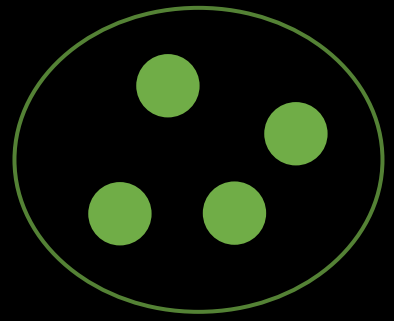
What is this Course About?



Categories of Data Structures

Linear Ordered	Non-linear Ordered	Not Ordered
Lists	Trees	Sets
Stacks	Graphs	Tables/Maps
Queues		

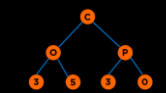




Categories of Algorithms

Brute Force	Divide & Conquer	Greedy	Dynamic Programming
Selection Sort	Binary Search	Minimum Spanning Tree	Knapsack
Bubble Sort	Merge Sort	Shortest Paths	Fibonacci
Insertion Sort	Quick Sort		
NP Complete Problems			

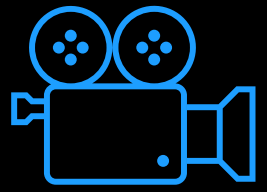
Logistics & Policies



Format

Action Items by Monday morning

Optional: Attend synchronous discussions on Tue.



1. Watch recorded lectures or YouTube videos asynchronously later.
2. Optional: Attend or watch lectures synchronously on Mon, Wed, and Fri.

1. Conceptual Quiz due on Tue.
2. Programming Quiz due on Sat.

Communication

Slack

- Everything!
  - for all question related to the course
  - for communicating with peers
  - one-to-one communication with me
- Use Appropriate Tags
- Response in < 48 business hours

Office Hours

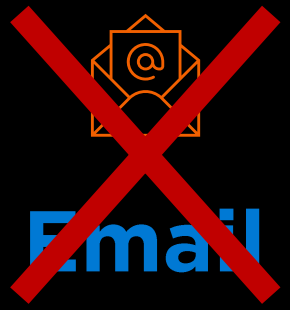
- Mon 5-6 pm
- Wed 1-2 pm
- By Appointment (24 hours in advance)

Communication

Email

Fine for

- Personal
- Accommodations
- Emergencies



Email

Not okay for

- Questions regarding logistics
- Questions on coding
- Fixing bugs

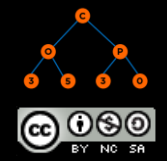
Communication

Canvas Messages

Phone Call

Debugging

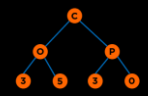
- Students should visit the course staff during scheduled office hours for help and provide context for help.
- Debugging requests for projects/quiz questions must first go through the TAs or peer mentors. This is strongly encouraged given we have a large class and several of you might have similar questions.
- If your problem is not fixed, then start a conversation with both the Instructor and the TA/Peer mentor who you asked for help. Debugging requests to the Instructor as a Slack direct message or an email will be ignored if you do not follow the above protocol.



Grading

Modality	Assignment	% of Final Grade
Individual	Programming / HTG Quizzes (drop two lowest scores)	12%
	Conceptual Quizzes (drop two lowest scores)	10%
	Exam 1	22%
	Exam 2 (Cumulative)	22%
	Project 1	12%
	Project 2	10%
Collaborative	Final Project (Individual or Group: 3a & 3b)	12%
Individual	Extra Credit Opportunities & Bug Bounty Program	Up to 2%
		Total: 102%

Total assessments: 28 excluding extra credit

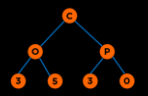


Timeline

Week	Dates*		Topic	Deadlines
1	9 May	13 May	Overview, Algorithm Analysis, and Lists	
2	16 May	20 May	Stacks, & Queues / Trees & Traversals	Q_1 Q_2
3	23 May	27 May	Trees & Traversals / Balanced Trees 1	Q_3
4	31 May	3 Jun	Balanced Trees 2	Q_4
5	6 Jun	10 Jun	Heaps & Priority Queues / Sorting	P_1
6	13 Jun	17 Jun	Sorting / Exam 1	E_1, Q_5, Q_6
	20 Jun	24 Jun	Summer Break	
7	27 Jun	1 Jul	Sets, Maps, & Hashing / Graphs 1	P_{3a}, Q_7
8	5 Jul	8 Jul	Graphs 1 and 2	Q_8
9	11 Jul	15 Jul	Graphs 2 / Greedy Algorithms	Q_9, P_2
10	18 Jul	22 Jul	Greedy Algorithms / Dynamic Programming	Q_{10}
11	25 Jul	29 Jul	Dynamic Programming / Exam 2	E_2, Q_{11}
12	1 Aug	5 Aug	Complexity Theory	P_{3b}

*Note: There will be no in-class lectures on May 23, May 25, June 27, and June 29 due to business travel. You will watch pre-recorded videos.

Legend: Q_N = Programming and Conceptual Quiz N, P_N = Project N, E_N = Exam N



Programming Language

Default (Project 1 & 2, Stepik/Edugator, Quizzes):

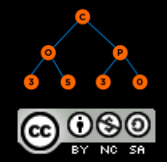
C++14

Compilation command:

```
g++ -std=c++14 -Werror -Wuninitialized -o EXECUTABLE_NAME YOUR_FILE.cpp
```

Project 3 or Final Project:

Any Language



Tools

Compiler

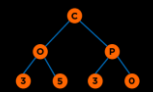
- G++
- Stepik/Edugator

IDE

- OnlineGDB
- Visual Studio Code
- Clion

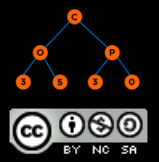
Textbook (Optional)

- **Data Structures and Algorithm Analysis in C++**
  - Mark Allen Weiss
  - Fourth edition, 2014, ISBN 9780132847377
- **OpenDSA Book**
  - https://opendsa-server.cs.vt.edu/OpenDSA/Books/Everything/html/index.html



Feedback

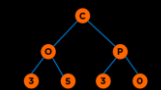
- COP 3530 Feedback Form
- Bug Bounty Program : Upto 1% EC in Range 0.2-1% per Bug
  - Quiz is not accessible due to a locked module
  - Typo in one of the quizzes/project descriptions
  - Incorrect solution in a certain test case
  - An accessibility bug such as no headings in documents for screen-readers
  - the algorithm has an off-by-one error



Expectations

- **We want you to focus on**
  - Correctness
  - Clean, readable, tested, and documented code
  - Secondary focus on optimization

- **The course will not cover**
  - Mathematical Proofs
  - Design Patterns
  - Competitive Programming

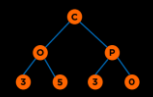


Academic Dishonesty

Quiz questions on Edugator, Quiz questions on Canvas, and Exams:

- Work independently
- No discussion at the conceptual level

- You are allowed to
  - discuss solutions after the due date and late days have passed.
  - search for C++ syntax or refer to definitions of standard functions in the C++ library. For example, using the documentation listed here is fine: https://www.cplusplus.com/reference/ or https://en.cppreference.com/w/

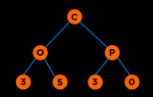


Academic Dishonesty

Project 1 and 2:

- Work independently
- Discussion at the conceptual level is fine if you are stuck with no sharing/viewing of code

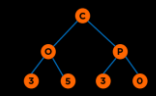
- You are allowed to
  - discuss conceptually without discussing any code with a peer provided you cite the peer with who you discussed it. Such discussions should be held on a whiteboard using explanation figures/pseudo-codes or through talking.
  - discuss solutions after the due date and late days have passed.
  - search for C++ syntax or refer to definitions of standard functions in the C++ library. For example, using the documentation listed here is fine: https://www.cplusplus.com/reference/ or https://en.cppreference.com/w/



Academic Dishonesty

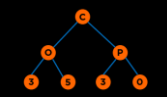
Project 3 and Stepik ungraded questions:

- It is fine to collaborate with peers. You must make sure you are not blindly copy-pasting another student's code. Also, you must cite the peer you worked with at the code level or conceptually.



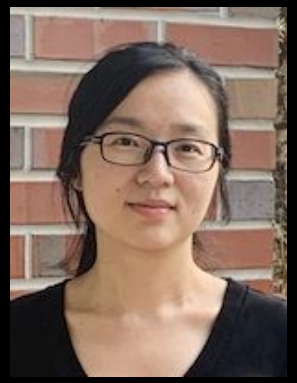
Academic Dishonesty

- Sharing/copying, “borrowing” of code structure, looking at code from another student or providing such code, and plagiarism, in addition to other dishonest behaviors, are all considered to be academic dishonesty.
- No information regarding the project 1 and 2, quiz, and exam solutions may be shared by students. We strongly encourage that if you have doubts, visit the course staff in-office hours. Looking at any piece of your peer’s code, sharing files, searching for solutions found online, or using someone else to code your solution is strictly prohibited.
- Penalty
  - zero on that assignment and a two-letter final grade decrement for a first offense
  - E grade for second offence
  - For both offenses, you will be reported to the Honor Court



Acknowledgements

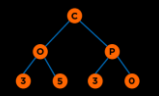
Cheryl Resch
Lecturer,
Dept. of Engineering Education,
University of Florida



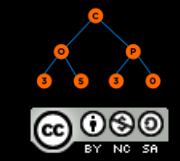
Lisha Zhou
Lecturer,
Dept. of Engineering Education,
University of Florida

References

- Books/Notes
  - Dr. Sartaj Sahni
  - Dr. James Aspen
  - Dr. Mark Weiss
  - OpenDSA
  - Dr. Cathy Hughes
- Videos Authority
  - Dr. Josh Hug
  - MIT OCW 6.006: Dr. Erik Demaine and Dr. Srini Devadas
  - Dr. Robert Sedgewick
- Videos Youtube
  - HackerRank: Data Structures
  - HackerRank: Algorithms
  - Back To Back SWE
  - MyCodeSchool
  - Abdul Bari
- GeeksforGeeks

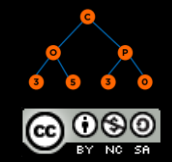


Walkthrough



Walkthrough

- Canvas
- OpenDSA
- Slack
- Stepik/Edugator



Questions