Data Structures & Algorithms

COP 3530 : Fall 2022

Data Structures & Algorithm

About Me: Amanpreet Kapoor

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

kapooramanpreet@ufl.edu

Course Staff

Robin
(Teaching Lead)

Andrew
(Infrastructure Lead)

Dustin

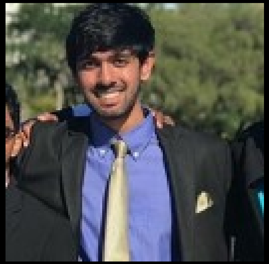
Julia

Michael

Mateusz

Rutvi

Blake



Nitin

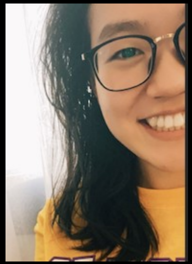
Emily

Eugene

Sunny

Eric

Richie



Tianwei

Sara

Leon

Olivia

Benjamin

Prayuj

Learners: Let’s Get to Know You

Go To Menti.com

Code: 6658 7211

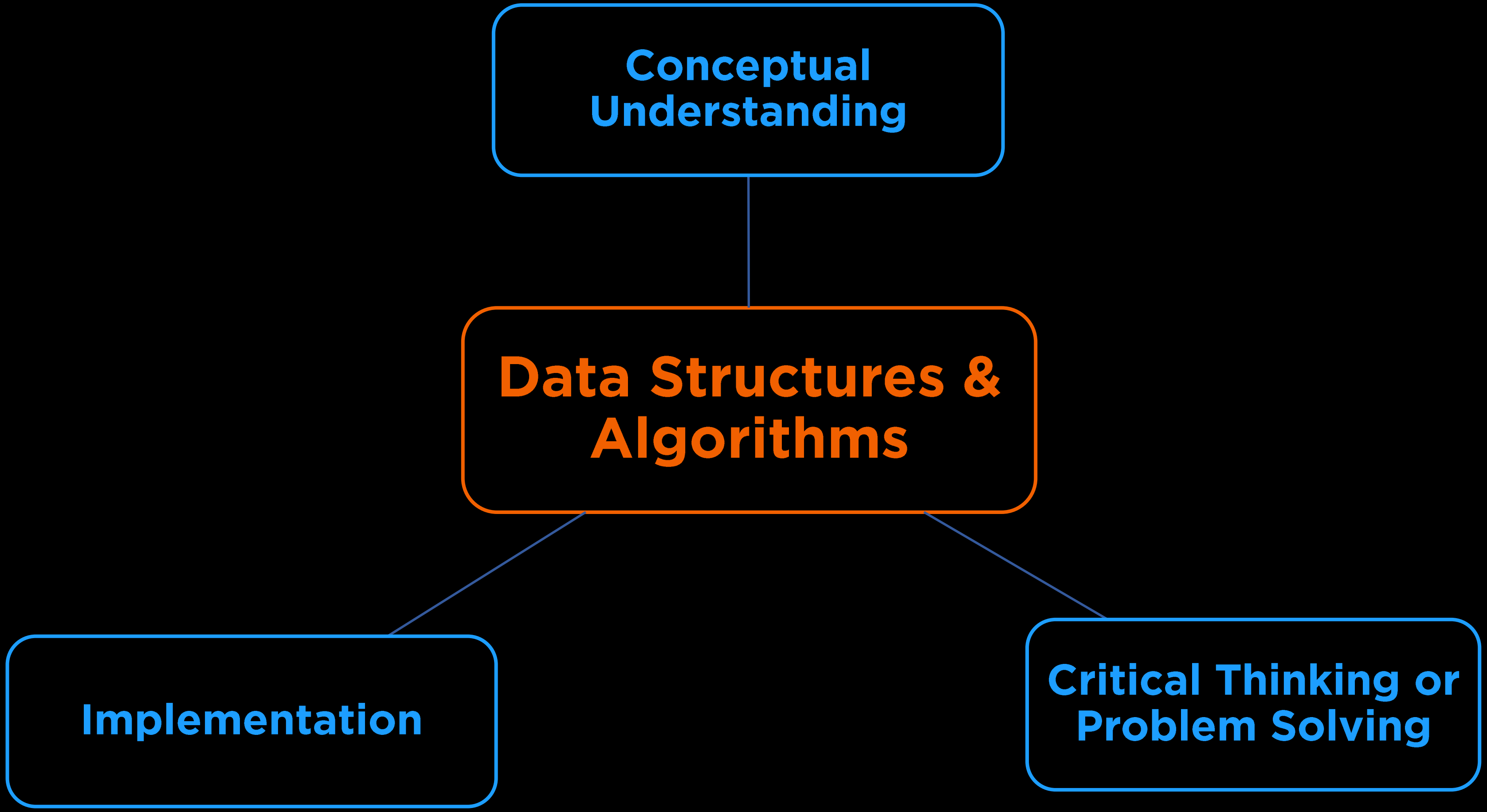
Course Objectives

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

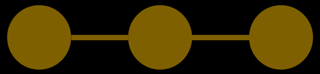
What is this Course About?

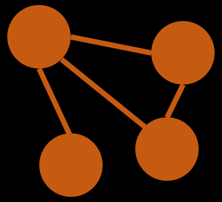


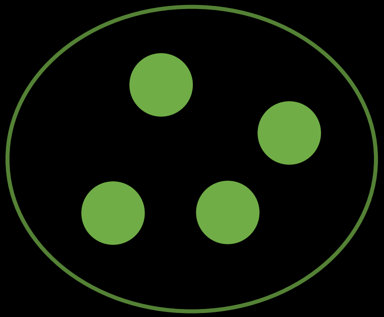
Conceptual Understanding
Data Structures & Algorithms
Implementation
Critical Thinking or Problem Solving

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

Attend in-person discussions on Tue/Wed.

1. Attend or watch lectures synchronously on Tue or Thu.
2. Optional: Watch recorded lectures asynchronously later.

1. Conceptual Quiz due on Fri.
2. Programming Quiz due on Fri.

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 4:05-4:55 pm
- Fri 9:35-10:25 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)	12%
	Conceptual quizzes (drop two lowest)	10%
	In-class/discussion activities (drop four lowest)	4%
	Exam 1	20%
	Exam 2 (Cumulative)	22%
	Project 1	12%
	Project 2	10%
Collaborative	Final Project (Individual or Group: 3a & 3b)	10%
Individual	Extra Credit Opportunities & Bug Bounty Program	Up to 2%
		Total: 102%

Total assessments: 28 excluding extra credit and class participation

Timeline

Week	Dates		Topic	Deadlines
1	24-Aug	28-Aug	Course Introduction	
2	29-Aug	4-Sep	Algorithm Analysis	Q_1
3	5-Sep	11-Sep	List, Stacks, & Queues	Q_2
4	12-Sep	18-Sep	Trees & Traversals	Q_3
5	19-Sep	25-Sep	Balanced Trees 1	Q_4
6	26-Sep	2-Oct	Balanced Trees 2	Q_{5a}
7	3-Oct	9-Oct	Heaps & Priority Queues	Q_{5b}, P_1
8	10-Oct	16-Oct	Exam 1 – October 13	Q_6, E_1
9	17-Oct	23-Oct	Sorting	
10	24-Oct	30-Oct	Sets, Maps, & Hashing	Q_7
11	31-Oct	6-Nov	Graphs 1	P_{3a}
12	7-Nov	13-Nov	Graphs 2	Q_8, P_2
13	14-Nov	20-Nov	Greedy Algorithms	Q_9
14	21-Nov	27-Nov	Dynamic Programming	Q_{10}
15	28-Nov	4-Dec	Exam 2 – December 1	Q_{11}, E_2
16	5-Dec	7-Dec	Complexity Theory	P_{3b}

Legend: Q_N = 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/Gradescope

IDE

- OnlineGDB
- Visual Studio Code
- Clion

Tools

Directory Structures

- src – includes .h and .cpp files

  (You can use lib/ too for separating interfaces - .h)
- test – contains test files
- build – contains executables (e.g. .exe)

- Know basic commands on compilation through command line:
  - cd, ls, mv, g++, pwd …

https://cplusplus.com/forum/beginner/261697
https://stackoverflow.com/questions/2360734/whats-a-good-directory-structure-for-larger-c-projects-using-makefile

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
- Gradescope

Questions