Northeastern
College of Engineering

INFO 6205: Program Structures and Algorithms

Course Information
Course Title: **Program Structure and Algorithms**
Course Number:INFO6205
Term and Year: Summer2025
Credit Hour: 4
CRN 52291
Course Format: ONLINE

Instructor Information
Full Name: Jagadeesh Vasudevamurthy Ph.D.
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Instructor Biography
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Teaching Assistant Information

Course Prerequisites
Graduate Level CSYE 6200 Minimum Grade of B- or Undergraduate Level INFO 5100 Minimum Grade of B- or Graduate Level INFO 5100 Minimum Grade of B-

Course Description
This course covers fundamental programming constructs and their performance. These include lists, stacks, queues, trees, trees, trees, trees, trees, tries, and graphs. The course emphasizes several problems- solving techniques: brute force, recursion, divide-and-conquer, dynamic programming, greedy algorithms, iterative improvement and backtracking. The course also covers both theoretical and experimental measurement of performance, as well as the concept of complexity. The course will also illustrate the various design techniques with problems in graph theory as it applies to social networking paradigms.

Data structures and algorithms are two facets of one fundamental technique of programming. It is impossible to have one without the other. The class will be detail oriented and will provide an essential component for anyone contemplating a career as a software developer. Although the subject could be studied using any language, the language of this class is Python 3.7 and above

Course Learning Outcomes
1. Describe, explain, and use abstract data types including stacks, queues, lists, tree, hash, and graphs.

2. Describe, explain, and implement using varieties of algorithmic techniques like divide and conquer, greedy algorithms, dynamic programming, and back tracking.
3. Describe the asymptotic performance of the algorithms studied in this course and understand the practical implications of that information.
4. Read, criticize, and analyze complexity of Python programs written by some other author.
5. Solve many of the interview problems efficiently on the Leetcode and Hacker Rank interview web sites and confidently attend Google, Amazon, and Facebook interviews. This course is a gold mine for students seeking jobs.

Required Tools and Course Textbooks.

No textbook required. You must install Jupyter notebook to solve the assignment.

Course Schedule/Topics Covered.

Week	Date	In Class Topic	Assignment Due
1	05/11	. Introduction 2. Basic data type 3. Pass by value 4. Swapping two objects in constant time 5. Class and objects 6. Int class 7. Data structure of Int 8. Need for private and public 9. Convert int to Python lost 10. Convert Python list to int 11. How to reverse in place Python List 12. Need for operator overloading 1. __str__ 2. __len__ 3, __getitem__ 4. __setitem__ 5. __add__ 6. __sub__ 7. __lt__ 8. __eq__	05/18
2	05/18	1. Introduction 2. OOP 3. Class 4. Objects 5. Test bench 6. Solution 7. Product of Array Except Self 8. How to write testbench as a class 9. O(n^2) tine complexity 9. O(n) time complexity 10. O(n) space complexity 11 O(1) space complexity 12. How to use Leetcode to evaluate software	05/25

3	**05/25**	**1. Pass by value** **2. Implementing python list as a dynamic growable array** **3. Table doubling algorithm** **4. Amortized cost** **5. O(1)** **6. Problem in prepending a list** **7. Problem in deleting an element from slist** **8. Need for a singly linked list** **9. append, prepend, find and delete objects from slist** **10. a[i] in a slst** **11. stack** **12. Queue** **13. Deque**	**06/08**
4	**06/08**	**1. Need for recursion** **2. Factorial using iteration and recursion** **3. Printing a digit of a number iteration and recursion** **3. Return the reverse value of an integer** **4. Need for helper function** **5. Merge sort** **6. Recurrence tree**	**06/15**
5	**06/15**	**1. Solution to HW** **2. Need for hash.** **3. Building hash from basic Python** **4. Using hash.**	**06/22**
6	**06/22**	**Graph Data Structure. Representation of million node graphs** **1 class Graph** **2. Build a graph from a file** **3 Dump of a graph as a text file** **4. Visualizing graphs using Graphviz package**	**06/29**
7	**06/29**	**1. Binary tree** **2. Complete binary tree** **3. Need for heap** **4. Max heap and min heap** **5. Representing heap an array** **6. Finding left, right and parent in THETA(1)** **7. How to build heap in nlogn and O(n) time** **8. Heap sort** **9. How to use heap from Python Library**	**NO HW**
8	**07/06**	**Midterm**	
9	**07/13**	**1. Greedy algorithm** **2. Need for dynamic programming** **3. Memorization and optimal table building** **4. Coin change problem**	**07/20**

		5. How to get answers back **6. 0/1 Knapsack problem**	
10	**07/20**	**1. Need for graph** **2. Transportation problem** **3. Minimal spanning tree** **4. Course selection** **5. Activity problem** **6. Directed and undirected graph** **7. Directed acyclic graph (DAG)** **8. Graph representation using matrices** **9. Graph representation using fan-in and fan-outut list**	**07/27**
11	**07/27**	**1. DFS using time stamps BFS.** **2. BFS** **3. Topological sort** **4. Dijkstra Algorithm**	**08/03**
12	**08/03**	**Binary tree** **1. Need for left and right pointers** **2. Why is parent pointer not required?** **3 Tree traversals** **4 Preorder, In order, post order, and Level order traversal** **5 Level order traversal.** **6 Tree visualization using Graphviz.**	**08/10**
13	**08/10**	**1. Huffman encoding** **2. Why Disjoint Set?** **3. Need for union and find** **4. Disjoint set data structure** **5. Union by size** **6. Path compression** **7. Inverse Ackerman function**	**08/17**
14	**08/24**	**FINAL**	**NO HW**

Assignment Grading

- Attendance – 5%
- 12 Programming assignments -45%
- Midterm Exam – 25%
- Final Exam – 25%

Grading Scale

Letter Grade Conversion Scale

Final percentage scores will align with the following letter grades and their Grade Point Equivalents (accurate to three decimal places, as used in transcripts and Degree Audits). These percentage ranges are defined to ensure clarity:

Percentage Range	Letter Grade	Grade Point Equivalent
95.0–100.0%	A	4.000
90.0–94.9%	A-	3.667
87.0–89.9%	B+	3.333
84.0–86.9%	B	3.000
80.0–83.9%	B-	2.667
77.0–79.9%	C+	2.333
74.0–76.9%	C	2.000
70.0–73.9%	C-	1.667
69.9% and Below	F	0.000

Attendance/Late Work Policy
Attendance Policy

In each term, students enrolled in on-ground sections are expected to be on campus and attending class beginning with the first day of classes. Students in online sections are expected to log in and participate in class beginning with the first day of classes.

Students who join a class after the first day of class during the university add period, or who are approved for late registration by the instructor and the Graduate School of Engineering, are responsible for all coursework missed prior to enrolling. In the interest of students' success, the college does not support the arrival of students to class after the university add deadline. **Enrolled students who do not attend class during the first week of a semester risk being dropped from the course.**

In cases where an enrolled student cannot arrive to campus by the first day of class due to circumstances beyond their control, it is the student's responsibility to contact the instructor for approval and notify the Graduate School of Engineering.

Students registered in MGEN courses (INFO, CSYE, and DAMG) are allowed **a maximum of 2 absences per course,** with 3 or more absences resulting in an 'F' for that course. Course instructors are not expected to make accommodations and students are expected to inform their instructors of any absences in advance of the class. Should a student anticipate being unable to attend 3 or more classes, they should discuss their situation with their Academic Advisor to explore other types of leave and accommodations in accordance with the University's academic and global entry expectations. Students may be asked to share communications about class absences with their Academic Advisor. If a student

is sick long-term or experiences a medical issue that prevents class attendance, it is strongly encouraged that they speak with their Academic Advisor (coe-gradadvising@northeastern.edu) to learn more about the Medical Leave of Absence. International students should review the Office of Global Services webpage to understand their visa compliance requirements.

Teaching Assistants (TAs) or Instructional Assistants (IAs) will be present at each class to collect student attendance.

Late Work Policy

Students must submit assignments by the deadline in the time zone noted in the syllabus. Students must communicate with the faculty prior to the deadline if they anticipate work will be submitted late. Work submitted late without prior communication with faculty will not be graded.

Course Evaluations
Student feedback on their learning experience is valuable and helps improve future courses. We encourage all students to complete the course evaluation surveys when they become available.

Surveys are distributed at both the midterm mark and the end of the term via email and are completely anonymous and confidential. Any questions about the surveys can be directed to mgen-programs@coe.northeastern.edu

MGEN Student Feedback
Students who would like to provide the MGEN unit with anonymous feedback on this particular course, Teaching Assistants, Instructional Assistants, professors, or to provide general feedback regarding their program, may do so using this survey: https://neu.co1.qualtrics.com/jfe/form/SV_cTIAbH7ZRaaw0Ki

Academic Integrity
A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

The following is a broad overview, but not an all-encompassing definition, of what constitutes a violation of academic integrity:

Cheating: The University defines cheating as using or attempting to use unauthorized materials, information, or study aids in any academic exercise. When completing any academic assignment, a student shall rely on their own mastery of the subject.

Fabrication: The University defines fabrication as falsification, misrepresentation, or invention of any information, data, or citation in an academic exercise.

Plagiarism: The University defines plagiarism as using as one's own the words, ideas, data, code, or other original academic material of another without providing proper citation or attribution. Plagiarism can apply to any assignment, either final or drafted copies, and it can occur either accidentally or deliberately. Claiming that one has "forgotten" to document ideas or material taken from another source does not exempt one from plagiarizing.

Unauthorized Collaboration: The University defines unauthorized collaboration as instances when students submit individual academic works that are substantially similar to one another. While several students may have the same source material, any analysis, interpretation, or reporting of data required by an assignment must be each individual's independent work unless the instructor has explicitly granted permission for group work.

Participation in Academically Dishonest Activities: The University defines participation in academically dishonest activities as any action taken by a student with the intention of gaining an unfair advantage over other students.

Facilitating Academic Dishonesty: The University defines facilitating academic dishonesty as intentionally or knowingly helping or contributing to the violation of any provision of this policy.

Please visit https://osccr.sites.northeastern.edu/academic-integrity-policy/ to access the full academic integrity policy.

University Health and Counseling Services
As a student enrolled in this course, you are fully responsible for assignments, work, and course materials as outlined in this syllabus and in the classroom. Over the course of the semester if you experience any health issues, please contact UHCS.

For more information, visit https://www.northeastern.edu/uhcs.

Student Accommodations/Disability Access Services (DAS)
Northeastern University and the Disability Access Services (DAS) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations, students must provide appropriate documentation as provided by the DAS office.

If the course is conducted in an on-ground (in-person) format, students are expected to attend class physically as scheduled. Professors are **not required to provide virtual attendance links** unless a student has documented accommodation approved by the **Disability Access Services (DAS) office**

and their **Academic Advisor**. If a student requires accommodation for remote participation, they must submit a formal request through the **Disability Office** and coordinate with their **Academic Advisor** prior to the course start date.

For more information, visit https://disabilityaccessservices.sites.northeastern.edu/

Office of Global Services
As an F-1, J-1, or Study Permit student, you must meet certain obligations in order to maintain lawful nonimmigrant status. Maintaining status is necessary in order to retain eligibility for the benefits of F-1 or J-1 status, such as employment authorization and program extension, and can be crucial to a successful application for a change or adjustment of nonimmigrant status in the future. Failure to maintain your nonimmigrant status can result in serious problems with immigration and *could lead to deportation from the U.S. or Canada.*

Students must maintain on-ground presence throughout the academic term. At Northeastern, there are four different defined instructional methods: Traditional, Hybrid, Live Cast, and Online. Traditional, Hybrid, and Live Cast courses meet the Visas' on-ground presence requirements. **Online courses do not meet the Visas' on-ground presence requirements.**

Students enrolled in Summer courses should adhere to OGS guidelines on maintaining status during the Summer term.

For more information please visit, https://international.northeastern.edu/ogs/current-students/understanding-visa-requirements/guidelines-on-maintaining-status/

Library Services
The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals.

For more information and for education specific resources, visit https://library.northeastern.edu
Network Campus Library Services: Northeastern University Library Global Campus Portals

24/7 Canvas Technical Help
For immediate technical support for Canvas, call 617-373-4357 or email help@northeastern.edu

Canvas Student Resources: https://canvas.northeastern.edu/student-resources/

For assistance with my Northeastern e-mail, and basic technical support:
Visit ITS at https://its.northeastern.edu
Email: help@northeastern.edu
ITS Customer Service Desk: 617-373-4357

Outreach, Engagement, Belonging

Northeastern University is committed to fostering a community of belonging, which is essential to the advancement of Northeastern University's mission of teaching and research. Our university is stronger as a result of the varied backgrounds, experiences, and perspectives that all members of our global community bring to the pursuit of knowledge. Embracing this pluralism is not the work of one office, department, or academic unit. It is a shared responsibility that spans disciplines and boundaries. By harnessing the power of our differences, we will continue to light the path to bold new ideas and life-changing discoveries.

It is my intention that students from all backgrounds and perspectives will be well served by this course, and that the diverse experiences that students bring to this class will be viewed as an asset. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, socioeconomic background, family education level, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and belonging environment for every other member of the class. Your suggestions are encouraged and appreciated.

Please visit Belonging at Northeastern – Northeastern Provost for complete information.

Title IX

Northeastern University complies with federal, state, and provincial civil rights laws and prohibits discrimination within any of its programs, activities, and services in accordance with *Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments Act of 1972, Age Discrimination Act of 1975, U.S. Department of Homeland Security Regulation 6 C.F.F. Part 19, and other applicable civil rights laws and regulations.*

In case of an emergency, please call 911.

*Please visit **https://ouec.northeastern.edu/services/** for a complete list of reporting options and resources both on- and off-campus.*