

CMSC 401

Algorithm Analysis with Advanced Data Structures

Syllabus (Spring 2023)

Catalog listing:	CMSC 401
Course Level:	Undergraduate
Prerequisites:	CMSC 256 and CMSC 302
Instructor:	Daniel Cranston
Office:	E4249
email:	dcranston@vcu.edu
Classroom:	MW 4:00 PM – 5:15 PM (Engineering Hall West 101)
Class website:	Canvas
Office Hours:	MW – 1-2pm (room E4249)
TAs:	Reem Mahmoud Office hours: F 1-2pm, 3-5pm (outside Engineering Hall West 101)

1.0 – Overview (Catalog Course Description):

Semester course; 3 lecture hours. 3 credits. Prerequisites: CMSC 256 with a grade of C or better and CMSC 302 with a grade of C or better. Introduction to algorithm analysis and complexity classes. Advanced data structures topics including multiple linked lists, height-balanced trees, B-trees, hashing and graph representation; incorporating data structures into object-oriented design. Analysis of various searching and sorting algorithms. Algorithm design topics include divide-and-conquer, dynamic programming and greedy methods.

2.0 – Course Structure:

Lecture hours/week –	3
Lab hours/week –	0

3.0 – Course Goals

Upon successful completion of this course, the student will be able to:

- Understand and run given algorithms.
- Analyze the asymptotic running time of given algorithms (for recursive algorithms, extract and solve a recurrence bounding the running time).
- Choose appropriate data structures to efficiently support given algorithms.
- Given a new problem, design an algorithm to solve it and/or show how to solve it by applying a known algorithm.
- Justify (prove) all claims of correctness and running time.
- Describe all algorithms in English.
- Determine the boundaries of own current understanding and take systematic steps to expand that understanding. (This is a key to lifelong learning.)

4.0 – ABET Criteria Addressed:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
6. Apply computer science theory and software development fundamentals to produce computing-based solutions.

Other Criteria Addressed:

- Substantial coverage of algorithms and complexity, computer science theory, concepts of programming languages, and software development.

5.0 – Major Topics Covered:

- Foundations of algorithm and complexity analysis
- Solving recurrences
- Divide and conquer approach
- Advanced Data Structures
- Sorting and Order Statistics
- Advanced design and analysis techniques
- Graph algorithms (BFS, DFS, Dijkstra, MST, Max-Flow)
- Greedy Approach
- Dynamic programming

6.0 – Textbooks:

Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms, Third Edition"

Jeff Erickson, "Algorithms" (recommended)

Both books are available on Canvas. Erickson's is also at <http://algorithms.wtf>

7.0 – Class Schedule:

- Lecture: M/W 4:00 PM – 5:15 PM (Engineering Hall West 101)
- Lab: None

8.0 – Evaluation:

General Instructions:

Exams: There will be 2 midterms and a final. Tentative Exam Schedule:

- Midterm 1: Feb 22 (Thu class) Topics: Lectures 0-8
- Midterm 2: Mar 29 (Thu class) Topics: Lectures 9-16

- Final: May 10 Topics: Cumulative, with emphasis on material after Midterm 2.

No make-ups for exams (unless special permission has been given prior to the date of the test, usually for a medical emergency.)

Course assignments:

- Weekly homework and daily classwork (submit on Canvas)

Late submissions: 24 hour automatic extension for weekly homework; after that it will not be accepted (no excuses, plan accordingly).

Grading:

Category	% weight
Weekly Homework	20%
Daily Classwork	10%
Test 1	20%
Test 2	20%
Final	30%

Final grade:

A (85% - 100%),
B (70% - 84.99%),
 C (60% - 69.99%),
 D (50%-59.99%),
 F (0% - 49.99%)

9.0- Resources needed:

Java compiler - required
 Canvas - required
 Discord - required, for asynchronous Q&A outside of office hours
 Standard computing resources (computer, operating system, editor, PDF viewer, email client, web browser etc.) - required

Students should also visit <http://go.vcu.edu/syllabus> and review all syllabus statement information. The full university syllabus statement includes information on safety, registration, the VCU Honor Code, student conduct, withdrawal and more.