

# CMSC 401

## Algorithm Analysis with Advanced Data Structures

### Spring 2025 Syllabus

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**Catalog listing:** CMSC 401  
**Course Level:** Undergraduate  
**Prerequisites:** CMSC 256 and CMSC 302  
**Instructor:**  
**Office:**  
**email:**  
**Classroom:** MW 4:00 PM – 5:15 PM  
**Class website:** CANVAS  
**Office Hours:** F 12-2pm  
**TAs:**

Office hour: TR 3-4pm, F 11am-12pm

Office hour: M/W 3-4pm

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#### 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. Topics covered include foundations of algorithm and complexity analysis, advanced data structures including heaps, B-trees, hashing and graph representation; incorporating data structures into object-oriented design; analysis of various searching, sorting and shortest-path 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:

- Apply mathematical knowledge to analyze algorithm's computational complexity
- Use knowledge of computing to prove correctness of algorithms
- Make correct design choices on the type of data structures and the type of the algorithms to use to solve given problems

#### **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 – Textbook(s):**

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

Book is available online at VCU library

<https://ebookcentral.proquest.com/lib/VCU/detail.action?docID=6925615>

#### **7.0 – Class Schedule:**

- Lecture: M/W 4:00 PM – 5:15 PM
- Lab: None

#### **8.0 – Evaluation:**

##### **General Instructions:**

**Exams:** There will be 2 tests and one final exam. **Tentative** Exam Schedule:

- Test 1: February 17, Topics: Lectures 0-8
- Test 2: March 19, Topics: Lectures 9-16
- Final exam: April 23, Topics: Mostly Lectures 17-24 (may include content from Test 1-2 topics)

**No make-ups for exams** (unless special permission has been given prior to the date of the test.)

**Course assignments:**

- 4 programming assignments
- 3 theory assignments

**Late submissions:** 1 day: 20% penalty, 2 days 40% penalty, after 2 days not accepted (no excuses, plan accordingly).

**Grading:**

Category	% weight
Participation Quiz	5% (5-10 of them)
Programming Assignments	30% (7.5% each)
Theory Assignments	15% (5% each)
Test 1	15%
Test 2	15%
Final exam	20%

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

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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.