Syllabus: CS 4104
Data and Algorithm Analysis
Fall, 2017

1 General Course Information

CRN	82576
Meeting Time	9:30 PM–10:45 PM; Tuesdays and Thursdays
Classroom	113 McBryde Hall
Final Exam	Monday, December 18, 7:45 AM–9:45 AM

Instructor: Lenwood S. Heath

- **Office:** 2160J Torgersen Hall
- **Office Hours:** 1:00–3:00, Tuesdays and Thursdays
- **Email:** `heath@vt.edu`

Teaching Assistants:

	Zhen Guo	You Lu
Email	`zguo@vt.edu`	`you.lu@vt.edu`
Office Hours	See Web site	See Web site
Room	See Web site	See Web site

Web Site: `http://courses.cs.vt.edu/cs4104/heath/Fall2017/index.php`

Canvas: `https://canvas.vt.edu/`

Piazza: `https://piazza.com/vt/fall2017/cs4104`

Prerequisites:

- CS 3114, Data Structures and Algorithms; minimum grade C
- MATH 3134, Applied Combinatorics and Graph Theory, or MATH 3034, Introduction to Proofs

Required Textbook: Introduction to Algorithms (Third Edition). Cormen, Leiserson, Rivest, and Stein. MIT Press, 2009. ISBN: 978-0-262-03384-8.

2 Course Description

This course emphasizes techniques for constructing efficient algorithms and techniques for analyzing the efficiency of an algorithm. The notion of a *problem* is defined. Problems in a number of application areas are covered. Lower bounds on the efficiency of solving a problem are also addressed, especially the notion of NP-completeness.

3 Grading Policy

Grading for the course is on a 1000-point scale, with the points distributed as follows:

Homework assignments: 10 at about 60 points each	600
Midterm exam: October 12, 2017	150
Final exam: Monday, December 18, 7:45 AM–9:45 AM	250

A typical homework assignment consists of 2 to 4 problems, posted on the course web site approximately one week before the due date.

All homework must be prepared with LaTeX[1] or other word processing system and submitted as a PDF to Canvas by 5:00 PM on the due date[2]. **No late homework will be accepted.**

4 Readings

For most classes, there is a reading assignment (see Section 8) to be completed by class time. Each assignment consists of sections in the textbook.

5 Online Modules

Some online modules created by Professor Shaffer for senior algorithms are found here:

`https://canvas.instructure.com/courses/1179276`

Click on the "Join this Course" link if you want to work through the modules in detail and have your progress tracked. The modules on "Limits to Computing" will be especially useful in our study of NP-completeness.

[1] See LaTeX resources on the course web site.

[2] See Calendar on the course web site.

6 Ethics

The Honor Code applies. All work submitted must be the student's own work. Students may solicit help only from the instructor or the teaching assistants.

The Undergraduate Honor Code pledge that each member of the university community agrees to abide by states: **"As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do."**

Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code. For additional information about the Honor Code, please visit: `www.honorsystem.vt.edu`.

If you have questions or are unclear about what constitutes academic misconduct on an assignment, please speak with me. I take the Honor Code very seriously in this course. The normal sanction I will recommend for a violation of the Honor Code is an F* sanction as your final course grade. The F represents failure in the course. The "*" is intended to identify a student who has failed to uphold the values of academic integrity at Virginia Tech. A student who receives a sanction of F* as their final course grade shall have it documented on their transcript with the notation "FAILURE DUE TO ACADEMIC HONOR CODE VIOLATION." You would be required to complete an education program administered by the Honor System in order to have the "*" and notation "FAILURE DUE TO ACADEMIC HONOR CODE VIOLATION" removed from your transcript. The F however would be permanently on your transcript.

7 Announcement

If any student needs special accommodations because of a disability, please contact the instructor during the first week of classes.

8 Course Schedule

Dates	Reading Assignment	Topics
August		
8/28–9/1	Chapters 1 and 2	Problems, complexity, analysis
September		
9/4–9/8	Chapter 3; Section 15.1	Asymptotics; dynamic programming
9/11–9/15	Sections 15.2–15.4	Dynamic programming
9/18–9/22	Sections 16.1–16.3	Greedy algorithms
9/25–9/29	Section 22.1–22.4	Depth-first search; topological sort
October		
10/2–10/6	Section 23.1–23.2	Substitution arguments; minimum spanning trees
10/9-10/13	Sections 24.1–24.3	Single-source shortest paths; relaxation; Bellman-Ford; Dijkstra
10/12	**Midterm Exam**	Topics through minimum spanning trees
10/16-10/20	Sections 25.1–25.2	All-pairs shortest paths; Floyd-Warshall; transitive closure
10/23–10/27	Sections 34.1–34.2	Polynomial time; optimization and decision problems; encoding problems
10/30–11/3	Sections 34.2–34.3	Polynomial-time reductions and NP-completeness
November		
11/6–11/10	Sections 34.4–34.5	Proving problems NP-complete
11/13–11/17	Sections 35.1–35.3	Approximation algorithms
11/20–11/24	Thanksgiving Break	
11/27–12/1	Sections 32.1–32.3	String matching
December		
12/4–12/8	Sections 26.1–26.3	Maximum flow; maximum bipartite matching
12/12	**Last Day of Class**	Review for final; questions on homework solutions and course material
12/18	**Final Exam**	**7:45 AM–9:45 AM:** Comprehensive final exam

End of Syllabus