Syllabus: CS 4104
Data and Algorithm Analysis
Spring, 2018

1 General Course Information

CRN	12738
Meeting Time	1:25 PM–2:15 PM; Monday/Wednesday/Friday
Classroom	250 New Classroom Building
Final Exam	Tuesday, May 8, 3:25 PM–5:25 PM

Instructor: John Paul C. Vergara

- **Office:** 2160M Torgersen Hall
- **Office Hours:** 1:00–2:30 PM, Tuesday/Thursday
- **Email:** `jvergara@vt.edu`

Teaching Assistants:

	Chidubem Arachie	Daniel Junker
Email	`achid17@vt.edu`	`dcj2114@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/Spring2018/index.php`

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

Piazza: `https://piazza.com/vt/spring2018/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: March 2, 2018	150
Final exam: Tuesday, May 8, 3:25 PM–5:25 PM	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]. Also, any required drawings must be drawn in a drawing program, not scanned and inserted. **No late homework will be accepted.**

4 Grading Scale

Grade	Points
A	930–1000
A-	900–929
B+	870–899
B	830–869
B-	800–829
C+	770–799
C	730–769
C-	700–729
D+	670–699
D	630–669
D-	600–629
F	0–599

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

[2] See Calendar on the course web site.

5 Readings

For most classes, there is a reading assignment (see Section 9) to be completed by class time. Each assignment consists of sections in the textbook.

6 Online Modules

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

`https://canvas.instructure.com/enroll/8PMDLD`

Enroll in the course to have your progress tracked. The modules on "Limits to Computing" will be especially useful in our study of NP-completeness.

7 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.

8 Announcement

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

9 Course Schedule

Dates	Reading Assignment	Topics
	January	
1/16–1/19	Chapters 1 and 2	Problems, complexity, analysis
1/22–1/26	Chapter 3; Section 15.1	Asymptotics; dynamic programming
1/29–2/2	Sections 15.2–15.4	Dynamic programming
	February	
2/5–2/9	Sections 16.1–16.3	Greedy algorithms
2/12–2/16	Section 22.1–22.4	Depth-first search; topological sort
2/19–2/23	Section 23.1–23.2	Substitution arguments; minimum spanning trees
2/26-3/2	Sections 24.1–24.3	Single-source shortest paths; relaxation; Bellman-Ford; Dijkstra
	March	
3/2	**Midterm Exam**	Topics through minimum spanning trees
3/5–3/9	Spring Break	
3/12-3/16	Sections 25.1–25.2	All-pairs shortest paths; Floyd-Warshall; transitive closure
3/19–3/23	Sections 34.1–34.2	Polynomial time; optimization and decision problems; encoding problems
3/26–3/30	Sections 34.2–34.3	Polynomial-time reductions and NP-completeness
	April	
4/2–4/6	Sections 34.4–34.5	Proving problems NP-complete
4/9–4/13	Sections 35.1–35.3	Approximation algorithms
4/16–4/20	Sections 32.1–32.3	String matching
4/23–4/27	Sections 26.1–26.3	Maximum flow; maximum bipartite matching
	May	
5/2	**Last Day of Class**	Review for final; questions on homework solutions and course material
5/8	**Final Exam**	**3:25 PM–5:25 PM:** Comprehensive final exam

End of Syllabus