Class Syllabus

CSE 4081 & CSE 5211 Analysis of Algorithms

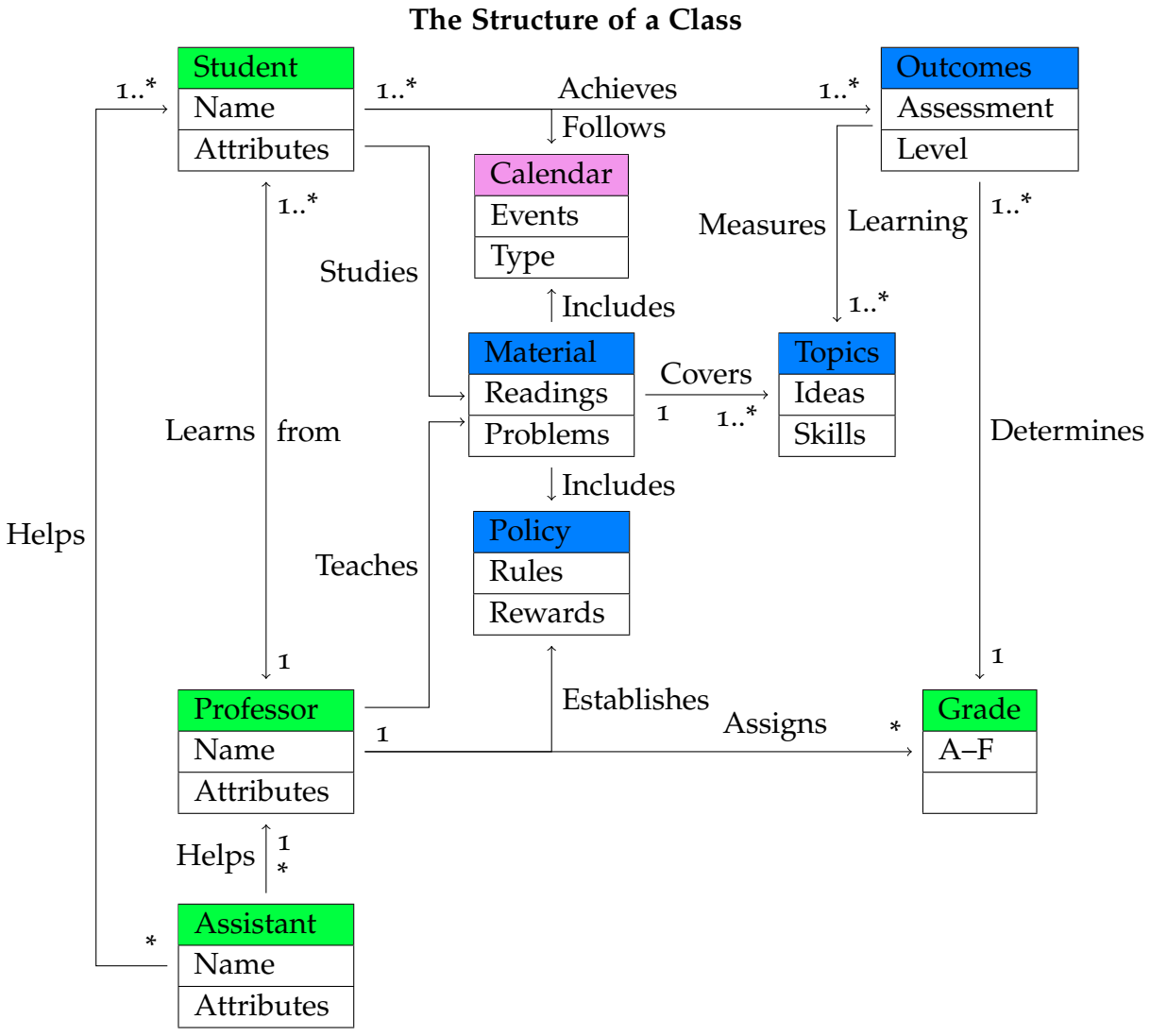
Instructor: William David Shoaff

Department of Computer Engineering & Sciences

College of Engineering and Sciences

Florida Tech

Spring 2022 2022(Compiled: January 17, 2022)



Student Outcomes

By the end of the course, each student will be able to:

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.
3. Communicate effectively in a variety of professional contexts.
4. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
5. Plan, develop requirements, design, implement, test, and present a useful and robust software system.
6. Acquire and apply new knowledge as needed, using appropriate learning strategies.
7. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Course Schedule

Course Number/Section	Title	Days	Times	Place
CSE 4081/01	Analysis of Algorithms	MWF	1:00-1:50	Evans Library Pavillion P – 133
CSE 5211/01	Analysis of Algorithms	MWF	1:00-1:50	Evans Library Pavillion P – 133

Catalog Descriptions

CSE 4081 Analysis of Algorithms

Credit Hours: 3 Covers time and space complexity of algorithms. Analyzes algorithms for sorting, searching, string processing and graph problems. Presents strategies such as brute-force, divide-and-conquer, greedy, dynamic programming, and backtracking as problem-solution paradigms.

Prerequisite: CSE 2010 or (ECE 2552 and ECE 3541)

5211 Introduction to the Analysis of Algorithms

Credit Hours: 3 Presents time and space complexity of computer algorithms. Includes algorithm classes, such as divide-and-conquer, greedy, dynamic programming and backtracking; techniques for solving recurrence equations; graph algorithms; searching and sorting; and deterministic and nondeterministic polynomial time problem classes.

Recommended: Background knowledge equivalent to CSE 2010 Algorithms and Data Structures and MTH 1002 Calculus 2.

Students, Professor & Assistants

Students

Get to know your fellow classmates. Help each other. The roster is on Canvas Learning Management System. There is a group/team assignment.

The Professor


William David Shoaff

3/Harris Center for Science and Engineering, Room 209

wds@cs.fit.edu

(Please don't use Canvas to email me: It creates an indirection making communication difficult)


Office: (321) 674-8066; Home (321) 474-7823


Office Hours WDS Personal Zoom Meeting Room ID – 569 113 5725
MWF 10:00 – 10:45, or by appointment, walk-ins welcome

Teaching Hours:


Teaching Hours:
CSE 4083/5210 MWF 10:00 A.M. Evans Library 133;
CSE 4101/4201 MWF 11:00 A.M. Crawford 404;
CSE 4081/5211 MWF 1:00 P.M. FITCommons 244);
CSE 3100 M 3:00 P.M. Olin Life Sciences 129;

Assistant

Josias Moukpe Tuesday 9am - 10:30am Thursday 9am - 10am, followed by CS Help Desk from 10am - 12pm For all those hours, I will be located at 118 Henry Building in Student Success Support Center (South of Panther Dining Hall).

Here is the link to the CS Help Desk times Help Desk

Calendar

Dates for exams, projects, and presentations are predictions and subject to change. Attend class and listen to Canvas announcements for updates. A more detailed weekly schedule is posted below.

The Florida Tech calendar for this Spring 2022is here.

The The course calendar of assignments is subject to changed based on the flow of the course: Descriptions of assignments are posted in the Module tab on Canvas Learning Management System. Each assignment contributes 25% toward your course grade.

- An Individual Project Due Friday of week 7.
- Comprehensive Midterm, scheduled for Friday of week 9.
- A Group Project with presentations to begin on Monday of the 14^{th} week.
- A Comprehensive Final, This final is scheduled by the registrar

Policy

Academic Accommodations: Florida Tech is committed to equal opportunity for persons with disabilities in the participation of activities operated or sponsored by the university. Therefore, students with documented disabilities are entitled to reasonable educational accommodations. The Office Accessibility Resources (OAR) supports students by assisting with accommodations, providing recommended interventions, and engaging in case management services. It is the student's responsibility to make a request to OAR before any accommodations can be approved/implemented. Also, students with/approved accommodations are encouraged to speak with the course instructor to discuss any arrangements and/or concerns relating to their accommodation class. Office of Accessibility Resources (OAR): Telephone: (321) 674-8285

accessibilityresources@fit.edu Website: https://www.fit.edu/accessibility-resources"

Recording Disclosure: This course will be recorded for use by students and faculty. Enrolled students are subject to having their images and voices recorded during the classroom presentations, remote access learning, and online course discussions. Course participants should have no expectation of privacy regarding their participation in the class. Recordings may not be reproduced, shared with those not registered in the course, or uploaded to other online environments. All recordings will be deleted at the conclusion of the academic term.

Mandatory Face Covering In accordance with "Florida Tech Safe: Return to Learn" procedures, instructors will enforce Florida Tech's mandatory face covering policy in all classrooms and teaching labs. All students must wear appropriate face coverings that cover their mouth and nose during all face-to-face course meetings. Students who fail to comply with this policy will be required to leave the classroom immediately. Students unable to comply may contact the Dean of Students Rodney Bowers for further options.

Title IX The Patsy L. Mink Equal Opportunity in Education Act, is also know as Title IX: Title IX of the Education Amendments of 1972 is a federal civil rights law that prohibits discrimination on the basis of sex in federally funded education programs and activities. Florida Institute of Technology policy also prohibits discrimination on the basis of sex. Florida Tech faculty are committed to helping create a safe learning environment for all students that is free from all forms of discrimination and sexual harassment, including sexual assault, domestic violence, dating violence, and stalking. If you, or someone you know, have experienced or is experiencing any of these behaviors, know that help and support are available.

Florida Tech strongly encourages all members of the community to take action, seek support, and report any incident of sexual harassment or gender discrimination to

Fanak Baarmand the Title IX Coordinator for the university. All incidents or complaints concerning Title IX policy violations should be referred to her.

Office: Room 135, Quad 401, Miller Building Phone: (321) 674-8885
fbaarman.edu

Please note that as your professor, I am required to report all incidents to the Title IX Coordinator. If you wish to speak to an employee who does not have this reporting responsibility, please contact the Student Counseling Center at (321) 674-8050.
Please see, read, and understand title IX

Topics

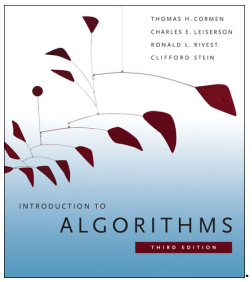
Here is a partial list of topics I hope to present and you will master. You can spend a lifetime and still have more to learn.

The emphasis is on algorithmic problem-solving. Algorithmic elegance and generality are also quality characteristics, but perhaps more difficult to measure.

1. Growth of functions: Asymptotic notation: Big-Omicron (People say "Big-O", but I wanted to be fancy and pay homage to Don Knuth), Big-Omega Ω, and Big-Theta Θ.
2. Divide-and-conquer algorithms
3. Sorting Algorithms: Best, Worst, and Average Case Analysis

4. Hash tables
5. Dynamic programming
6. Greedy algorithms
7. Amortized analysis
8. Graph algorithms
9. String algorithms
10. Approximation algorithms
11. Probabilistic Analysis and Randomized algorithms
12. Complexity theory: Deterministic and Non-Deterministic Polynomial time algorithms; NP-Complete and NP-Hard Problems

Material



The textbook for this class is (Cormen et al., 2009).

My (old) URL for the class is

http://cs.fit.edu/~wds/classes/iaa

There you will find the following material

1. an (historic) syllabus
2. (historic) The class handouts

There are many excellent sources that you can use to learn topics about algorithms:

- (Bentley, 1982),
- (Bentley, 1988),
- (Bird, 2010),
- (Graham et al., 1989),
- (Knuth, 1997a)
- (Knuth, 1997b),
- (Knuth, 1998),
- (Okasaki, 1998),
- (Rabhi and Lapalme, 1999)
- (Stinson, 1987).

There is additional material on the Canvas Learning Management Systemunder Modules. The main use of the Canvas Learning Management Systemis communicating announcements, posting material in Modules, posting grades, and linking back to (old) files stored at the class URL.

Individual project

Full description will be posted on (Canvas Learning Management System)

- Instructor selected
- Programming language: Individual student choice
- Deliverables: Same as team project deliverables, (see below)
- Complete before the start of the seventh week.

Team project

Full description posted on (Canvas Learning Management System)

- Self-organizing team of 2 to 3 students (submit team roster to instructor before end of week 3.
- Team selected project (submit topic to instructor before end of week 4.
- Deliverables:
  - Problem statement,
  - (Pseudo-code) for at least one algorithm that solves the problem,
  - Code compiled and executed (team choice for programming language),
  - Build and execution instructions,
  - Mathematical analysis of the algorithms' time and /space complexity,
  - Profile report of the algorithms' execution,
  - Slides for in-class presentation,
  - Summary of team-members' contributions,
  - A written report.
  - Complete before penultimate week of the course.

Grades

Your final grade will be based on your performance on exams and projects. Exams and Projects will be submitted electronically using the Canvas Learning Management System.

Grades and their relation to performance

Grade	A	B	C	D	F
Performance	Excellent	Good	Average	Poor	Failure

Student performance is measured in the following ways.

1. Individual Project (25% of grade)
2. Team Project (25% of grade)
3. Midterm Exam (25% of grade)
4. Final Exam (25% of grade)

Your score S will be a number between 0 and 100 computed by the formula

$$S = \frac{25}{100} \sum (\text{individual projects} + \text{team project} + \text{midterm} + \text{final})$$

Extra credit will not be given.

Final letter grades will be assigned based on the range in which your score S falls:

$$(90 \leq S \leq 100) \Rightarrow \texttt{A}, \quad (80 \leq S \leq 89) \Rightarrow \texttt{B}, \quad (70 \leq S \leq 79) \Rightarrow \texttt{C}, \quad (60 \leq S \leq 69) \Rightarrow \texttt{D}, \quad (0 \leq S \leq 59) \Rightarrow \texttt{F}$$

The last day to withdraw for the class with a final grade of `W` is Friday March 25.

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Measure of Success

The target achievement levels for the class are:

- 70% of students will score at or above average (70%) on the final comprehensive examination. The questions on the final measure attainment of course outcomes.
- 80% of students will rate their teammates as good to excellent as measured by a rubric completed by teammates.
- 80% of students will be rated as good to excellent communicators as measured by a rubric completed classmates and the instructor.

Checking Grades

Check you grades on Canvas Learning Management System. Contact your professor when you find an error in your recorded grades. Be able to document the error.

Weekly Schedule

This is a projection of the week-by-week class topics and assignments. It may change as the term progresses. Pay attention to announcements on the Canvas Learning Management System.

All material is covered in the textbook:  . My summaries in the class handout are not a substitute for the more complete treatment in the textbook. When the assignment says "Read . . . " it means read material in the class handout or textbook.
Use supplemental sources such as Wikipedia as well. Learn to learn.

Week	Weekly Topic	Assignment
Week 1	Syllabus	Read the preliminary material.
Week 2	Introduction	Read the introduction material.
Week 3	Algorithmic Design	Read the algorithmic design material, submit team roster.
Week 4	Recursion	Read the recursion material, submit team project topic.
Week 5	Euclidean Algorithm, Fibonacci & Lame	Read the historical material.
Week 6	Review topics to date	prepare for midterm exam.
Week 7	Numerics	Read the numerical analysis material, Take midterm posted on Canvas.
Week 8	String algorithms	Read the pattern matching material.
Week 9	Generating Functions & Recurrence Relations	Read the generating functions material.
Week 10	Sorting	Read the sorting algorithms material.
Week 11	Dynamic Programming	Read the dynamic programming material.
Week 12	Greedy Algorithms	Read the greedy algorithms material.
Week 13	Computational Complexity	Read the complexity material.
Week 14	Team Presentations.	TBD
Week 15	Team Presentations.	TBD
Week 16	Review Class Topics,	Take Final Exam posted on Canvas.

Here is the Final Exam Schedule for Florida Tech

References

Bentley, J. L. (1982). Writing Efficient Programs. Prentice-Hall.

Bentley, J. L. (1988). More Programming Pearls: Confessions of a Coder. Addison-Wesley.

Bird, R. (2010). Pearls of Functional Algorithm Design. Cambridge University Press, New York, NY, USA, 1st edition.

Cormen, T. H., Leiserson, C. E., Rivest, R. L., and Stein, C. (2009). Introduction to Algorithms, Third Edition. The MIT Press, 3rd edition.

Graham, R. L., Knuth, D. E., and Patashnik, O. (1989). Concrete Mathematics. Addison-Wesley.

Knuth, D. E. (1997a). The Art of Computer Programming, Volume 1 (3rd Ed.): Fundamental Algorithms. Addison Wesley Longman Publishing Co., Inc., Redwood City, CA, USA.

Knuth, D. E. (1997b). The Art of Computer Programming, Volume 2 (3rd Ed.): Seminumerical Algorithms. Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA.

Knuth, D. E. (1998). The Art of Computer Programming, Volume 3: (2nd Ed.) Sorting and Searching. Addison Wesley Longman Publishing Co., Inc., Redwood City, CA, USA.

Okasaki, C. (1998). Purely Functional Data Structures. Cambridge University Press, New York, NY, USA.

Rabhi, F. A. and Lapalme, G. (1999). Algorithms: A Functional Programming Approach. Addison-Wesley.

Stinson, D. R. (1987). An Introduction to the Design and Analysis of Algorithms. The Charles Babbage Research Center, P. O. Box 272, St. Norbert Postal Station, Winnipeg, Manitoba R3V 1L6, Canada, second edition.