

CSCI 3342 - ALGORITHM ANALYSIS

CREDIT HOURS: 3
PREREQUISITES: CSCI 3302 and 3333
GRADE REMINDER: Must have a grade of C or better in each prerequisite course.

CATALOG DESCRIPTION

Study of algorithm design, analysis tools and techniques for selected problems, including sorting, searching, graphs, branch and bound strategies, dynamic programming, algebraic methods, string matching, and sets. An introduction to order notation, timing routines and complexity classes.

PURPOSE OF COURSE

The purpose of this course is to provide the student with tools and techniques for analyzing problem solutions. Complexity theory and computability issues are introduced. Evaluation of algorithms used in solving representative problems will be emphasized.

EDUCATIONAL OBJECTIVES

This course will provide students an opportunity to do the following:

1. To develop the concept of an algorithm, and thereby distinguish between solvable and unsolvable problems.
2. To present various complexity-levels of algorithms, and illustrate the concept with examples of algorithms that run in polynomial time as well as some that require exponential time.
3. To apply formal analysis techniques, based on algorithm time and space requirements, to algorithms involving iteration and recursion.
4. To develop the use of mathematical techniques, such as recurrence relations, as tools for analyzing the complexity of algorithms.
5. To study, implement, and analyze the performance of algorithms for sorting, generalized searching, string matching, pattern matching, and data compression.
6. To develop and implement branch-and-bound algorithms for solving selected NP-complete problems, and present efficient heuristic methods for finding sub-optimal but practical solutions to such problems.
7. To discuss emerging trends in algorithm developments, including parallel and distributed processing.

COURSE CALENDAR

This course meets for a minimum of 37.5 lecture contact hours during the semester. Students have significant weekly reading assignments. Students are expected to complete weekly homework/programming assignments, and 2-3 periodic exams in addition to the final exam. Students are expected to prepare for any class assignments or quizzes over the material covered in class or in the reading material. Successful completion of these activities requires at a minimum six additional hours of outside of classroom work each week. Students are expected to spend 6 hours out of class studying lectures, working assignments, working on course projects, and other course-related material

CONTENT

Hours

Introduction and Math Preliminaries	5
Notation, recursion, recurrence, induction	
Order notation	

Analysis tools and timing routines Overview of complexity classes (P, NP, exponential)	
Sorting and Searching Algorithms	5
Selection, insertion, exchange, special, binary, tree, hashing	
String Algorithms.....	3
Matching (Knuth-Morris-Pratt, Boyer-Moore), parsing, compression	
Graph Algorithms	9
Representation, connectivity, reachability, traversal, shortest path, minimum spanning tree, transitive closure, topological sort, Steiner trees, networks, depth first search, breadth first search.	
Set Algorithms	3
Union-find, dictionary, Boolean matrices	
Algebraic Methods.....	3
Polynomials, matrix operations, random numbers	
Complexity Classes.....	4
Definition, classes, examples	
Branch and Bound Algorithms	3
Backtracking, greedy methods, traveling salesman problem	
Dynamic Programming.....	3
Optimal search trees, all pairs shortest path	
Advanced Topics	4
Computation models - computability, decidability, finite state machines, grammars, pushdown automata Iterative Refinement Parallel and Distributed algorithms Geometric algorithms Heuristics (including genetic and neural techniques) Probabilistic and approximation algorithms	
Exams.....	3
	TOTAL
	45

REFERENCES

- Aho, A. V., Hopcroft, J. E. and Ullman, J. D. The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974.
- Baase, S. Van Gelder, A., Computer Algorithms, 3rd. Ed., Addison-Wesley, 1999.
- Cormen, T., Leiserson, C., Rivest, R., Stein, C., Introduction to Algorithms, 3rd. Ed., MIT Press/McGraw Hill, 2009.
- Goodrich, M., Tamassia, R., Algorithm Design, Wiley, 2002.
- Harel, D., Algorithmics, Addison-Wesley, 1987.
- Kleinberg, J., Tardos, E., Algorithm Design, Addison Wesley, 2006.
- Knuth, D. E., The Art of Computer Programming, Addison-Wesley, Vol I (2nd Ed.) 1973, Vol II (2nd Ed.) 1981, Vol III 1973.
- Levitin, A., The Design & Analysis of Algorithms, 3rd. Ed., Addison-Wesley, 2012.

Manber, U., Introduction to Algorithms, Addison-Wesley, 1989.

Sedgewick, R., Wayne, K., Algorithms, 4th Ed., Addison-Wesley, 2011.

Wirth, N., Algorithms + Data Structures = Programs, Prentice-Hall, 1976.

Attendance Policy:

Attendance will be taken at the beginning of each class. If you have 3 unexcused absences, then your final grade will be reduced by one letter grade. If you have 4 unexcused absences, you will receive an "F" in the course. To receive an excused absence a written and signed notice is required within three class days of the absence. If you miss class without approval of your instructor, you will receive a grade of zero on the missed assignment. Authorized absences must be approved by your instructor in advance of the absence unless you have an emergency or illness. Make-up work must be completed outside of normal class hours and within one week following an excused absence. It is your responsibility to see your instructor and make arrangements for make-up work.

Academic Integrity (A-9.1)

Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty

Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit.

Please read the complete policy at http://www.sfasu.edu/policies/academic_integrity.asp

Withheld Grades - Semester Grades Policy (A-54)

Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

Students with Disabilities

To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to <http://www.sfasu.edu/disabilityservices/>.

Mental Health Statement

SFASU values students' mental health and the role it plays in academic and overall student success. SFA provides a variety of resources to support students' mental health and wellness. Many of these resources are free, and all of them are confidential.

On-campus Resources:

SFASU Counseling Services
www.sfasu.edu/counselingservices
3rd Floor Rusk Building
936-468-2401

SFASU Human Services Counseling Clinic
www.sfasu.edu/humanservices/139.asp
Human Services Room 202
936-468-1041

Crisis Resources:

Burke 24-hour crisis line 1(800) 392-8343
Suicide Prevention Lifeline 1(800) 273-TALK (8255)
Crisis Text Line: Text HELLO to 741-741