

CSET 3150 Advanced Programming (4 semester credit hours)

CSET Required
IT Elective**Current Catalog Description:**

This course covers object oriented programming and advanced algorithms. Topic includes C++ and OO concepts, algorithms and data structures as implemented in the C++ and Java programming languages. The final project is implemented in Java. This course is programming intensive and lays a firm foundation for student's OO programming skills.

Textbooks:

1. "Introduction to Algorithms," Third Edition, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Ronald Rivest, The MIT Press, September 30, 2009, ISBN 978-0262033848

References:

1. Course web site
2. Various web references assigned by the instructor
3. "Data Structures and Algorithm Analysis in C++," 3rd Edition, Mark Alan Weiss, Addison-Wesley, ISBN 0-321-37531-9
4. "C++ Primer Plus," 5th Edition, Stephen Prata, Sams. November 2004. ISBN 0672326973

CSET Program Outcomes:

CSET Program Outcomes are (a, b, c, i, j, and k)

IT Program Outcomes are (a, b, c and i)

See attached tables.

Course Objectives:

After successful completion of this course, given a problem, students will:

- be able to find an algorithm to solve the problem,
- be able prove that the algorithm solves the problem correctly,
- be able to prove that we cannot solve the problem any faster,
- be able to implement the algorithm

Major Topics Covered in the Course

Topic	Lecture Hours	Lab Hours
Introduction	1.5	
Introduction to Sorting Algorithms	6	4
Asymptotic notation	1.5	
Recurrences	1.5	
More on Sorting Algorithms (chapters 6-9)	9	6
Searching Algorithms (chapters 11-13)	4.5	
Selection Algorithms	3	
Advanced Data Structures	4.5	6
Dynamic Programming	3	
Greedy Algorithms	3	
Graph Algorithms (chapters 22-25)	7.5	
String matching	1.5	
NP-Complete Problems	1.5	
Totals	48	16

Laboratory Projects:

Students will have several laboratory projects/assignments using the C++ and Java programming languages.

1. Implementation and comparison of sorting algorithms
 - a. Insertion sort
 - b. Merge sort
 - c. Quick sort
 - d. Counting sort
2. Solving practical problems using various data structures.
 - a. Stack
 - b. List
 - c. Tree
 - d. Graph
 - e. Hash table

Written Communications

Every student is required to submit at least 2 written reports (not including exams, tests, or commented programs) of an appropriate length (normally 4 pages) as part of the two laboratory projects. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.

Social and Ethical Issues

Not part of this course syllabus

Theoretical Content

Fundamental algorithms and a set of advanced algorithms will be discussed in the class and implemented in homework and projects.

- Asymptotic notation
- Recurrences
- Advanced sorting algorithms
- Searching algorithms
- Selection algorithms
- Dynamic programming
- Greedy algorithms
- Graph algorithms
- String matching
- NP-Complete problems

Problem Analysis

Students will need to carefully analyze their programs for running time and complexity. They are also taught to analyze their program by separating the program into smaller sections.

Solution Design

Students have programming exercises in their lab assignments related to algorithms and data structures taught in class to complete in a 2 weeks range. They must make their choice of data structures and algorithms based on program performance.

Course Coordinator:

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2/27/07

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2/24/11

Syllabus: CSET 3150

CSET	Student Outcomes:	Course Outcomes	Assessment Methods
a	An ability to select and apply knowledge of computing and mathematics appropriate to the discipline. More specifically, an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.	Use function notation to analyze behaviors of algorithms.	Evaluation of related questions from examinations and homework assignments.
b	An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.	Determine which data model or algorithm is appropriate for solving a specific problem.	Evaluation of data structures or algorithms used in programming projects.
c	An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs. More specifically, an ability to apply design and development principles in the construction of software systems of varying complexity.	Develop program and analyze algorithm performance.	Evaluation of programming projects.
d	An ability to function effectively as a member or leader on technical teams to accomplish a common goal.		
e	An understanding of professional, ethical, legal, security and social issues and responsibilities including a respect for diversity.		
f	An ability to communicate effectively with a range of audiences using a range of modalities including written, oral and graphical.		
g	An ability to analyze the local and global impact of computing on individuals, organizations, and society.		
h	Recognition and understanding of the need for and an ability to engage in self-directed continuing professional development.		
i	An ability to select and apply current techniques, skills, and tools necessary for computing practice.	Understand a range of standard algorithms and techniques for analyzing algorithms.	Evaluation of homework, projects and examinations.
j	An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.	Implement and compare execution time for different sorting algorithms, and provides analysis.	Evaluation of the laboratory project on sorting.
k	A commitment to quality, timeliness, and continuous improvement.	Submit projects on time and continuously improve their projects once design issues are identified.	Evaluate students' efforts in meeting deadline and improving their laboratory projects.

Syllabus: CSET 3150

IT	Student Outcomes	Course Outcomes	Assessment Methods
a	an ability to select and apply knowledge of computing and mathematics appropriate to the discipline. Specifically, an ability to use and apply current technical concepts and practices in the core information technologies. [IT-j]	Use function notation to analyze behaviors of algorithms.	Evaluation of related questions from examinations and homework assignments.
b	an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.	Determine which data model or algorithm is appropriate for solving a specific problem.	Evaluation of data structures or algorithms used in programming projects.
c	an ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs. And, an ability to identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems. [IT-k]	Develop program and analyze algorithm performance.	Evaluation of programming projects.
d	an ability to function effectively as a member or leader on technical teams to accomplish a common goal.		
e	an understanding of professional, ethical, legal, security and social issues and responsibilities including a respect for diversity.		
f	an ability to communicate effectively with a range of audiences using a range of modalities including written, oral and graphical.		
g	an ability to analyze the local and global impact of computing on individuals, organizations, and society.		
h	recognition and understanding of the need for and an ability to engage in self-directed continuing professional development.		
i	an ability to select and apply current techniques, skills, and tools necessary for computing practice. And an ability to effectively integrate IT-based solutions into the user environment. [IT-l]	Understand a range of standard algorithms and techniques for analyzing algorithms.	Evaluation of homework, projects and examinations.
j	an understanding of best practices and their application. [IT-m]		
k	an ability to assist in the creation of an effective project plan. [IT-n]		