CS312 Course Syllabus
Fall 2011
T,R: 6:10PM – 7:50PM

Instructor
Valentino Crespi
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Office location: E&T A318
Office hours: TR: 3:10PM-4:30PM. Outside those hours by appointment.

Course number CS 312

Course name Data Structures and Algorithms

Credits 4 units

Contact hours 4 hours/week

Coordinator Valentino Crespi

Text book Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein. *Introduction to Algorithms (3rd edition).* MIT Press, 2009.

Other Texts:

- R. Johnsonbaugh, M. Schaefer. *Algorithms.* Prentice Hall, 2003.
- Sanjoy Dasgupta, Christos Papadimidriou, Umesh Vazirani. *Algorithms*. Mc Graw Hill, 2006.
- Michael T. Goodrich, Roberto Tamassia. *Data Structures and Algorithms in Java (5th edition).* John Wiley & Sons, Inc, 2010.
- J. Kleinberg, E. Tardos. *Algorithmic Design*. Addison-Wesley, 2005.
- Robert L. Kruse. *Data structures and program design (3rd edition).* Prentice Hall, 1994.
- Mark A. Weiss**.** *Data Structures and Algorithm Analysis in Java (2nd edition).* Addison-Wesley, 2006.
- Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman. *The Design and Analysis of Computer Algorithms.* Addison-Wesley, 1974.

Course Information

a) Abstract data types and their use in constructing algorithms for manipulating lists, trees, and graphs; analysis of algorithms for searching, sorting, and data structure manipulation.
b) Prerequisites: Math 208, Math 248, CS203.
c) This course is required in the BS program.

Course Goals The Student Learning Outcomes that are addressed by the course are:

SLO #1. *Students will be able to apply concepts and techniques from computing and mathematics to both theoretical and practical problems.*

SLO #3. *Students will have a strong foundation in the design, analysis, and application of many types of algorithms.*

Other outcomes of instruction:

- Analyze the correctness and computational complexity of computer algorithms.
- Design (specify and implement) efficient advanced Data Structures.
- Know advanced design techniques and their nontrivial application to classic problems of searching, sorting, graph optimization and combinatorial optimization.

Brief list of topics to be covered

- Mathematical Foundations (Summation Formulas, Logarithms, Induction, Lower and Upper bounds, Asymptotic Notation, Recurrence Relations, Master Theorem, Loop Invariants).
- Analysis of the Correctness and of the Computational Complexity of Computer Algorithms.
- Advanced Data Structures (Binary Search Trees, Balanced Trees, Heaps, Indirect Heaps, Priority Queues, Dictionaries, Hash Tables, Union-Find).
- Graph Algorithms and Searching and Sorting Algorithms.
- Design Techniques (Divide and Conquer, Greedy and Dynamic Programming).

Grading Policy

One midterm exam: 30%, Final Exam: 40%, three to four Quizzes: 20%, Class Project: 10%.

A	90 - 100 %
B	80 - 90 %
C	60 - 80 %
D	50 - 60 %
F	Below 50%

Class Schedule

Week 1	Presentation of the course. Basic concepts and definitions. Asymptotic notation.
Week 2	Summation Formulas, logarithms, Loop Invariants. Proof of correctness and analysis of the computational complexity. The factorial of arbitrary integers. Models of computation.
Week 3	Analysis of nested for-loop statements. Selectionsort. Introduction to the Divide-and-Conquer Design Technique. Mergesort. Recurrence Relations. Master Method.
Week 4	Computation of integral powers of a number. Evaluation of polynomials on a point. Repeated Squaring method. Horner's rule.
Week 5	Midterm examination and recap of the first part of the course.
Week 6	Data Structures: stacks, queues, binary search trees, heaps, priority queues. Heapsort.
Week 7	Introduction to graphs. Shortest Path Problems. The Dijkstra

	algorithm. Indirect heaps and priority queue implementation.
Week 8	Partitions and Disjoint Sets. The Minimal Spanning Tree Problem. The Kruskal Algorithm.
Week 9	Introduction to Dynamic Programming. The Matrix-Chain multiplication problem. The all-pairs shortest path Problem. The Floyd-Warshall algorithm.
Week 10	Preparation to the final exam. Course recap.
Week 11	Final Exam.

Academic Integrity

Cheating will not be tolerated. All parties involved will receive a grade of F for the course and be reported to the proper authorities.

General Policies

- No makeup exams.
- No cell phones.
- No internet during lecture.
- Students arriving 30 minutes after the beginning of class will be admitted at the discretion of the instructor in order to prevent any disruption of the lecture.
- Students are warmly invited to visit the instructor during office hours for questions and clarifications. Meetings outside office hours are possible by appointment.