CS375-A0 Design and Analysis of Algorithms (Fall 2012)

Department of Computer Science

SUNY at Binghamton

Instructor:	Dr. Lijun Yin
Time:	M, W, F 12:00pm – 1:00pm
Location:	UU215
Office:	N6
Office Hours:	W, F (9:00am – 10:00am)
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Web Page:	http://www.cs.binghamton.edu/~lijun/CS375_Fall2012/2012Fall_CS375.html
TA:	"Shawn Canavan" <scanava1@binghamton.edu>
Office Hours:	Shaun Canavan: Tu, Th: 2:00pm – 3:00pm at T5 (Engineering Building)
Lab Session (ACT 50)	Th: 11:40am – 1:05pm (UU206)
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Blackboard	http://blackboard.binghamton.edu

Course Description

Analysis of common algorithms for processing strings, trees, graphs and networks. Comparison of sorting and searching algorithms. Algorithm design strategies: divide and conquer, dynamic, greedy, backtracking, branch and bound. Introduction to NP-completeness and parallel algorithms.

Prerequisites: CS240 and Math314.

Textbooks Recommended

We will be using the following major books as texts:

- [1] T. Cormen, C. Leiserson, R. Rivest and C. Stein, **Introduction to Algorithms.** (Second Edition). McGraw-Hill. 2001 (ISBN: 0-07-013151-1).
- [2] R. Neapolitan and K. Naimipour, **Foundation of Algorithms Using C++ Pseudocode** (Third Edition). Jones and Bartlett, 2004 (ISBN: 0-7637-2387-8)

References:

- [3] Neapolitan R. and Naimipour K., **Foundation of Algorithms Using C++ Pseudocode,** (Second Edition). Jones and Bartlett, 1998 (QA9.58 .N43 1998) (on reserve)
- [4] Baase S**, Computer Algorithms- Introduction to Design and Analysis**, 3rd , Addison-Wesley, 2000. (QA76.6 B25) (on reserve)
- [5] Skiena S. S., **The Algorithm Design Manual,** Springer-Verlag 1998. (QA76.9.A43S55, on

reserve)

- [6] Sedgewick Robert, **Algorithms in Java parts 1-4,** 3rd edition, Addison Wesley, 2003 (QA6.73.J38 S4, on reserve)
- [7] Sedgewick Robert, **Algorithms in Java part1 5,** 3rd edition, Addison Wesley, 2004 (on reserve)
- [8] Sedgewick Robert, **Algorithms in C++ parts 1-4,** 3rd edition, Addison Wesley, 2002 (on reserve)
- [9] Sedgewick Robert, **Algorithms in C++ part1 5,** 3rd edition, Addison Wesley, 2004 (on reserve)
- [10] Brassard, Gilles, **Fundamentals of Algorithmics**, 1st ed. Prentice Hall, Aug. 1996 (QA9.58 .B73, on reserve)

Requirements

Your grade will be based on the following criteria:

- Assignments (Theory and Programming) (41%)
- Quizzes (10%)
- Class attendance (4%)
- Mid-term exam (20%)
- Final exam (25%)

Computer Facilities

The assignments must be done on Bingsuns with C/C++.

Syllabus

Please note that this syllabus is approximate, and subject to change.

DATE	TOPICS	READINGS	ASSIGNMENTS	LABS
9/4	Introduction	[1] Ch.1 and Class Notes(1)		
9/6	Analysis and problem size	[1] Ch.2 and Class-notes(2)		
9/10	Cont'd and counts	[2] Ch.1.1-1.3, class-notes (3)		
	Asymptotic growth functions	[1] Ch. 3 and Class-notes(4-5) [2] Ch.1.4	Assignment 1 Sample of input and output Example code for data I/O	Review of basic searching algorithms (sequential, binary);

				sorting algorithms (merge-sort, exchange sort, …) Review of mathematical induction, logarithms, sums of series. [1] Chapter 3, 51-56, Math review [1] Appendix A Induction
	Asymptotic growth functions and proving correctness	[1] Ch.2 17-19 and Class notes (6)		
	Recurrence	[1] Ch.2 17-19 and class notes (7-8)		Review of growth function and recurrence Review of Assignment 1
	Recurrence (cont'd)	[1] Ch. 4		Quiz-1
	Divide and Conquer	[1] Ch.7; [2] Ch.2 Class notes(9-10)	Assignment 2	Review of Quiz-I Review of Assignment 1 (*Students' Demo and Presentation on the Programming Part*)

	Cont'd	[1] 33.4 and supplemental material		Review of Assignment 2
	Cont'd and Heap sort	[1] Ch.6; [2] Ch. 7.6 Class notes(11-12)		Quiz-II
	Dynamic Programming and Optimality	[1] Ch.15 [2] Ch.3 Class notes (13-14-15)	Assignment 3	Review of Quiz-II Review of Assignment 2 (*Students' Demo and Presentation on the Programming Part)*
	LCS			
	Floyd Algorithm			
	Binary search trees and Memoization	[2] Ch.3.1 [2] Ch.3.2, Ch.3.5 [1] Ch.15		Review of Assignment 3 (*Students' Demo and Presentation on the Programming Part)* Review of Assignment 3
	Cont'd and Graphs	[1] Ch.22 Class-notes (16-17-18)	Assignment 4	Prepare for mid-term
	Graphs traversals	[1] Ch.22		
	Cont'd			Mid-term exam (Nov.

				1)
	Greedy	[1] Ch.16; [2] Ch.4 Class-notes (19)		
	Cont'd			Review of mid-term exam
	Prim's algorithm	[2] Ch.4.1, Ch.4.2 [1] Ch.23.2 Class-notes (20-21)		
	Disjoint union set and Kruskal's algorithm	[1] Ch.21, Ch.23.2 [2] Ch.4.1, Appendix C Class notes (22-23)		Review of Assignment 4 (*Students' Demo and Presentation on the Programming Part)*
	Cont'd and Amortized Analysis	Class notes (23b)	Assignment 5	
	Dijkstra's algorithm	[1] Ch.24.3 [2] Ch.4.2 Class note (24)		
	Knapsack Problem	[2] Ch.4.5; [1] Ch.16.2 Class note (25)		
	Backtracking Branch and bound	[2] Ch.5 and Class notes (26) [2] Ch.6.1.2		
	NP-Completeness	[2] Ch.9 Class notes (27-28)	Assignment 6	Review of Assignment 5 (*Students' Demo and Presentation on the*

				Programming Part) Quiz-III
	NP-Completeness	[2] Ch.9		
	Traveling Salesman problem Approximation algorithm and Parallel algorithm (wrap-up)	[2] Ch.3.6, Ch.9.5.1 Class notes (29-30) [2] Ch.9.5.1, Ch.11		Review of Assignment 6 Review questions for final exam
	Cont'd			
	Final Exam			Final Exam 11:00am-1:00pm, December 19 at LH-013

Advice

- The standard rules on plagiarism apply. Late assignments will not be accepted (unless approved by the instructor).
- Students must take each quiz and exam on the scheduled date and time.
- It is important to attend all the classes and lab sessions. The purpose of lab sessions is to
  - Clarify the material taught during the regular lectures (Please prepare questions to ask during Lab)
  - Reinforce the understanding of concepts discussed in the lectures
  - Review solutions of the homework assignments
  - Provide additional examples of applying various algorithms
  - Provide students with opportunities to present and discuss their work
  - Provide supplemental material
- The criteria of grading theory assignments are based on (1) correctness; (2) clearly written and analysis, and (3) correct solutions which would result in efficient code.
- The criteria of grading programming assignments are based on (1) correctness of solution and the analysis (including a general explanation of the main algorithm, justification of the data structure used, computation time analysis), (2) efficiency in terms of time and space, and (3) readability of the

code (including comments on functions, variables and major operations, etc.) TA will post grades in blackboard for CS375 (http://blackboard.binghamton.edu/)

- Read the recommended chapters and class-notes for each lecture; Start working on your assignment early; Prepare well for the quizzes and exams. Good luck!

This course is also offered under the articulation agreement between Binghamton University and SUNYIT. It is available to qualified students at Binghamton University via the distance learning system Enginet.