

**SYLLABUS**

**Spring 2013**

**CSC 415 Analysis of Algorithms**

**3 credits**

**Prerequisites:** CSC 260 and MAT 220 and one of the following: CSC 311, CSC 325, CSC 340, CSC 390

**Instructor:** Beifang Yi  
**email:** byi@salemstate.edu

**Office:** MH 211A  
**Hours:** TWRf (11:00am-1:00pm)

**Phone:** (978) 542-7246  
**Web Site:** <http://cs.salemstate.edu/~byi/>

Section	Time	Room	Final Exam
D1	2~3 hours/week (TBA)	TBA	<b>TBA</b>

**Catalog description:**

Advanced concepts from data structures and general algorithms are discussed from both theoretical and applied viewpoints. Topics covered include: multi-lists, graph theory, searching and sorting algorithms, and general n-way tree structures. Techniques for analysis of algorithms for average and best/worst cases are presented. Laboratory work may involve programming in a high-level language. Three lecture hours per week.

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**Course Goals:**

The aims of this course are:

- CG01: to present a coherent view of the algorithms encountered in earlier courses;
- CG02: to introduce a selection of more advanced algorithms;
- CG03: to present the most common tools and techniques for assessing the costs and complexity of these algorithms.

**Course Objectives:**

Upon completion of the course, the student will have demonstrated the ability to:

- CO01: perform best case, worst case, and average case analysis of selected algorithms for managing lists, trees, heaps, and hash tables;
- CO02: explain and analyze examples of greedy algorithms, such as Huffman codes;
- CO03: explain and use the main ideas of probabilistic and amortized analysis;
- CO04: explain the analysis and use of breadth-first and depth-first search, minimum spanning trees, and shortest-path algorithms.

**Course Topics:**

A detailed topics list and a general course bibliography can be found on the Computer Science Department website at <http://cs.salemstate.edu/dept/index.php?page=184>. Select CSC 415 to access a PDF document. The topics include:

- brief review of course programming language (as appropriate)
- mathematical tools for algorithm analysis
  - limits and big-O notation
  - summation formulas
  - recursion relations
  - generating functions

- numeric algorithms (Fibonacci numbers, polynomial arithmetic, Fast Fourier Transform, etc.)
- analysis of searching and sorting algorithms
  - finding largest (or smallest), second largest, etc.
  - linear search, binary search
  - insertion sort, quicksort, merge sort, tree sort, heap sort
- multi-lists
- tree structures
  - general trees
  - n-way trees
  - balancing algorithms
  - traversal algorithms
  - expression trees
- review of basic hashing techniques
- advanced fast-access algorithms
- graphs, their representations, and traversal algorithms
- computational complexity, NP-completeness

In addition to the topics listed above (as the course description required), we will cover the following important topics:

- dynamic programming
- minimum spanning trees, single-source shortest paths, all-pairs shortest paths
- matrix operations
- string matching
- computational geometry

**Text (Required):**

- *The Algorithm Design Manual*, 2<sup>nd</sup> edition by Steven S. Skiena. Springer, 2008.
- *Programming Challenges* by Steven S. Skiena and Miguel Revilla Springer, 2003

**Additional references** (optional)—course materials will come from the following books:

- *Introduction to Algorithms* 3<sup>rd</sup> edition by T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein. The MIT Press, 2009.
- *Algorithms and Programming: Problems and Solutions* 2<sup>nd</sup> edition by Alexander Shen. Springer, 2009.
- *Puzzles for Programmers and Pros* by Dennis Shasha. John Wiley & Sons, 2007.
- *Introduction to Algorithms* 2<sup>nd</sup> edition by T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein. McGraw-Hill, 2003.
- *Introduction to the Design and Analysis of Algorithms* 3<sup>rd</sup> edition by Anany Levitin. Addison Wesley, 2011.
- *Programming Pearls* 2<sup>nd</sup> edition by Jon Bentley, 1999.
- *Cracking the Coding Interview, 150 Programming Interview Questions and Solutions* 4<sup>th</sup> edition by Gayle Laakmann. Create Space, 2008.
- *Programming Interviews Exposed: Secrets to Landing Your Next Job* 2<sup>nd</sup> edition by John Mongan, Noah Suojanen, and Eric Giguere. Wrox, 2007.
- *Algorithms for Interviews* 2<sup>nd</sup> edition by Adnan Aziz. Create Space, 2010.

**Required Material:**

(Required) Thumb (flash) drive, 2 GB minimum

**Software:**

(Required) J2SE 6.0 (or above).

**Cell phones:**

Turn the ringer off, or, better yet, *turn the phone off*.

**Class Attendance and Assignments:**

Since this is a directed studies course, class attendance (at least once week) is **required**. In the class meeting time, algorithms topics will be covered and evaluation of student's performance on some assignments in forms of Q&A (the instructor's asking questions and the student's answers to them) and presentation (of some algorithms topics). Students are responsible for all materials presented in class, quizzes, examinations, and other announcements. No excuses of any nature will be construed as relieving you from the responsibility for completion of the work assigned. Each student is responsible for completing all course requirements and for keeping up with all that goes on in the course (whether or not the student is present).

*Most of the algorithms introduced in the class are required to be implemented in Java code. Class attendance and performance are used to calculate the final grade.*

**Final Grade:**

Final grade will be determined using the following grading weights:

class participation and performance	25%
programming assignments	60%
final examination	15%

Class attendance is used to calculate the final grade; reading assignments are part of class participation.

The following table shows how the course work is assessed against the course objectives:

	Class Performance	Programming Assignments	Final Examination
CO01	✓	✓	✓
CO02	✓	✓	✓
CO03	✓	✓	
CO04	✓	✓	✓

**Exams:**

There will be one final (comprehensive) exam (15% total). **Note:** Make-ups are given for examinations only under exceptional and documented circumstances.

**Missed Tests:**

Missed tests will be made up *only under extreme conditions/emergency with the proper documentation*. Students who know in advance that they must be absent on an exam day for an excusable reason should notify the instructor prior to the exam day. Students who are absent on the day of the exam for an excusable reason should contact the instructor immediately following their absence. Makeup work will be permitted *only when* the instructor is presented with acceptable documentation for acceptable absences. It is your responsibility to notify your instructor of any excused absence as far in advance as possible.

**Study Groups:**

While I strongly encourage study groups, for non-group assignments I require that each student hand in his/her answers in his/her own words - **if two answers come out exactly the same or highly similar, neither will receive credit and/or further actions will be taken** (such as reporting to the department and/or university). Given the nature of most of the projects, homework questions and writing assignments, it will be almost impossible for two people to come up with highly similar answers UNLESS they copy.

**Academic Integrity:**

Academic Integrity Policy and Regulations can be found in the University Catalog and on the University's website ([http://catalog.salemstate.edu/content.php?catoid=13&navoid=1295#Academic\\_Integrity](http://catalog.salemstate.edu/content.php?catoid=13&navoid=1295#Academic_Integrity)). The formal regulations are extensive and detailed - familiarize yourself with them if you have not previously done so. A concise summary of and direct quote from the regulations: "Materials (written or otherwise) submitted to fulfill academic requirements must represent a student's own efforts". *Submission of other's work as one's own without proper attribution is in direct violation of the University's Policy and will be dealt*

with according to the University's formal Procedures.

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"Salem State University is committed to providing equal access to the educational experience for all students in compliance with Section 504 of The Rehabilitation Act and The Americans with Disabilities Act and to providing all reasonable academic accommodations, aids and adjustments. Any student who has a documented disability requiring an accommodation, aid or adjustment should speak with the instructor immediately. Students with Disabilities who have not previously done so should provide documentation to and schedule an appointment with the Office for Students with Disabilities and obtain appropriate services."

In the event of a university declared critical emergency, Salem State University reserves the right to alter this course plan. Students should refer to <http://www.salemstate.edu> for further information and updates. The course attendance policy stays in effect until there is a university declared critical emergency. In the event of an emergency, please refer to the alternative educational plans for this course located at <http://cs.salemstate.edu/~byi/2013Spring/CSC246/emergency/index.html>. Students should review the plans and gather all required materials when an emergency is declared.

Please remember that if, for any reason, you decide to drop this course, you **must** do so officially through the Registrar's office. The last day to withdraw from a course this semester is **April 12<sup>th</sup>**.

**Note:** This syllabus represents the intended structure of the course for the semester. If changes are necessary, students will be notified in writing and via all regular class communication mechanisms (class discussion, emails, and/or the course homepage through the instructor's website at <http://cs.salemstate.edu/~byi/>).