NJIT

New Jersey's Science &
Technology University

A. V. Gerbessiotis

Aug 20, 2016

Course Syllabus: General Information

CS610-103

Fall 2016

Handout 1

Intensive study of the fundamentals of data structures and algorithms. Presents the definitions, representations, processing algorithms for data structures, general design and analysis techniques for algorithms. Covers a broad variety of data structures, algorithms and their applications including linked lists, various tree organizations, hash tables, strings, storage allocation, algorithms for searching and sorting, and a selected collection of other algorithms.

1.1 Contact Information

INSTRUCTOR:	Alex Gerbessiotis	E-MAIL:	alexg+cs610@njit.edu
OFFICE:	GITC 4213, 4th floor	TEL:	(973)-596-3244
OFFICE HOURS:	Mon 4:00-5:30pm and Tue 4:30-5:30pm	Else, by	appointment Mon/Tue/Wed
ASSISTANT:	TBA on course web-page		
CLASS HOURS:	Mon 6:00-9:05pm, CKB 217		

COURSE WEB PAGE: http://www.cs.njit.edu/∼alexg/courses/cs610/index.html

Print Handout 1 from Web-page and compare the printout to this document! They must be identical.

1.2 Course Administration

Prerequisites	Per catalog: CS 505 or CS 335. What this means: Completion of all bridge course requirements such as CS 505 and CS 506, if any. (The 335 is a relic from the past.)
Textbook	Algorithm Design: Foundations, analysis, and internet examples. M. T. Goodrich and R. Tamassia. Wiley, 2001, ISBN 0-471-38365-1. *We abbreviate it in class as GT.*
CourseWork:	**3 exams (including the final)**. Programming project. Potentially one more unannounced quiz (To be determined).
Grading scheme:	1000 points = PrP(134) + Ex1 (200) + Ex2 (333) + Ex3(333).
PrP	A programming project (PrP) with 2 options each one worth 134 points. A student may submit one or two options but both options must be submitted in one shot; a grade of 0-30 points for an option is accounted as 0 towards the final grade. No more than 134 points of credit from the sum of the grades of the two options. See Handout 2 for more details.
Practice PS	Five comprehensive problem sets PS1-5 will be periodically posted along with their solutions. Exams may be based on these problem sets.
Exams	Dates in Course Calendar; all exams in classroom. Exams are open-textbook only; you may bring a hardcopy of the textbook but you may not borrow one during the exam. Exam1 (quiz) is on **Oct 3**, 60mins, 200 points. Exam2 (midterm) is on **Oct 24**, 2hours 333 points. Exam3 (final) is on **Dec 19**, 2hours, 333 points. A second quiz might be given around Nov 21; in that case Exam1's grade gets halved and this quiz will count for the cut 100 points.
Due Dates	PrP submitted **only by email and MUST be received BEFORE NOON-TIME**; 30 points subtracted from every option (after work is graded) at deadline plus 1 minute, and every 24-hour period thereafter. We strongly recommend that you use an NJIT email account to email your code; if you do not use one, do not complain about potential loss of email (or NJIT's blocking of it). Read Handout 2 for details and the homework itself. Programs can be done in C, C++, or Java and will be processed, compiled and tested on afsconnect1.njit.edu or afsconnect2.njit.edu.

A. V. GERBESSIOTIS

AUG 20, 2016

COURSE SYLLABUS: COURSE OBJECTIVES AND OUTCOMES

CS610-103

FALL 2016

PAGE 2

2.1 Course Objectives and Outcomes

Objective 1 Understand and formulate the input-output relationship of computational problems, and formulate the requirements, data and operations of abstract data types (ADT). data structures.

Objective 2 Learn, Understand and be able to describe data structures that represent the mathematical model underlying an ADT.

Objective 3 Learn how to describe, derive and determine, the asymptotic performance of algorithms and data structures.

Objective 4 Learn how fundamental algorithms and data-structures operate, and understand their characteristics. Be able to choose among a variety of similar ones based on problem/program specification and requirements.

Objective 5 Learn how to compose more complex algorithms using as building blocks the fundamental algorithms introduced in class.

Objective 6 Learn how to compose more complex algorithms using the algorithmic design techniques introduced in class.

Outcome 1 Be able to accurately specify the input/output relationship of computational problems, and describe correctly fundamental ADTs.

Outcome 2 Be able to accurately specify the operations of fundamental ADTs and the data structures underlying them; be able to correctly describe the performance of algorithms for the operations on these data structures.

Outcome 3 Be able to asymptotically compare functions using $o, O, \omega, \Omega, \Theta$.

Outcome 4 Be able to solve recurrences using the master, the iteration/recursion tree, and the substitution methods.

Outcome 5 Become familiar with a variety of algorithms for sorting, selecting and searching data and their performance characteristics (eg, running time, stability, space usage) and be able to choose the best one under a variety of requirements.

Outcome 6 Be able to understand fundamental algorithms and data structures and their performance and be able to trace their operations for problems such as sorting, searching, selection, operations on numbers, polynomials and matrices, and graphs.

Outcome 7 Be able to understand fundamental algorithm design techniques and understand how to use them to solve algorithmic problems.

Outcome 8 Be able to use the fundamental algorithms introduced in class to design algorithms for more complex problems and analyze their performance.

Outcome 9 Be able to use the design techniques and algorithms introduced in class to design algorithms for more complex problems and analyze their performance.

N J I T

New Jersey's Science &
Technology University

A. V. GERBESSIOTIS

CS610-103

AUG 20, 2016

FALL 2016

COURSE SYLLABUS: COURSE CALENDAR AND TOPICS

PAGE 3

3.1 Tentative Course Calendar

Fall 2016				
Week	Wed	Exams	PrP or PS	Comments
W01	9/12		PrPout,PS1*	
W02	9/19			
W03	9/26		PS2*	
W04	10/03	**Exam1**		
W05	10/10		PS3*	
W06	10/17			
W07	10/24	**Exam2**		**aka Midterm**
W08	10/31		PS4*	
W09	11/07			Nov 7 is last day to Withdraw
W10	11/14		PS5*	
W11	11/21			Pop-up quiz?
W12	11/28			
W13	12/05		PrPin	
W14	12/12			
W15	12/19	**Exam3**		Final Exam

Topics to be covered

```
T1 :Ch1,5.2     : Introduction (insertion-sort, fibonacci sequences),
                  Algorithm Analysis (Asymptotic Growth of functions, recurrences)
T2 :Ch1,4.1,5.2 : Algorithm Design Techniques (Incremental, Divide-and-Conquer)
                  Sorting(selection-sort,bubble-sort,merge-sort).
T3 :Ch2.1-2.3   : Elementary Data Structures and Trees. Tree traverals.
   Ch4.2          Union-find operations.
T4 :Ch2.4,9.3   : Heaps and Priority Queues. Greedy Algorithms and Huffman coding.
T5 :Ch4         : Quick sort. Complexity of sorting. Sorting in linear time
                  (radix-sort, bucket/count-sort). Selection.
T5 :Ch2.5-2.7   : Hashing.
T6 :Ch3         : Binary Search Trees and Balanced Binary Search trees.
T7 :Ch5         : Integer operations (addition and multiplication).
                  Matrix operations (addition and multiplication). Strassen's method.
                  Dynamic Programming and chained matrix multiplication.
T8 :Ch6         : Graphs and their representation. Graph traversals (DFS,BFS).
                  Strongly connected components. Topological sorting.
T9 :Ch7         : Weighted graph problems. Shortest-path problems (Dijkstra's).
                  All-pairs shortest paths and transitive closure (Floyd-Warshall).
                  Spanning trees (Prim's and Kruskal's algorithms).
T10:Not in GT   : Graphs and Web-page Ranking: Google's PageRank, Kleinberg's HITS algorithm.
T11:Ch9         :String and Pattern matching algorithms**.
T12:Ch13        :P and NP. NP-completeness.
```

* Problem Sets (PS) with solutions are not for credit. The following describes a tentative list of topics that is intended to be covered in class with indicative chapter pointers to GT. The lecture summaries contain detailed correspondence to chapters of the textbook.
** Time permitting.

Any modifications or deviations from these dates or information, will be done in consultation with the attending students and will be posted on the course Web-page. It is imperative that students check the Course Web-page regularly and frequently.

MISSING   If you miss a class, it's up to you to make up for lost time. For any exam, you MUST CONTACT the Dean of Student Services (DOSS) within 2 working days from the day the reason for the absence is lifted with all necessary documentation. The maximum accommodation period will be the number of missing days to the exam date: it is imperative then that you contact DOSS even before the 2 working day period has expired if the accommodation period would be shorter. For Exam1, a DOSS approval will get you a scaled Exam2 grade for Exam1. For the unannounced quiz and a DOSS approval, Exam1 stays as is.

PrP Grading   Handout 2 and PrP compliant options are evaluated/graded separately. Then the lateness penalty is applied. A 0-30 grade for an option is accounted as 0. The sum of the resulting grades for the two options cutoff at 134 points is your programming grade.

Grading   Written work will be graded for conciseness and correctness. Use formal arguments. Be brief and to the point and write clearly. Material covered in class and appearing in the relevant notes and chapters of the designated textbook can be used without proof or citation. Programming points discarded may be used, at the discretion of the instructor, to remove a student from a fail zone (assuming no violation of the Collaboration policy). **DO NOT USE pencils to write down your solutions; IF YOU DO USE PENCILS do not complain about grading.**

Grades   Check the marks in a written work and report errors promptly. **Make sure you report such problems to the grader or the instructor within two weeks from receipt/return** and **no later than the (first) Reading Day** whichever comes first. First resolve issues with the grader, then the instructor (if different). The final grade is decided on a 0 to 1000 point scale. A student who collects at least 500 points (including some minimal programming work) should expect a passing grade (C or better). 900 points or more are usually needed for an A including robust programming work but this varies and may be lower. If you score less than 500 points the only way to avoid an F is to do well in the cumulative final (say more than half of the points) or have leftover programming points. (Assuming always no violation of the Collaboration policy.)

Incomplete   A grade of I(incomplete) is given in rare cases where work cannot be completed during the semester due to documented long-term illness or absence (e.g. unexpected national guard duty). A student needs to be in good standing (i.e. passing the course before the absence) and receives an I if there is no time to makeup for the DOSS documented lost time. Not showing up in the final will probably get you an F rather than an I.

Collaboration **Collaboration of any kind is PROHIBITED in the in-class exams or the project (PrP). For PrP, a student must turn in code that has fully been written by him/her. Any submitted code (even few lines) obtained through the Internet or otherwise, or is product of someone else's work or is common with another student submission, in the same or other section/course, risks severe punishment, as outlined by the University; all parties of such interaction receive automatically 0 and grade is lowered by one or two levels. The work you submit must be the result of your own mental effort and you must safeguard it from other parties; if you can't protect your home computer, use a Lab machine.**

Mobile Devices Mobile devices etc **must be switched off/shut** before and during class exams or lectures.

Email/SPAM   Use an NJIT email address or your email might not reach us. Send email to the designated course email address and always include `cs610` in the subject line.   ∎.

The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Student Services (DOSS). Read this handout carefully!