

[July 7 Revision]

COURSE SYLLABUS
605.721.71 Design and Analysis Algorithms
Fall 2009 Johns Hopkins University

Instructor: Mr. John E. Boon, Jr.

NOT AVAILABLE PERIODS SPRING 2008

Monday	Tuesday	Wednesday	Thursday	Friday
13:30-18:00	18:00-22:00	18:00-22:00	18:00-22:00	11:30-13:00

Mr. John E. Boon, Jr. is the course instructor for these class meetings. He is an Operations Researcher for RAND. Mr. Boon was previously an Associate Professor of Computer Science and Chairperson, Department of Mathematics and Computer Science, Hood College. Mr. Boon also continues to maintain a consulting practice in operations research and computer science.

You are encouraged at any time to phone my cell number. I encourage you to contact me if you have any questions at all. I may be able to clarify requirements as well as suggest additional resources and strategies for a given problem. Be sure to (1) state your name, (2) state what I may do for you, (3) state your phone number twice, (4) state the hours during which I may return your call if you leave a voice message.

My complete list of contact information follows:

My e-mail addresses: <mailto:jboonjr@apl.jhu.edu>

WWW Home Pages: <http://www.apl.jhu.edu/Notes/Boon/605721/>

(see also <https://ptesrv.apl.jhu.edu/course-homepages/>)

Phone: **(301) 606-4115 (cell)**

Course Description:

In this follow-on course to 605.421 Foundations of Algorithms, design paradigms are explored in greater depth, and more advanced techniques for solving computational problems are presented. Topics include randomized algorithms, adaptive algorithms (genetic, neural networks, simulated annealing), approximate algorithms, advanced data structures, online algorithms, computational complexity classes and intractability, formal proofs of correctness, sorting networks, and parallel algorithms. Students will read research papers in the field of algorithms and will investigate the practicality and implementation issues with state-of-the-art solutions to algorithmic problems. Grading is based on problem sets, programming projects, and in-class presentations.

Prerequisites:

605.421 Foundations of Algorithms or equivalent, and discrete mathematics.

Computer Requirement:

Students must have an email address and must make that address known to the course instructor as soon as practical after the start of the course. Students may use their own computing resources (hardware/software tools) or may arrange to access the necessary tools through the student services entities of JHU. Class examples will be compiled and processed with GNU port of gcc for 32-bit Windows version (Cygwin), with Java, and with Matlab. Students with JHU computer accounts may

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also access the GNU port of gcc and Matlab on the Solaris system. Students must have access to the Internet, have a web browser and the Acrobat Reader application.

Instructional Objectives:

Students completing this course will demonstrate mastery of the mathematical tools used in analyzing the performance and efficiency of computer algorithms.

Students completing this course will demonstrate mastery of several approximation algorithms

Students completing this course will demonstrate mastery of several randomized algorithms.

Students completing this course will demonstrate mastery of simulated annealing and genetic algorithms.

Required Texts:

Juraj Hromkovič, *Algorithmics for Hard Problems: Introduction to Combinatorial Optimization, Randomization, Approximation, and Heuristics*. 2nd edition 2003, Corrected 2nd printing, 2004. (ISBN: 978-3-540-44134-2)

Optional Texts:

Melanie Mitchell, *An Introduction to Genetic Algorithms*. A Bradford Book, The MIT Press, 1996.

Internet Resources, Library Reserve Texts, Information, Articles, and Videos:

Please note weekly changes to the class WWW page for posted links and special resources related to the course as it progresses.

You are encouraged to consult resources in Dr. Dobb's Journal, <http://www.ddj.com>, for algorithm topical articles on algorithms in C/C++ and Java.

It is your responsibility to check the class WWW pages no later than Noon each class day for updates and class information (<http://www.apl.jhu.edu/Notes/Boon/605721/>). I tend to post extensive class information on my class pages (important news items about the upcoming class, items important to the upcoming class lecture, notes, links, problems, solutions, projects, programming resources). I promise to have the page updated by Noon the day of class for any information you may need to bring with you to class that day.

You are encouraged to obtain a JCARD for accessing JHU library resources. You can access library resources from off-campus as well as on-campus computers (<http://www.library.jhu.edu/>). See instructions at: <http://www.library.jhu.edu/services/computing/remotearchive.html> If you are interested in general searches for journal articles, please consult <http://www.ingenta.com/>.

Reading Assignments:

You will be expected to read assigned material before the class at which it will be discussed. You do not serve yourself by being exposed to these ideas for the first time in lecture. Keep notes in the margins or in a notebook to remind you to ask them during lectures later. You will be expected to search out and read additional material on topics during this course.

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Homework Assignments:

These assignments will involve research and computation. Research will be done to investigate and study algorithms described in popular and scientific literature. Computation will be done to analyze the time and space complexity of algorithms and to "walk-through" some of the algorithms we won't be translating into source programs. Although the Internet provides more examples of algorithms than you may ever wish to wade through, you are encouraged to think and assimilate, rather than regurgitate. The objective of researching algorithms this semester will be to compare their design and performance and for this you need your mind, not just books and the Internet.

Please note that in all assignments, you must cite all references and sources you use (see links on course WWW page for proper form of references of WWW pages). I will not tolerate the use of quoted or paraphrased information, algorithms, or code segments from published sources or from others without appropriate citation.

Programming Assignments:

You may write programs in Java or C++. You may use your own compiler (e.g., Sun, GNU, Borland, Microsoft) or resources on JHU computers.

I will provide you with a code header that you will complete for each program. You will be required to develop test cases for each program you submit. When you deliver your work, submit:

1. CD formatted for Window/Intel computer containing:
 - program source code, including completed code header documentation (see the required code template at either http://www.apl.jhu.edu/Notes/Boon/Common/Java_Links.shtml or http://www.apl.jhu.edu/Notes/Boon/Common/CPP_Links.shtml)
 - data file(s) required by your program;
2. printed listing(s) of your program(s);
3. printed test case statements and printed test case results.

Failure to submit all required materials will result in a reduction of grade on the assignment.

Exams:

One exam is planned. The exam is intended to assess your mastery of the key concepts and relationships investigated during the course. The final exam will be taken during the last class meeting of the semester.

Graded Assignments:

Distribution of weights in grading:

Homework/Programs	(25%)
Research Paper	(35%)
Exam	(25%)
Class Participation	(15%)

Assignments turned after the due date will not be accepted. Assignments may be marked as excused for extraordinary situations; no points will be assigned and the assignment will not be used in computing your final grade.

Grading Policy:

I will award partial credit for work done even if the result is incorrect, but this implies that you show all your intermediate work and clearly label your answer. I will deduct points for answers that do not make any sense at all; you should always check your work, even work done using the computer. The explanation of your work is as important as the work itself -- do not concentrate on the programs or mathematics and ignore the importance of clear descriptions of what you did and what it means.

The following grading scale will be used 100-90 = A, 89-80=B, 79-70=C, 69-Below=F. Letter grades approximately imply:

- A - complete understanding of the topic plus additional insight, creative, or other indicators of advancement beyond complete understanding of the topic;
- B - mastery of the basic material;
- C - attempt to complete the basic material but significant gaps in understanding and mastery exist;
- F - failure to complete basic material successfully.

I do not grade on a curve.

Attendance:

Class attendance is essential. Significant material is covered at each of our class meetings this semester. I may excuse absences if I am notified.

Academic Standards:

Students are reminded of sections in the current catalog: Academic Ethics and Violations of Academic Integrity¹.

All assignments this semester are individual effort assignments. It is a violation of the rules of academic conduct in this class for individuals to collaborate with other individuals, whether or not they are members of this class, on assignments, unless specifically directed that such collaboration is allowed for a specific assignment by the professor.

During class, you are expected to concentrate on and contribute to class presentations, lecture, and group discussion. Small group discussions that distract from the ability of others in class to adequately concentrate upon class presentations, lecture, and group discussion will not be tolerated. Use of laptop computers during class will be restricted to note taking and computer-based activities as assigned by the instructor. Internet surfing, writing of other papers, or use of programs not specifically related to the lecture will not be tolerated.

¹ <http://catalog.ep.jhu.edu/content.php?catoid=14&navoid=283>

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TENTATIVE COURSE SCHEDULE
605.721.91 Design and Analysis of Algorithms, Fall 2009, JHU

Class meetings Monday 4:30pm-7:10pm, GH203, Gilchrist Hall, Montgomery County Center.
Class WWW page <http://www.apl.jhu.edu/Notes/Boon/605721/>

Class	Date	Objectives	Text
1	09/14	Semester Overview; Term Paper Assignment; Fundamentals of Algorithmics	<i>(Read Chapter 1 and sections 2.1 and 2.2 for context and reference)</i> H 2.3
2	09/21	Fundamentals of Algorithmics	H 2.3
3	09/28	Deterministic Approaches	H 3
4	10/05	Deterministic Approaches	H 3
5	10/12	Deterministic Approaches	H 3
6	10/19	Approximation Algorithms	H 4
7	10/26	Approximation Algorithms	H 4
8	11/02	Randomized Algorithms	H 5
9	11/09	Randomized Algorithms	H 5
10	11/16	Simulated Annealing	H 6.1 and 6.2
11	11/23	Genetic Algorithms	H 6.3
12	11/29	Genetic Algorithms	H 6.3
13	12/07	Problem Solving Approaches	H 7.1 – 7.5
14	12/14	New Technologies	H 7.6

H – Hromkovič text

Final Exam will be a take home exam, distributed 12/07 and due 12/14