MAHARISHI INTERNATIONAL UNIVERSITY

SD 421 – Introduction to Algorithms

Discovering the Hidden Dynamics of Natural Law

Faculty
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Maharishi's Fifteenth Year of Invincibility

Global Raam Raj

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COURSE OBJECTIVES, ACTIVITIES, AND ASSESSMENTS

This is what you'll learn to do*	This is how you'll learn it.	This is what will show you've learned it
1. Develop skills in designing algorithms to solve problems (3,5)	By working on lab exercises and working with the Professor to understand lab solutions.	Results from daily Quizzes, Lab evaluations, Midterm exam, and Final exam.
2. Develop skill in performing asymptotic analysis of the worst-case running time of algorithms, providing a means to classify algorithms according to their level of efficiency. (3,5)	By studying material in the lecture slides and the textbook, we are practicing the techniques in Labs by working with the Professor to understand Lab solutions.	Results from Lab evaluations, Midterm exam, and Final exam.
3. Learn to represent algorithms in an implementation-neutral algorithm language (pseudocode) (3,5)	By translating algorithm descriptions, presented either in code or in English prose, into pseudocode. This kind of exercise will be done in the Labs.	Results from daily Quizzes and Midterm exam.
4. Learn the ins and outs of a core of classical algorithmic solutions for several problems of interest, both theoretically and practically. (3,5)	By studying the material in the lecture slides and the textbook and answering questions about these algorithms in the Labs	Results from daily Quizzes, Midterm exam and Final exam.
5. Implement algorithmic solutions in Java script and compare running times by executing in a suitable test environment. (3,5)	By working on programming problems provided in the labs and learning to use one or more pre-package test environments.	Results from Labs and Midterm.

6. Learn the algorithmic solutions with various strategies for Sorting, Searching, Trees and Graphs problems.	By understanding the material in the lecture slides and the textbook and answering questions about these algorithms in the Labs	Results from daily Quizzes, Midterm exam and Final exam.
7. Explain the connections between the Science of Consciousness and the Essentials of Algorithms (2)	By making the appealing points with written Science of Consciousness connections	Short Essay Exam Questions on Midterm and Final exams.

*The numbers in parentheses refer to the MUM Essential Learning Outcomes that are best supported by this course objective.

1. Holistic development of Consciousness and health
2. **Consciousness-Based understanding (Knowledge)**
3. **Creative and critical thinking**
4. Communication
5. **Scientific and quantitative reasoning**
6. Collaboration and leadership
7. Sustainable local and global citizenship

SD421 Course Overview Chart

Theme	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Foundations, Analysis, and Abstract Data Types	1. Introduction and Overview: Abstraction and Complexity	2. Sequences and List ADT	3. Stacks and Queues	4. Recursion	5. Binary Trees **Quiz-1**	6. The Heap
	Algorithm Analysis	Study & Homework	Study & Homework	Study & Homework	Reading & Homework	Reading & Homework
Sorting	7. Selection-Sort, Insertion-Sort Heap-Sort, and Shell-Sort	8. Priority Queues, PQ-sorting, and Radix-sort	9. Merge-Sort	10. Quick-Sort	Review for Exam	Mid-term Exam
	Reading & Homework	Reading & Homework	Reading & Homework	Reading & Homework	Study	
Searching Techniques and Strategies	11. Dictionaries: Log files, Hash Tables, and Lookup Tables	12. Ordered Dictionaries, Balanced BST's, and AVL Trees	13. 2-4 Trees	14. Ordered Dictionaries: Red-Black Trees	15. Introduction to Graphs and Graph Traversal: DFS	15. Continued **Quiz-2**
	Reading & Homework	Lab, Reading & Homework	Reading & Homework	Reading & Homework	Reading & Homework	Reading & Homework
Graphs	16. Weighted Graphs & Shortest Paths	17. Minimum Spanning Trees	Review for Exam and Short Answer Quiz	Final Exam		
	Reading & Homework	Reading & Homework	Study			

CS 321: Algorithms

Discovering the Hidden Dynamics of the Laws of Nature

He who in action sees inaction and in
inaction sees action as wise among men.

--Bhagavad-Gita IV v18

Goals and Objectives of the Course

- The goal of the course is to learn how to design and analyze various algorithms to solve a computational problem, including how to evaluate algorithm efficiency, select from a range of possible design strategies and/or abstract data types, and justify those selections in the design of a solution.

- This goal will be achieved by exploring a range of algorithms, including their design, analysis, implementation (in JavaScript), and experimentation.

Students should be able to:

1. Design a pseudo code algorithm to solve a computational problem using one or more of the basic design strategies: exhaustive search, divide-and-conquer, greedy, randomization, and/or decrease-and-conquer.
2. Create complex algorithms using various abstract data structures as building blocks in pseudo code and JavaScript algorithms.
3. Translate a pseudo code algorithm into a JavaScript program.
4. Understand through direct experience why it is **important to design the algorithm** before coding in JavaScript (or any programming language).
5. Explain and use big O notation to specify the asymptotic bounds of an algorithm's space and time complexity, e.g., the computational complexity of the principal algorithms for sorting, searching, selection, and hashing.
6. Explain factors other than computational efficiency that influence the choice of algorithms, such as programming time, simplicity, maintainability, and the use of application-specific patterns in the input data.
7. Design solutions to graph problems by incorporating the fundamental graph algorithms, including depth-first and breadth-first search, single-source shortest paths, and minimum spanning tree.
8. Explain the connection between the Science and Technology of Consciousness and Algorithm Analysis and Design.

Class Schedule

Class is in session from 10:00 AM to 12 PM Mon-Sat. On Mon-Fri, the afternoon session resumes at 1:00 and continues till 3:15 (approximately). There will be a group meditation at 11:45 AM each day and, on Mon-Fri, at (approximately) 2:45 PM.

Evaluation Criteria

The course grade will be based on two examinations, few quizzes, lab assignments, class participation, and the Professional Etiquette evaluation with the following weights:

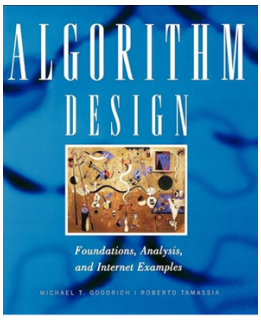
Labs	10%
Quizzes	Bonus
Midterm Exam	45%
Final Exam	45%

Attendance at all class sessions including labs is required. Unexcused absences or tardiness will reduce a student's final grade.

No Course Textbook

The data structures that I provide will be variations and adaptations from the ones in the following book.

- ***Algorithm Design: Foundations, Analysis, and Internet Examples,*** **by M. Goodrich & R. Tamassia, published by Wiley & Sons, 2002.**



Other References

- *An Introduction to Algorithms* by T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein published by The MIT Press, 2009 (1000 pages, difficult reading but a great reference.)
- *The Algorithm Design Manual* by Steve S. Skiena published by Springer-Verlag 1998 (500 pages, a unique and excellent book containing an outstanding collection of real-life challenges, a survey of problems, solutions, and heuristics, and references help one find the code one needs.)
- *Data Structures and Algorithms in Java, 4th Ed.* by M. Goodrich & R. Tamassia, published by Wiley & Sons, 2006.
- *Foundations of Algorithms, Using Java Pseudocode* by Richard Neapolitan and Kumarss Naimipour published by Jones and Bartlett Publishers, 2004 (600 pages, all mathematics is fully explained; clear analysis)

Labs

Each lesson has a corresponding assignment for you to do. The work that you need to do for each of the Lessons can be found in the Assignments area of Sakai. Assignment 1 goes with Lesson 1, Assignment 2 with Lesson 2, etc. For a given Assignment, you will see some instructions and attached documents. Every Assignment has a due date and a last possible time/date for submission. If you do not submit by the last acceptable date, you will not receive credit for the lab. Re-submission of assignments is not allowed. Each lab is due by 10 pm on the next day. You will be working in a team with 2 or 3 persons. Strictly not more than 3.

Guidelines for Lab Submission

1. If a problem asks you to write code, work it out in a development environment, and submit a soft copy of your code bundled with other work you have done for that problem.

2. Your submissions should be coding file, pdf or jpeg.

3. Each soft-copy submission should include the following information:
   - *Assignment Number*
   - *Your group Number*

Academic Honesty

The homework assignments allow you to work with the course material and gain a deeper understanding.

You should turn in only the work that you have done yourself. If you don't have time for a particular assignment, don't turn it in.

If you take any of the following alternatives instead, your assignment will receive a score of "0".

1. Copy a solution from another student and turn it in as your own.
2. Copy a solution from a solution sheet or notes from a student that comes from a previous version of this course
3. Copy a solution from the Internet and AI tools.

Quizzes

There will be few quizzes. The quizzes allow me to:

1. Check how well you understood the material.
2. Give you a feeling for the kinds of assessment questions you may get on this material.

Grading Scale

We will use the following grading scale:

Range	Letter Grade
93-100	A
90 - 92	A-
87 - 89	B+
83 - 86	B
80 - 82	B-
77 - 79	C+
73 - 76	C
67 - 72	C-
0 - 66	NC