# CS 520 - Advanced Analysis of Algorithms (Fall 2003)

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## 1 Preview

This course is intended for a graduate audience in the CSEE and Mathematics Departments. It will serve as a thorough introduction to the fundamentals of design and analysis of algorithms.

For the most part, the focus will be on deterministic models of computation, although there will be occasions where randomized algorithms will be introduced and analyzed.

## 2 Pre-requisites

Exposure to Discrete Mathematics and Probability.

## 3 Logistics

1. Class Times Tu - Th $8:00\ am - 9:15\ am$.
2. Location - 109 MER-E.
3. Office Hours - By appointment.
4. Class URL: `http://www.csee.wvu.edu/~ksmani/courses/fa03/algos/algos.html`.
5. Teaching Assistant - L. Kovalchick (lynn@csee.wvu.edu).

## 4 Syllabus sketch

1. Mathematical Preliminaries - Growth of Functions, Summations, Recurrences, Probabilistic Analysis (5 Lectures).
2. Sorting and Order Statistics - Heapsort, Quicksort, Lower bounds for comparison sorting, Sorting in Linear Time, Selection in Expected and worst-case linear time (4 Lectures).
3. Data Structures - Stacks, queues, Binary Search Trees, Graph Structures (2 Lectures).
4. Dynamic Programming - Matrix Chain multiplication, Longest common subsequence, Optimal Path planning (3 Lectures).
5. Greedy Algorithms - Kruskal's algorithm, Activity selection, Huffman codes (3 Lectures).
6. Graph Algorithms - Minimum Spanning Trees, Single-Source Shortest Paths and Maximum Flows (5 Lectures).

7. `NP-completeness` - Verification and decidability, `NP-completeness` and reducibility, `NP-complete` problems (5 Lectures).

## 5 Material

There are a number of texts that provide adequate introductions to the analysis of algorithms. [CLRS01] is a comprehensive (albeit intimidating) treatise on all the fundamental aspects of algorithm design. [Wil02] provides a quick overview of most of the topics in the course syllabus. Finally, [GJ79] is the authorative source on `NP-completeness`.

## 6 Assessment

1. Quizzes (2) - Two quizzes will be held; one on September 23 and the other on November 18. These quizzes will be in-class and closed book. Each quiz is worth 20% (for a total of 40%) of your grade.
2. Midterm - The midterm will be held on October 21. It is in-class, closed book and worth 30% of your grade.
3. Final - The final will be held on December 11, $15:00-17:00$. It is in-class, closed book and worth 30% of your grade.

A maximum of 5 points is reserved for class performance, which includes regular attendance and participating in class discussions.

## 7 Grade Boundaries

1. **A** - $\geq 90$
2. **B** - $75-89$
3. **C** - $60-74$
4. **D** - $50-59$
5. **F** - $0-49$

## 8 Social Justice Statement

West Virginia University is committed to social justice. I concur with that commitment and expect to foster a nurturing learning environment, based upon open communication, mutual respect and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religon, sexual orientation, color or national origin. Any suggestions to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation, in order to participate in this class, please advise me of the same and make appropriate arrangments with Disability Services $(293-6700)$.

If you feel that you are being treated inappropriately or unfairly in any way, please feel free to bring your concerns to my attention; rest assured that doing so will not prejudice the grading process. In return, I expect you to behave professionally and ethically.

## References

[CLRS01] T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein. *Introduction to Algorithms.* MIT Press, 2001.

[GJ79] M. R. Garey and D. S. Johnson. *Computers and Intractability: A Guide to the Theory of NP-Completeness.* W. H. Freeman Company, San Francisco, 1979.

[Wil02] Herbert S. Wilf. *Algorithms and Complexity.* A K Peters, Ltd., 2002.