## Math 343J: Discrete Mathematics

**Winter 2008**

Professor: Dr. Barbara Wahl

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Office: Fine Arts 137 (x 7326)

Office Hours: MWF 11:00 - 11:50, and by appointment

Course handouts & etc. available online: vault.hanover.edu/~wahl

**Description**: According to *Computing Curricula 2001*, “Mathematics provides a language for working with ideas relevant to computing, specific tools for analysis and verification, and a theoretical framework for understanding important computing ideas. For example, functional programming and problem solving draw directly upon the mathematical concepts and notations for functions; algorithmic analysis depends heavily on the mathematical topics of counting, permutations and combinations, and probability; discussions of concurrency and deadlock draw heavily from graph theory; and both program verification and computability build upon formal logic and deduction.”

This course investigates mathematical topics which are fundamental to computer science, including logic, proof, functions, relations, cardinality, combinatorics, discrete probability, recurrence relations, and graph theory.

**Prerequisite**: Math 220

**Required Textbooks**:

1. *Discrete Mathematics, 2nd edition,* by James L. Hein (Jones and Bartlett, 2002).
2. *Maple Experiments in Discrete Mathematics*, by James L. Hein (self-published, 2005). Download PDF version from this URL (I'll tell you which pages to print before each lab): <http://web.cecs.pdx.edu/~jhein/books/MapleLabBook.pdf>

**Homework:** Will be assigned and collected weekly (approximately). I will assign homework grades based on overall quality, correctness (spot-check), and completeness.

**Late Policy**: Please turn in all assignments by the *beginning* of class on the due date; a 10% per day penalty will be levied for turning in a late assignment. For example, an assignment which was due on Friday and turned in the following Tuesday would be four days late, resulting in a 40% reduction in grade.

**Computer Labs**: We will use *Maple* as an experimental tool for testing properties of discrete structures. No previous experience with *Maple* or computer programming will be assumed. You do need to download and print the lab manual (see URL given above).

**Class Participation**: Your active participation is essential to learning the material. Your class participation grade will be based on your contributions to class discussions and your work at the board (quantity and quality). I expect you to read the assigned material *before class*, to work through the examples and proofs to your own satisfaction, to attempt some of the related exercises, and to record any questions you may have. Please meet with me outside of class if you are having difficulties.

Rubric:

* A participation grade of C denotes that you have been an active participant in class discussions and made a serious effort to master the concepts.
* A participation grade of B denotes a daily demonstration in class discussions of your knowledge of concepts that you understand and questions about concepts and problems that you do not understand. B-level students should make occasional presentations of their work at the board.
* A participation grade of A denotes all the above requirements have been met, plus you have made frequent high-quality presentations at the board.

**Absences:** I expect and encourage you to come to class each day, except in case of serious illness or other emergencies. If you do miss a class, I appreciate knowing why – please send me a brief email, or leave a voicemail message at x7326. Absences obviously have a negative effect on your participation grade and on your learning.

**Homework:** Will be assigned and collected weekly (approximately). I will assign homework grades based on overall quality, correctness (spot-check), and completeness.

**Exams**: The tentative schedule is as follows:

* Exam #1, Friday 2/1/08
* Exam #2 , Friday 3/7/09
* Exam #3, final exam week

**Grading**: Your grade will be determined according to the following standards.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Class Participation | 10% |  | A | 93 |  | C | 73 |
| Homework | 20% |  | A- | 90 |  | C- | 70 |
| Labs | 10% |  | B+ | 87 |  | D+ | 67 |
| 3 Exams | 60% |  | B | 83 |  | D | 63 |
| Total | 100% |  | B- | 80 |  | D- | 60 |
|  |  |  | C+ | 77 |  | F | 0 |

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| **Math 343 -- Winter 2008 -- Tentative Schedule, by Section** | |  |
|  |  |  |
| **Section** | **Topic** | **Week** |
| 1.3 | Ordered structures (tuples, lists, strings, relations) | 1 |
| 1.4 | Graphs and trees | 1,2 |
| 2.1 | Functions: definitions and examples | 2 |
| 2.2 | Functions: constructing and combining | 3 |
| 2.3 | Functions: properties; pigeonhole principle; hash functions | 3 |
| 2.4 | Countability; limits on computability | 4 |
| 3.1 | Inductively defined sets | 5 |
| 3.2 | Recursive functions and procedures | 5,6 |
| 3.3 | Formal grammars | 6 |
| 4.3 | Order relations | 7 |
| 4.4 | Mathematical induction, well-founded induction | 7,8 |
| 5.1 | Analysis methods: worst-case running time; decision trees | 9 |
| 5.2 | Analysis methods: finding closed forms for sums | 10 |
| 5.3 | Analysis methods: combinatorics and discrete probability | 10,11 |
| handout | Analysis methods: analyzing data from a single numerical variable | 11,12 |
| 5.4 | Analysis methods: recurrence relations | 12,13 |

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| **Math 343 -- Winter 2008 -- Tentative Schedule, by Day** | | | | | |
|  |  |  |  |  |  |
| week | date | M | W | R | F |
| 1 | 7-Jan | 1.3 | 1.3 | no class | 1.4 |
| 2 | 14-Jan | 1.4 | 2.1 | lab | 2.1 |
| 3 | 21-Jan | 2.2 | 2.3 | lab | 2.3 |
| 4 | 28-Jan | 2.4 | review | lab | exam 1 |
| 5 | 4-Feb | 3.1 | 3.2 | lab | 3.2 |
| 6 | 11-Feb | 3.2 | 3.3 | lab | 3.3 |
| 7 | 18-Feb | 4.3 | 4.3 | lab | 4.4 |
| 8 | 3-Mar | 4.4 | review | lab | exam 2 |
| 9 | 10-Mar | 5.1 | 5.1 | lab | 5.1 |
| 10 | 17-Mar | 5.2 | 5.3 | lab | 5.3 |
| 11 | 24-Mar | 5.3 | stats | lab | stats |
| 12 | 31-Mar | stats | 5.4 | lab | 5.4 |
| 13 | 7-Apr | 5.4 | catch-up | no lab | review |