Math 232

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Course Description

This course builds on the foundational mathematical ideas from Math 231, which included logic, language of sets and functions, mathematical proofs and some basic number theory related to the Euclidean Algorithm. In Math 232, we will consolidate these ideas and add also the important method of proof by induction and the idea of recursive definitions. These go hand-in hand with recursive algorithms which are common in computer programming. Math 232 also develops important new concepts and tools, including linear recurrence relations, some of the combinatorial mathematics arising from graphs and trees, and optimization algorithms involving networks of various sorts.

Textbook

Rosen, Discrete Mathematics and Applications, 7th or 8th edition. This course will cover some parts of the Chapters 5, 8, 10, 11. (For details on topics covered, see below).

Calculators

A scientific calculator will save you time doing simple computations. You will only be allowed to use one of the following calculators on quizzes and exams: Casio fx-260, Casio fx-300MS (or Plus), Casio fx-300ES (or Plus), TI-30X (a, S, or IIS), TI-34.

Prerequisites/Corequisites

Prerequisites: Math 231

Course Objectives

Successful students should:

1. (CO 1) consolidate the accurate usage of the language of mathematics initiated in Math 231;
2. (CO 2) become familiar with the method of proof by induction;
3. (CO 3) gain more proof-writing experience and see some more significant proofs; in the various applications;
4. (CO 4) be able to solve linear recurrence relations;
5. (CO 5) understand some of the mathematics of networks, graphs, planar graphs and trees;
6. (CO 6) apply some optimization algorithms performed on graphs and networks.

Topics covered

1. the basic template for an induction proof, lots of examples proving identities seen in Math 231 such as summation formulae, inequalities and more involving the idea of divisibility
2. the binomial theorem revisited, and proved now by induction using the recursive definition of the binomial coefficient
3. proof of the Fundamental Theorem of Arithmetic from Section 4.3.
4. the basic method for solving homogeneous linear recurrence relations
5. the definitions of a graph, multigraph, digraph, relevant examples of graphs
6. Neighbors, degrees, special graphs including K_n and $K_{m,n}$, matchings and Hall's Marriage Theorem
7. graph isomorphisms
8. Euler and Hamilton circuits
9. planar graphs, Euler's theorem, non-planarity of K_5 and $K_{3,3}$, statement of Kuratowski's theorem
10. Brief discussion of the famous Four Color Theorem
11. Basic terminology of trees and forests
12. ordered rooted trees and some of their applications
13. connection between binary rooted trees and Catalan numbers
14. Dijkstra's shortest path algorithm
15. the traveling salesman problem
16. one of Prim's or Kruskal's algorithm for finding minimal spanning trees

Assessments

1. Classwork(15%): There will be problem/discuss session in the second half of each lecture (except Fridays). You will work on a problem set based on the lecture. You can discuss it with your peers and/or me, but you will need to write up the solutions on your own and hand them in by the end of lecture. Grading on classwork is based on completion rather than correctness, meaning you'll get full credit if you complete (probably some of) it.

2. Written homework (15%): There will be weekly written homework, due on Fridays at 11:59am.

3. Quizzes(20%): There will be quizzes which take place in the second half of the lecture on Fridays in weeks 1,2 and 3. Your best two will count toward your grade. (i.e. it's OK if you do bad or miss one of them.)

4. Final exam(50%): Of course, there will be a final exam on Friday in week 4.

Tentative weekly schedule

Week	Topics covered	assessments
1	5.1-5.2, 8.1-8.2	written homework, quiz 1
2	10.1-10.3, 10.5, 10.7	written homework, quiz 2
3	11.1-11.3	written homework, quiz 3
4	10.7, 11.5, some additional topics if time permits	written homework, Final exam

Course Policies

Attendance

Attendance is not strictly required, but definitely recommended. Also, you won't be able to complete and hand in the classwork if you don't show up.

Late assignments / absence in quizzes/exams

Late assignments will not be accepted. Making up a quiz is not possible. For the final exam, if there is a valid reason that you will have to miss an exam, let me know in advance and we'll try to figure out what we can do to make it up.

Academic Integrity and Honesty

Students are required to comply with the university policy on academic integrity. We have zero tolerance for cheating. Nevertheless, collaborative discussion on assignments with your classmates and writing solutions up on your own does not count cheating and is encouraged.