MATH 530 Discrete Mathematics with Applications I

1. Catalog Description

MATH 530 Discrete Mathematics with Applications I **4 units**

Prerequisite: MATH 248 with a grade of C- or better and MATH 336 and graduate standing, or consent of instructor.

Methods of discrete mathematics with applications. Generating functions and Lagrange inversion, partition theory, permutation statistics and q-analogues, posets and Möbius inversion. Additional topics including lattice paths and basic hypergeometric series. 4 lectures. Not open to students with credit in MATH 435.

2. Required Background or Experience

Prerequisite: MATH 248 with a grade of C- or better and MATH 336, or consent of instructor.

3. Learning Objectives

Upon completion of MATH 530, a student should be able to:

a. Use generating functions to investigate the properties of integer sequences and to solve counting problems.
b. Understand integer partitions and become familiar with classical results in the area
c. Learn how to examine permutations by rises, descents, inversions, and the major index.
d. Extend their basic knowledge of inclusion/exclusion gained in MATH 336 by examining partially ordered sets and Möbius inversion.
e. Understand and apply the standard techniques of discrete mathematics to solve problems from probability theory, combinatorics, and number theory.

4. Text and References

Text to be specified by instructor. Suggested texts include:

- Graham, Ronald, Concrete Mathematics
- Hardy, G. H. and E. M. Wright, An Introduction to the Theory of Numbers
- J.H. Van Lint and R.M. Wilson, A course in Combinatorics
- R. Stanley, Enumerative Combinatorics Vol. I and II
- P. Goulden and D.M. Jackson, Combinatorial Enumeration
- G. E. Andrews. The Theory of Partitions

5. Minimum Student Materials

Paper, pencils and notebook.

6. Minimum University Facilities

Classroom with ample chalkboard space for class use.

7. Content

a. Generating functions, Lagrange inversion, the exponential formula.
b. Partition theory, Euler's pentagonal number theorem, the Jacobi triple product, Rogers-Ramanujan type identities
c. Permutation statistics, Gaussian numbers, and q-analogues
d. Posets and Möbius inversion, generalized inclusion/exclusion
e. Lattice paths and /or hypergeometric series and/or other advanced topics as selected by instructor (time Permitting)

Note:

The topics covered in MATH 435 are identical to those covered in MATH 530. MATH 530 is the graduate level version of MATH 435, and requires additional work for the graduate students enrolled in the course. Students in MATH 530 will be responsible for supplementary exercises and additional readings, and a presentation or project on the additional readings. Students will be prohibited from taking both MATH 435 and MATH 530.

8. Methods of Assessment

Exams, homework, and possibly student presentations.