



Discrete Mathematics for Young Mathematicians Advanced Math Classes from Yul Inn

Discrete mathematics comprises a broad range of areas of mathematics that is rich with thought-provoking problems. It offers countless opportunities to explore and learn advanced mathematics, and to develop powerful reasoning and problem solving techniques. The areas from discrete mathematics are especially applicable to computer science, engineering, and other high technology related fields. In the Discrete Mathematics for Young Mathematicians courses I introduce topics in discrete mathematics and allow students to discover mathematics through stimulating, open-ended problems.

In a typical class period, I define necessary mathematical terms and notation for the day's topic, and walk through some examples. I then hand out problem sets; most of class period is spent working on the problems. As students work on problems, I offer hints but do not provide answers: discovery is an incomparable learning method.

Depending on the class's progress on the problems, we may discuss the solutions at the end of class, or students may have to finish problems as homework. In the latter case, we discuss the solutions at the beginning of the next class. In the discussions, students are required to justify and prove results discovered or observed in solving the problems. In this class, the justifications/proofs are as important as the solutions themselves.

In the end, students have the opportunity to work on some interesting, fun, and challenging problems, and to discover some very cool and useful mathematics!

About Yul Inn:

As the founder of Fun Math Club I have taught math enrichment programs for schools and community organizations in the San Jose area since 2003. I work extensively with gifted and talented students. I have been an instructor in the Johns Hopkins University Center for Talented Youth summer programs and the Stanford University Pre-Collegiate Studies (formerly EPGY) Summer Institutes since 2005 and have mentored award-winning students in the Intel International Science and Engineering Fair. I also lead math circles at Stanford, San Jose State, and other local schools.

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Past Course List

Each course on the next page has been offered in the past. New courses are created from time to time. Each has a set of core topics, and a set of advanced topics, that may be covered depending on the progress of the students:

Discrete Mathematics for Young Mathematicians

Course List

1. Logic, Sets, and Counting

This class covers basic techniques and terminology required when working with finite sets. The core topics include propositional logic, set theory, functions, and counting methods. Optional advanced topics come from combinatorial identities, Pascal's triangle, and recurrence formulas

2. Graph Theory

Graph theory deals with relations between objects. It has many applications in scientific, engineering and computer fields. Topics include directed and undirected graphs, Eulerian and Hamiltonian cycles, and trees. Optional advanced topics come from planar graphs, graph decompositions, and graph coloring.

3. Cryptography and Number Theory

Cryptography deals with secure communication, both constructing the ciphers to prevent unauthorized access and methods to attack secure transmissions. Number theory concepts and techniques form the base for much of cryptography. Core topics include divisibility, prime numbers, modular arithmetic, and traditional cryptography. Optional advanced topics come from public-key cryptosystems, hashing functions, and signature schemes.

4. Symmetry*

Symmetry is a multi-disciplinary topic that, from a mathematical point of view, is generally thought of as a geometric concept. This class explores "geometric" symmetry and its relation to algebra. Core topics include two and three dimensional symmetry and elements of group theory. Optional advanced topics come from permutation groups and advanced counting methods.

5. Excursions in Probability*

Data analysis, probability, and game theory have wide applications in all areas of the "hard" sciences as well as fields such as political science, economics, psychology, etc. The core topics include discrete probabilities and applying probability to decision-making and games. Optional advanced topics come from game theory and information theory.

* Although these areas don't strictly fall under discrete mathematics, they share many concepts and methods from in discrete mathematics. The class focuses on the "discrete" aspects of these areas.