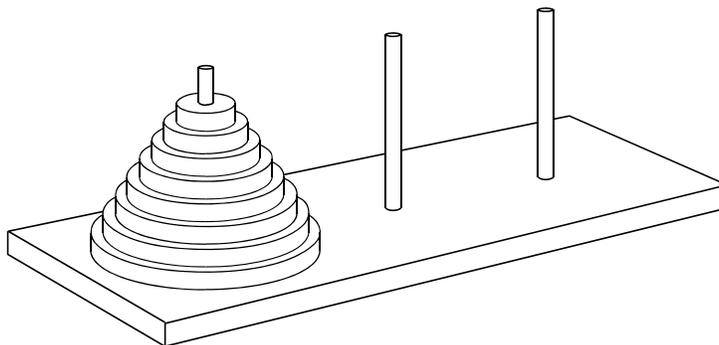


MATHEMATICS 2320
DISCRETE MATHEMATICS

The *Towers of Hanoi* is a popular puzzle. As illustrated on the right, it consists of three pegs and a number of discs of differing diameters, each with a hole in the centre. The discs initially sit on one of the pegs in order of decreasing diameter (smallest at top, largest at bottom), thus forming a triangular tower.



The object is to move the tower to one of the other pegs by transferring the discs to any peg one at a time in such a way that no disc is ever placed upon a smaller one. Suppose you can move a disc a second. Estimate the time required to transfer the discs if $n = 8$, $n = 16$, $n = 32$ and $n = 64$.

Suppose you have to put 500 examination books into alphabetical order. One way to proceed is to go check the names on the first two books and, if they are out of order, interchange them. Then check the names on the second and third books; if these are out of order, interchange them. Continue this way until you reach the last book, then go back to the beginning and repeat this procedure. Keep doing this until the books are in alphabetical order. Is this a good way to alphabetize? Is there a better way, and better in what sense?

The word *discrete* means separate or distinct. Mathematicians view it as the opposite of *continuous*. Whereas in calculus it is continuous functions of a real variable that are important, such functions are of essentially no interest in discrete mathematics. Instead of the real numbers, it is the natural numbers $1, 2, 3, \dots$ that play a fundamental role and functions with domain a (sometimes finite) subset of the natural numbers that are studied. Perhaps the best way to summarize the subject is to say that *Discrete Mathematics* is the study of problems associated with the natural numbers.

Text. *Discrete Mathematics* by E. G. Goodaire and M. M. Parmenter is frequently used as a text for this course.

Marks. Typically, 55% of the final grade in this course is awarded for performance on a final examination, 30% to performance on a midterm and 15% for homework.

Of course, these percentages vary from one instructor to another.

Calendar description. **2320 Discrete Mathematics** covers basic concepts of mathematical reasoning, sets and set operations, functions, relations including equivalence relations and partial orders as illustrated through the notions of congruence and divisibility of integers, mathematical induction, principles of counting, permutations, combinations and the Binomial Theorem.

Prerequisite: Mathematics 1001 or 2050.

Note: Credit cannot be obtained for both *Pure Mathematics 2320* and *Computer Science 2740*.

Offered. Fall, Winter, Spring