Mini-bibliography... Graph Theory

by Joseph Malkevitch

One of the most appealing topics in discrete mathematics is graph theory. The subject is quick starting, geometric, rich in applications (e.g. robot motion planning, examination scheduling, snowplow routing, etc.), and abounds in easy to explain unsolved problems. Here is a bibliography describing six relatively elementary books on the subject, followed by three intermediate level books and three which are more advanced.

Elementary:

Biggs, N., Lloyd, E., and Wilson, R. ***Graph Theory 1736-1936****, Clarendon Press, Oxford, 1986.* This is a paperback reissue of an earlier hardbound history of graph theory. It includes excerpts from some of the major papers contributing to the early development of the field.

Chartrand, Gary, ***Introductory Graph Theory****, Dover, New York.* This paperback book covers digraphs, traversability problems, connectivity, and mathematical modeling.

Malkevitch, Joseph, and Meyer, Walter, ***Graphs, Models, and Finite Mathematics****, Prentice-Hall, Englewood Cliffs, 1974.* This book's beginning chapters illustrate how by using graphs to construct mathematical models various problems in operations research can be solved. Topics treated include traversability, the critical path method, and coloring problems.

Ore, Oystein, ***Graphs and Their Uses****, Mathematical Association of America, Washington, 1963. (Revised edition: 1991, R. Wilson).* This introductory paperback book covers coloring problems, puzzles and games, traversability problems, trees, and matchings. The original version is a bit dated, but the revised version, updated by Robin Wilson, includes significant new material.

Steen, Lynn (ed.), ***For All Practical Purposes****, (second edition) W. H. Freeman, New York, 1991.* The beginning chapters of this book apply mathematical modelling techniques to a variety of problems. Topics treated include traversability problems, minimum cost spanning trees, and the critical path method. Five video tapes from the TV series with the same title support the written materials.

Wilson, Robin, and John Watkins, ***Graphs: An Introductory Approach****, John Wiley and Sons, New York, 1990.* Topics covered include: planarity, trees, colorings, digraphs, and applications of these concepts.

Topics... Recursively Expanding Enthusiasm

by Elyse Magram

One can't help but be amazed at the number of rabbits that are predicted by the Fibonacci numbers, a recursive pattern which begets a combinatorial explosion -- 75,025 rabbits by the twentieth generation, and many more to come, all generated from the simple recurrence relation $r_{n+2} = r_{n+1} + r_n$, where $r_0 = 1$ and $r_1 = 1$. This reminds me of the enthusiasm that has steadily grown in me since meeting discrete mathematics.

After 25 years of teaching, with two children in college, it seemed to be a good time to expand my horizons. ''Why pursue math?'' asked my friends, ''take something for fun, something light and colorful, something for joy.'' How could they understand that all this and more could be fulfilled for me in a math institute. This I found when I attended the Leadership Program in Discrete Mathematics at Rutgers University.

The work was overwhelming. The professional contacts were superior. The interrelationships between the participants, dedicated teachers, was incredible. We were exposed to distinguished speakers who introduced us to graph theory, algorithms, combinatorics, fair elections, and computational geometry. We worked together, alone, in twos and fours -- all day, in the evening, and on the weekends, too. We griped, we laughed, we sang, we burned the midnight oil. The contact and the sharing have been a true highlight in my teaching this year.

The material is exciting to use in class. The Tower of Hanoi was an excellent motivation for sequences and series in precalculus. Matrices were greatly enhanced by introducing the topic of secret codes. Map coloring and optimization were exciting to students at all levels. My students enjoyed doing an optimal time problem for lasagna preparation. Minimum spanning trees intrigued the slowest students, especially in planning condominium roads (see *Illustration* on top of page 10) and going through rat mazes. My students' intuition was awakened, and they found that math is really fun. There is such wonder in seeing the range of applications that mathematics has.

Teaching discrete mathematics can change your outlook as well; I urge you to search out a local program to add vitality and joy to your teaching.

Solution... TSP *(Continued from box on page 1)*

There are altogether 24 possible routes, corresponding to the 4! arrangements of B, C, D, and E; however, only 12 calculations are necessary since the 24 includes the reverse of each route. The shortest route is ACBEDA (or its reverse) with a total length of 92. Curiously, you don't travel from C to D which are the nearest pair of cities.