TAMS Tournament Programming Solutions

TAMS Computer Science

November 20, 2011

Rules

Binomial Expansion (binomial)

For each term, apply the binomial formula and multiply it by the constant to the next power to find the coefficient. Then, do a simple subtraction or use a counter to find the exponent of the variable. Follow the formatting guidelines to output the coefficient, variable, and exponent.

Currency exchanging (currency)

This problem can be solved using the Floyd-Warshall algorithm. After application of the algorithm, check each diagonal entry; if the entry is less than zero, a cycle exists. Note that you are actually searching for positive cycles in the input graph, so either negate each weight or use the Floyd-Warshall algorithm to actually find the longest path.

Maximize Equation (maximize)

This was a simple but long application of the shunting-yard algorithm (to convert from infix to reverse Polish notation). Once in reverse Polish notation, the expression can easily be evaluated (and maximized) using stacks.

Quadratic Solutions (quadsol)

Find $\frac{-b}{2a}$ and $\frac{\sqrt{|b^2-4ac|}}{2a}$. If the determinant is negative, the first is the real part and the second is the absolute value of the imaginary coefficient, but otherwise, the real part is the first added to the second and the first minus the second, with $b = 0$.

Remembering Questions (remq)

One way to identify palindromes is to reverse the sequence. If the sequence and its reversal are identical, the sequence is a palindrome.

Schedule (schedule)

A map could be used to store the hours and check for conflicts. Alternatively, since the hours were restricted, an array could be used.

Sequence Distances (sequence)

This program could be solved efficiently using dynamic programming. Let $d[i][j]$ be the distance between the first i elements of the S and the first j elements of T. Then, we are looking for $d[|S|+1][|T|+1]$, the distance between S and T. If $i = 0$ or $j = 0$, the distance is j or i, respectively. The other distances can be calculated with the recurrence relation, $d[i][j] = min\{d[i-1][j]+1, d[i][j-1]+1, d[i-1][j-1]+\delta\}$, where $\delta = 0$ if $S[i] = T[j]$ and 1 otherwise..