# CS 473: Undergraduate Algorithms, Spring 2009
# Homework 3

## Written solutions due Tuesday, February 17, 2009 at 11:59:59pm.

1. Redo Homework 2, but now with dynamic programming!

   (a) Describe and analyze an efficient algorithm to compute the minimum number of 1's in a basic arithmetic expression whose value is a given positive integer.

   (b) Describe and analyze an efficient algorithm to compute the length of the longest bitonic subsequence of a given input sequence.

   (c) Describe and analyze an efficient algorithm to compute the minimum number of palindromes that make up a given input string.

   Please see Homework 2 for more detailed descriptions of each problem. **Solutions for Homework 2 will be posted Friday, after the HW2 oral presentations.** You may (and should!) use anything from those solutions without justification.

2. Let $T$ be a rooted tree with integer weights on its edges, which could be positive, negative, or zero. Design an algorithm to find the minimum-length path from a node in $T$ down to one of its descendants. The length of a path is the sum of the weights of its edges. For example, given the tree shown below, your algorithm should return the number $-12$. For full credit, your algorithm should run in $O(n)$ time.
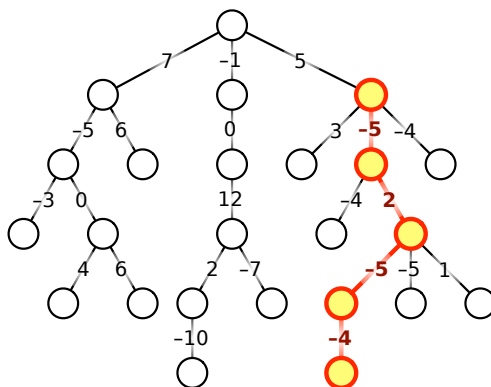


The minimum-weight downward path in this tree has weight $-12$.

3. Describe and analyze an efficient algorithm to compute the longest common subsequence of *three* given strings. For example, given the input strings <u>E</u><u>PI</u>D<u>E</u>M<u>I</u>OL<u>O</u>GIST, <u>R</u><u>E</u>F<u>RI</u>G<u>E</u>RAT<u>IO</u>N, and SUP<u>E</u>RCALIFRAGIL<u>I</u>STIC<u>E</u>XP<u>I</u>ALOD<u>O</u>CIOUS, your algorithm should return the number 5, because the longest common subsequence is <u>**EIEIO**</u>.