

Introduction To Algorithms
CS430

Spring 2013
HomeWork 2
Due 4th February

1. **Problem 1:** Consider the function \hat{O} defined as follows:

$f(n) = \hat{O}(g(n))$ iff there exists a positive constant, c and an integer n_0 such that

$$0 \leq f(n) \leq cg(n) \log n, \quad \forall n \geq n_0$$

Prove or Disprove

(a) $f(n) = \hat{O}(g(n))$ implies $g(n) = \hat{O}(f(n))$.

(b) $f(n) = \hat{O}(g(n))$ implies $\log f(n) = \hat{O}(\log g(n))$.

Do the same for:

(c) $f(n) + o(f(n)) = \Theta(f(n))$.

(d) $f(n) + g(n) = \Theta(\min(f(n), g(n)))$.

(20 pts)

2. **Problem 2:** Consider lopsided trees with costs 3 and 1 on the left and right branches, respectively, of the search tree. Characterize the weights (costs) at the leaves of the optimal trees. Establish a recurrence for the maximum number of leaf nodes of cost w .

(10 pts)

3. **Problem 3:** Egg-Drop. Given 2 eggs and a device to hold the egg, determine the highest floor of a building from which the egg will survive the fall. Your method should require the least number of tests. Note that if you have one egg then the only way is to go up the building one floor at a time.

(20 pts)