

**Introduction To Algorithms**  
**CS430**

**Spring 2014**  
**HomeWork 1**  
**Due 25th January**

1. What is the smallest value of  $n$  such that an algorithm, whose running time is  $200n^2$ , runs faster than an algorithm whose running time is  $1.5^n$  on the same machine.  
(10pts)

2. 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)

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)