

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

**Spring 2014**  
**HomeWork 2**  
**Due 3rd February**

1. **Problem 1** Solve the following recurrences where:

$$T(i) = 1; i = 1 \dots 10$$

- (a)  $T(n) = T(\log n) + 3$
- (b)  $T(n) = T(\log n) + 3n$

(10 pts)

2. **Problem 2.** Use the recursion tree method to solve

$$T(n) = T(n - c) + T(c) + f(n)$$

where  $c$  is a constant

- (a)  $f(n) = \log \log n$
- (b)  $f(n) = \sqrt{n}$

(20 pts)

3. **Problem 3.** Fill in details and analyse the following version of quicksort.

MultiQuicksort( $n$ ):

- (i) Partition the numbers into 3 parts
- (ii) Sort the parts recursively.

For the analysis, assume that the  $n$  numbers are partitioned into 3 (roughly) equal parts

(20 pts)

4. **Problem 4:** Show how to multiply two complex numbers  $a + bi$  and  $c + di$ . Use 3 multiplications only. (10 pts)
5. **Problem 5.** Consider lopsided trees with costs  $a$  and  $b$  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  $w$  (No need to solve the recurrence). (20 pts)