

## CPS 130: Homework 2

### Recurrences (Master Method), and Sorting (CLRS: Chapters 2, 4 and 7)

Date on which distributed: Tuesday, September 11, 2001

Date on which due: Tuesday, September 18, 2001

Note: Zero credit will be given for homeworks submitted late.

1.

Solve the following recurrences by the master method.

a.  $T(n) = 12T(n/4) + \frac{1}{20}n^2$ .

b.  $T(n) = 3T(n/2) + 2n^{\log_8 27}$ .

c.  $T(n) = 4T(n/3) + 100n \lg n$ .

2. [Exc 7.2-3 CLRS]

Show that the running time of QUICKSORT is  $\Theta(n^2)$  when the array  $A$  contains distinct elements and is sorted in decreasing order.

3. [Exc 7.2-5 CLRS]

Suppose that the splits at every level of quicksort are in the proportion  $1 - \alpha$  to  $\alpha$ , where  $0 < \alpha \leq 1/2$  is a constant. Show that the minimum depth of a leaf in the recursion tree is approximately  $-\lg n / \lg \alpha$  and the maximum depth is approximately  $-\lg n / \lg(1 - \alpha)$ . (Don't worry about the integer round-off.)

4. [Exc 2.3-1 CLRS]

Using Fig 2.4 (on page 33 of CLRS) as a model, illustrate the operation of merge sort on the array  $A = (3, 41, 52, 26, 38, 57, 9, 49)$ .