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**CS 303 Algorithms and Data Structures**

**Homework Assignment 3**

**1/30/18**

**1.**

**A) Exercise 4.3-2:** **Show that the solution of is**

* To show this, we must prove for :
* 1
* T (2) = T (1) + 1 so T (2) = 2 assuming T (1) = 1. Thus T (2) ≤ c lg 2 if c ≥ 2 (Namjoshi, 2008).

**B) Exercise 4.3-3: We saw that the solution of is . Show that the solution of this recurrence is also . Conclude that the solution is .**

* To show this, we must prove for :
* T(2) = 2T(1) + 2 so T(2) = 4 assuming T(1) = 1. Similarly, T(3) = 2T(1) + 3 so T(2) = 5. Thus T (2) ≥ c lg 2 and T (3) ≥ c lg 3 if c ≤ 1 (Namjoshi, 2008).
* Since is both and , we can conclude that the solution is .

**C) Exercise 4.4-1: Use a recursive tree to determine a good asymptotic upper bound on the recurrence of . Use the substitution method to verify your answer.**



2. **A) Exercise 5.1-1: Show that the assumption that we are always able to determine which candidate is best, in line 4 of procedure HIRE-ASSISTANT, implies that we know a total order on the ranks of the candidates.**

* One can compare two candidates and decide which one is better qualiﬁed, therefore can rank each candidate with a unique number from 1 through n, using rank(i) to show the rank of applicant i. One assumes we can compare any two candidates, then comparison must be a total relation and therefore we have a total order.

**B) Exercise 5.1-2: Describe an implementation of the procedure RANDOM(a, b) that only makes calls to RANDOM(0, 1). What is the expected running time of your procedure, as a function of a and b?**

* Without loss of generality we may assume that *a* = 0. Otherwise we can generate a random number between 0 and *b* − *a*, then add *a* to it.

**Algorithm 1:**

RANDOM(a,b)

n = ⌊lg(b)⌋ + 1

Initialize an array A of length n

while true do{

for i = 1 to n do{

A[i] = RANDOM(0,1)

}

if A holds the binary representation of a number less than or equal to b then{

return number represented by A

}

}

Works Cited

Namjoshi, Parag. "CMSC 441: Homework #2 Solutions." (n.d.): 1-3. 18 Feb. 2018. Web.