

04 October 2011

451 Algorithm Analysis
Assignment #1
Return date: 11 October 2011 09:30

20 pts. Q1) Order the following functions according to their order of growth (from the lowest to the highest):

$2^{\lg n} \lg n$, $\sqrt[3]{n}$, $\lg(n+10)^3$, $4^{\lg n}$, $\sqrt{\lg n}$, 6, $n!$, $(1/3)^n$, $(3/2)^n$, $\lg \lg n$

35 pts. Q2) Solve the following recurrence relation by backward substitution for $n = 2^k$.

$$T(n) = 3T(n/2) + n^2 - n \quad \text{for } n \geq 2 \quad T(1) = 1$$

45 pts. Q3) Consider the following algorithm.

ALGORITHM *GuessWhat* ($A[0 \dots n-1]$)

// Input : Array $A[0 \dots n-1]$ of numbers

// Output : ?

dgw \leftarrow 0

for $i \leftarrow 0$ *to* $n-2$

for $j \leftarrow i+1$ *to* $n-1$

if $|A[i] - A[j]| > dgw$

dgw $\leftarrow |A[i] - A[j]|$

return dgw

(5 pts) **a)** What does this algorithm compute?

(5 pts) **b)** What is its basic operation?

(10 pts) **c)** How many times is the basic operation executed?

(5 pts) **d)** What is the efficiency class of this algorithm?

(20 pts) **e)** Suggest an improvement or better algorithm altogether and indicate its efficiency class. If you cannot do it, try to prove that in fact it cannot be done.