

CMPE 300 - Analysis of Algorithms

Fall 2014

Assignment 1

Due date: November 19, 2014 17:00

Question 1 (40 Points)

1. Write a pseudocode for an **efficient** algorithm which finds both the **largest** and **second-smallest** element in a list $L[1:n]$ of size n .
2. Find worst-case complexity $W(n)$ and average-case complexity $A(n)$ of the algorithm in (a). You can assume input is uniformly distributed.

Question 2 (30 Points)

Find the recurrence relation for the following algorithm:

```
procedure SPLITARMULTIPLICATION( $A[1:n]$ ) recursive
  input:  $A[1:n]$  (an array of integers with size  $n$ )
  output:  $A[1:n]$  (array altered by the procedure)
  if  $n = 1$  then return
  for 1 to  $n/2$  do
     $A[i] := A[i] * A[i + n/2]$ 
  SplitArMultiplication( $A[1:n/2]$ )
```

Question 3 (30 Points)

Consider the given function $f(n)$ and determine whether the following cases are true or false. Justify your answers formally. (*Hint: Use Stirling's Approximation*)

$$f(n) = n^3 + n^3 \log(n^5 * n!) + n^2 \quad (1)$$

1. $f(n) \in O(n^3)$
2. $f(n) \in o(n^3 \log(n))$
3. $f(n) \in \Omega(n^2 \log(n))$
4. $f(n) \in \Theta(n^3 \log(n))$

Submission

You need to submit your answers via hardcopy. There will be a box in front of ETA31 during the deadline day. If you miss the deadline, you can leave your homeworks to the course assistant's mailbox in the secretariat. Note that the late submissions will be penalized by 20 points/day.