

# CmpE 300 - ASSIGNMENT 1

Posted on November 8, 2006

Please answer the following questions and submit your answers to your assistant until 17:00 Wednesday, November 15, 2006. The sole purpose of this homework is to familiarize you with the processes involved in answering complexity related questions. Please work on them by your own.

Please do not submit just an answer, but show all your reasoning, and how you arrive at the answers. For any further questions, contact the assistant.

**Question 1 (50 pts.):**  $\mathcal{F}$  denotes the set of real-valued functions  $f(n) : \mathcal{N} \rightarrow \mathcal{R}$  defined on the nonnegative integers that are eventually positive.

Let  $f(n)$ ,  $g(n)$ , and  $h(n) \in \mathcal{F}$ .  $f$  has a smaller order than  $g$  and  $g$  has a smaller order than  $h$ . Give an example of  $f(n)$ ,  $g(n)$ , and  $h(n)$  for each of the following conditions and show that each condition holds.

- i.  $f(n).h(n) \in o(g^2(n))$
- ii.  $f(n).h(n) \in \theta(g^2(n))$
- iii.  $g^2(n) \in o(f(n).h(n))$

**Question 2 (50 pts.):** What is the running time of the following function *modthree*( $n$ ) in terms of  $\Omega$ ,  $\Theta$ , and  $O$  notation? Note that you will use a single complexity function for all values of  $n$ ; not different functions for different values. (i.e.  $f(n) = \dots, n \in \mathcal{N}$ ).

```
function modthree( $n$ )
 $m = 0$ 
if  $n \bmod 3 = 0$ 
    for  $i = 1$  to  $n * n$  do
         $m = m + 2$ 
    endfor
elseif  $n \bmod 3 = 1$ 
    for  $i = 1$  to  $n * n * n$  do
         $m = m + 3$ 
    endfor
else
    for  $i = 1$  to  $n * n * n * n$  do
         $m = m + 4$ 
    endfor
endif
return  $m$ 
end modthree
```