Imperial College London – Department of Computing

MSc in Computing Science

580: Algorithms
Tutorial 1

1. Using asymptotic notation, state an upper and lower bound for the time complexity of the SimpleSearch procedure for *any input*. Can you also give a tight (Θ) bound?

2. (Cormen Exercise 3.1-4). The formal definition of O is:

$$O(g(N)) = \left\{ f(N) \mid \begin{array}{l} \text{there are positive constants } c \text{ and } N_0 \\ \text{such that } 0 \leq f(N) \leq c\, g(N) \text{ for all } N \geq N_0 \end{array} \right\}.$$

Using this definition, show whether each of the following statements is true or false.

   (a) $2^{N+1} = O(2^N)$

   (b) $2^{2N} = O(2^N)$

3. If a_0 and a_1 are constants, and a_2 is a positive constant, show that $a_2N^2 + a_1N + a_0$ is not in $O(N)$. What are the consequences for algorithm design? What are the limitations of these consequences?