

CSIT571 Homework #1

1. Which of the following statements are true, which are false? Prove your answers.

- i. $n^2 \in O(n^3)$
- ii. $n^3 \in O(n^2)$
- iii. $2^{n+1} \in O(2^n)$
- iv. $(n+1)! \in O(n!)$
- v. for any function $f : \mathbb{N} \rightarrow \mathbb{R}^*$, $f(n) \in O(n) \Rightarrow [f(n)]^2 \in O(n^2)$
- vi. for any function $f : \mathbb{N} \rightarrow \mathbb{R}^*$, $f(n) \in O(n) \Rightarrow 2^{f(n)} \in O(2^n)$

2. Analyze the running time for the following two programs, expressing the results in O -notation.

i. **function** *max* (*i*, *n*: integer) : integer;
 var
 m1, *m2*: integer;
 begin
 if *n* = 1 **then**
 return (*A*[*i*])
 else begin
 m1 := *max*(*i*, *n* div 2);
 m2 := *max*(*i*+*n* div 2, *n* div 2);
 if *m1* < *m2* **then**
 return (*m2*)
 else
 return (*m1*)
 end
 end

ii. **procedure** *mystery* (*n*: integer);
 var
 x, *count*: integer;
 begin
 count := 0;
 x := 2;
 while *x* < *n* **do begin**
 x := 2 * *x*;
 count := *count* + 1
 end;
 writeln(*count*)
 end