

## CPSC 413: Exercise Set 1

### Question 1

Rank the following functions in order of asymptotic growth rate: that is,  $f \leq g$  if  $f = O(g)$ :

- $(1.5)^n$ ;
- $(\log_2(n))^{10}$ ;
- $3n^2 + 5n - 4$ ;
- $\frac{15}{n}$ ;
- $\log_3(n) + 3$ ;
- $\frac{n}{15} + 105$ ;
- $\log_2(n^2)$ ;
- $n \log_3(n) + 3$

### Question 2

Which of the following statements are true? Why or why not? (Assume both  $f$  and  $g$  are arbitrary non-decreasing functions).

1.  $f + g = \Theta(\max(f, g))$ ;
2.  $f \cdot g = O(\max(f, g))$ ;
3.  $n^2 = O(100n)$ ;
4.  $n = O(n^2 - n - 1)$ ;
5.  $\log(15n^2) = \Theta(\log n)$ ;
6.  $2^n = \Omega(n^2)$ ;
7.  $15n = O((\log n)^2)$ .

### Question 3

Give a tight asymptotic bound for the sorting algorithm given in class: choose the lowest item in the list and put it at the beginning of the list, choose the next lowest item and put it second, etc.