CS2223
HW#2

DUE: Tuesday, November 9

1 (8 points) Assume you are given an array *A* of *n* integers, and the desired output is the median of *A*. You may assume that *n* is odd. (The median of *A* is the element of *A* such that $(n+1)/2$ elements of *A* are greater than or equal to the median and $(n+1)/2$ elements of *A* are less than or equal to the median). For example, if *n*=5 and $A = \langle -25, 14, 22, -10, -558 \rangle$, then the median is –10. Assuming the benchmark computational operation is a pairwise comparison, describe an algorithm (you don't need to write a program) to solve this problem which in the best-case uses *n*-1 pairwise comparisons.

2. (8 points) Group the following 14 functions so that *f* and *g* are in the same group if and only if $f \in \Theta(g)$ List the groups from lowest order to highest order.

n	n^{34}	2^n	$n*\lg n$
$\lg n$	$\sqrt{n} + \lg n$	$\lg \lg n$	$\sqrt{n} * (\lg n)^2$
$(1/3)^n$	$n!$	n^2	$n^2 + \lg n$
$\ln n$	$n^{1/2}$		

3. (6 points) The statement $f(n) \in O(g(n))$ can be viewed as a relation between functions *f* and *g*. Prove or give a counterexample to each of the following conjectures that this relation is reflexive, symmetric and transitive.

(*a*) **<u>CONJECTURE 1</u>**: For any (univariate) function *f*, $f(n) \in O(f(n))$.

(*b*) **<u>CONJECTURE 2</u>**: For any (univariate) functions *f*, *g*, if $f(n) \in O(g(n))$), then $g(n) \in O(f(n))$

(*c*) **<u>CONJECTURE 3</u>**: For any (univariate) functions *f*, *g*, *h*, if $f(n) \in O(g(n))$ and $g(n) \in O(h(n))$, then $f(n) \in O(h(n))$.