

Qualifying Exam: Fall 2004
Data structures, algorithms, and complexity

Problem 1:

a). (5 points): Define precisely what $f(n) = O(g(n))$ means.

b). (15 points): Fill in the rest of following table, where each entry should be O , Ω , or Θ according to whether the row function is O , Ω , or Θ of the column function. If more than one is true, you should put the strongest result possible.

	n^3	2^n	$\log n$
$\log(2n)$	O		
$2^{(2n)}$			
$n^{\log n}$			
$n!$			

Problem 2:

a). (10 points):

Give an efficient algorithm to find the minimum of an unsorted array of n elements. Ideally your algorithm should be as efficient as possible.

b). (10 points):

Show that any algorithm to achieve this task must use at least $n - 1$ comparisons.

Problem 3:

a). (5 points): Define P, NP, and coNP.

b). (15 points): Show that if $P = NP$, then $NP = \text{coNP}$.