

Due Thursday, April 11, 2013 (but you can turn it in by Monday morning April 15).

Problem 1. For each pair of expressions (A, B) below, indicate whether A is O , o , Ω , ω , or Θ of B . Note that zero, one or more of these relations may hold for a given pair; list all correct ones.

	A	B
(a)	$n^4/5$	$9n^3 + 1000n^2$
(a)	2^n	n^{50}
(b)	$\sqrt{n}$	$(\log n)^{12}$
(c)	$\sqrt{n}$	$n^{\cos(\pi n/8)}$
(d)	100^n	10^{2n}
(e)	$2^{(n^2)}$	10^n
(f)	$\log(n!)$	$n \log n$

Problem 2. Assume that your computer has special hardware that executes two comparisons in one step.

- (a) Design an algorithm based on Merge Sort to sort n elements using this special hardware. (This is an upper bound.)
- (b) Analyze your algorithm. Get the high order term (number of comparisons) exactly.
- (c) Use decision trees to find a lower bound for sorting when using this special hardware.
- (d) Compare your lower and upper bounds.

Problem 3.

- (a) Assume you have an alphabet of letters from “i” to “o”. Illustrate the operation of radix sort on the following list of English words:
loin, mojo, noon, join, moon, kiln, milk, mono, jink, limo
- (b) Use the words “jink” and “mojo” in an English sentence that indicates that you understand the meaning of both words.