

Name _____

Problem 1 ~ 4: 10 pts each
5 : 10 pts (2+2+2+4)

- 1) The value of which of the following growth-rate functions grows the fastest? (a) $O(n)$
(b) $O(n^2)$ (c) $O(1)$ (d) $O(\log_2 n)$
- 2) A bubble sort requires at most _____ passes to sort an array of n items.
(a) $n/2$ (b) $n-2$ (c) $n-1$ (d) n
- 3) Low-order terms can be ignored in an algorithm's growth-rate function. (True/False)
- 4) Consider the following nested loop. What is the order of the algorithm? Use Big O notation.

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for (int i = 0; i < n; ++i)
  for (int j = i; j < n; ++j)
    for (int k = 1; k < 100; ++k)
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- 5) Use mathematical induction to prove,
 $1 \times 2 + 2 \times 3 + 3 \times 4 + \dots + n(n+1) = n(n+1)(n+2)/3$
for all positive integers n .
 - (a) What is the proposition $P(n)$ in this proof?
 - (b) Show that $P(1)$ is true.
 - (c) What is the inductive hypothesis in this proof?
 - (d) Complete the inductive step.