

## Basic Sorts and Shell Sort

3-22-2002

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## Opening Discussion

- What did we talk about last class?
- Do you have any questions about assignment #4?
- Today we are talking about sorting. What is sorting? Why is sorting important to us? What sort algorithms are you familiar with? How do they scale? Can you write them off the top of your head?

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## Standard Sorts

- There are a few standard sorts that all take  $O(n^2)$  time.
  - Bubble sort - repeatedly runs through the array swapping adjacent elements if they are out of order.
  - Selection or min/max sort - Goes through and finds the smallest/largest object and moves it into place repeatedly. ( $O(n)$  in swaps)
  - Insertion sort - inserts each element into sorted order with previous elements.

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## Shellsort

- The first improvement over these  $O(n^2)$  sorts was the Shellsort. This sort repeatedly does one of the other sorts. Apparently insertion sort is the normal choice for the sort to use. That is also what all of their testing and proofs used. It isn't immediately clear how a different sort would change that.

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## Shellsort Continued

- Of course, just sorting an array many times doesn't make sense. What shellsort does is to sort different subsets of the array each time.
- It is also called a "diminishing gap" sort because it sorts sets with regularly spaced gaps and makes them smaller at each iteration.
- The last iteration uses a spacing of one.

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## Shellsort Continued

- Originally Shell proposed starting with a spacing of  $n/2$  and halving each time. This gives a worst case behavior of  $O(n^2)$ , but an average case of  $O(n^{3/2})$ .
- By adding one to the spacing when it is even, this improves the worst case to  $O(n^{3/2})$  and an average case that appears to be  $O(n^{5/4})$ . I say "appears to be" because it hasn't been proven to be.

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## Minute Essay

- From today's discussion, what is your impression of Shellsort? Would you ever use it in code? How much harder is it really to write it?
- The design for assignment #4 is due on Monday. Have a good weekend.

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