Sorting

Chapter 7

Objectives

- Understand the importance of the sort problem
- Analyze the running times of different sorting algorithms
- Choose the most efficient sorting algorithms based on the problem requirements

Sorting

- Given an array A of n elements, we need to sort the elements of the array so that A[1] < A[2] < … < A[n]
- For simplicity, we will assume no repeated values
- The values have a total order
- All comparisons are done through the < or > operators

Insertion Sort

- For j = 2 to n
  - Keep A[1..j] sorted

Insertion Sort

```
For j = 1 to n
  key = A[j]
  i = j - 1
  while i > 0 and A[i] > key
    A[i+1] = A[i]
    i = i – 1
  A[i+1] = key
```

Selection Sort

- For j = 1 to n
  - Find the j^{th} smallest element and put it in place

```
For j = 1 to n
  min = j
  for i = j+1 to n
    if A[i] < A[min]
      min = i
  swap(A[j], A[min])
```

Selection Sort

- For j = 1 to n
  - Find the j^{th} smallest element and put it in place

```
For j = 1 to n
  min = j
  for i = j+1 to n
    if A[i] < A[min]
      min = i
  swap(A[j], A[min])
```

Bubble Sort

- Whenever you find an unordered pair, reorder them

```
For j = 1 to n
  For i = 1 to n-1
    if A[i] > A[i+1]
      swap(A[i], A[i+1])
```

Bubble Sort

- Whenever you find an unordered pair, reorder them

```
For j = 1 to n
  For i = 1 to n-j
    if A[i] > A[i+1]
      swap(A[i], A[i+1])
```

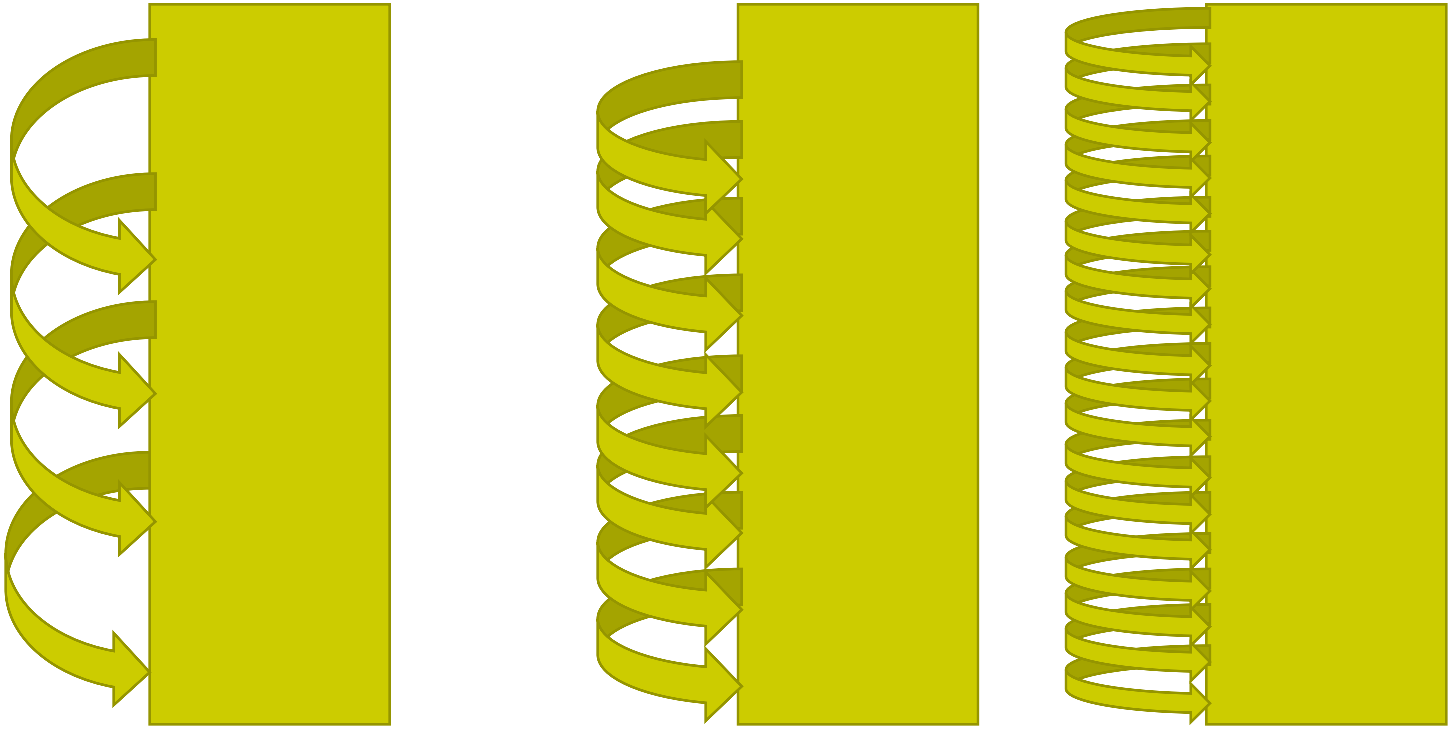
Bubble Sort

- Whenever you find an unordered pair, reorder them

```
For j = 1 to n
  sorted = true
  For i = 1 to n-j
    if A[i] > A[i+1]
      swap(A[i], A[i+1])
      sorted = false
  break if sorted
```

Shell Sort

- Bubble sort and insertion sort make a very slow progress
- Shell sort tries to make bigger leaps



Shell Sort

```
For gap = n/2 downto 1; gap = gap/2
  for j = gap to n
    for i = 1 to n-j
      if A[i] > A[i+gap]
        swap(A[i], A[i+gap])
```