

Quadratic Sorting Algorithms

Bubble Sort

```
for i = n downto 2 do
  for j = 1 to i-1 do
    if A[j] > A[j+1]
      then A[j]  $\leftrightarrow$  A[j+1]
    end if
  end for
end for
```

Bubble Sort (Modified)

```
i ← n-1
while i > 0 do
  t ← 1
  for j = 1 to i do
    if A[j] > A[j+1] then
      A[j] ↔ A[j+1]
      t ← j
    end if
  end for
  i ← t-1
end while
```

Cocktail-Shaker Sort

Insertion Sort with Sentinel

```
A[0] ←  $-\infty$ 
for i = 2 to n do
    t ← A[i]
    j ← i-1
    while t < A[j] do
        A[j+1] ← A[j]
        j ← j-1
    end while
    A[j+1] ← t
end for
```

Insertion Sort (without sentinel)

```
for i = 2 to n do
    t ← A[i]
    j ← i-1
    while j>0 and A[j]>t do
        A[j+1] ← A[j]
        j ← j-1
    end while
    A[j+1] ← t
end for
```

Selection Sort

```
for i = n downto 2 do
  k ← 1
  for j = 2 to i do
    if A[j] > A[k] then k ← j
  end for
  A[k] ↔ A[i]
end for
```

$n \log n$ Sorting Algorithms

Merge Sort

```
procedure MergeSort(A,p,r)
  if p<r then
    q ← ⌊(p+r)/2⌋
    MergeSort(A,p,q)
    MergeSort(A,q+1,r)
    Merge(A,(p,q),(q+1,r))
  end if
end procedure
```