

Lecture on pages 5-14, 16-21, and 24-25 in CLRS

What is an algorithm?

Well-defined computational procedure that takes some set of input and returns some set of output. Algorithm is sequence of computational steps that transform input to output.

Exercise:

Work in pairs.

Given 5 cards, or pieces of paper with numbers on them, put the cards in order, lowest to highest.

What is the input?

What is the output?

What is the algorithm you used?

How would you describe your algorithm to a computer? Not specific enough to say, "Look at the card and put it where it goes." Describe what happens in language of data structures, indices, variables, control structures.

Write it down, even if it's wordy

Sorting algorithms

What you just did is called a sorting algorithm and there are many of these things. Some are simple and work well on small data sets. Others are complicated, but may be really efficient on large data sets.

Efficiency refers to number of operations, or order of operations. Number of operations needed scales with input size (number of items to sort), which really matters when you have large inputs.

Insertion sort

Efficient on small data sets, there is pseudocode of this algorithm in your book.

With pseudocode, we don't care about syntax, error handling, variable declaration. We want the minimum to convey the algorithm.

Pseudocode

Insertion_Sort(A)

For j=2 to A.length

Key = A[j]

//insert A[j] into A[1...j-1]

i = j - 1

While i > 0 and A[i] > key

A[i+1] = A[i]

A[i+1] = key

Difference from real code

No type, no return value, A is array to sort

Start at second array item, go to end, indentation is block

Don't need to declare i first

Walk through and watch what happens.

Algorithm Analysis

Analyze how many operations, runtime, or order of an algorithm by counting number of times a loop executes. Often treat set of operations as a constant. For example, would treat both lines in the while as one total operation.

What is worse case performance of insertion sort? Occurs when array is sorted highest to lowest and want to go lowest to highest.

For loop j = 2 to A.length

n-1 times, where n is array size

while

When j = 2

1 time

When j = 3

2 times

When j = 4

3 times

When j = 5

4 times

While loop code block executes j-1 times each time through the loop