

Analysis of Algorithms

CS 3343 Lecture One

Prof. William Winsborough
August 28, 2008

Course Introduction

- See syllabus:
 - <http://www.cs.utsa.edu/~winsboro/teaching/CS3343F2008/Syllabus.htm>
- Attendance is **mandatory in lecture and recitation**
- Read the text book
- Please speak up!
- Read Chapter 1, Section 2.1, and Section 3.1 by next Thursday.
- If you didn't learn big-O notation in Discrete Math, also read
- No class Tuesday September 2
- Thursday September 4 will be covered by Prof. Ruan
- Your TA in this course is Zhe Wang
 - Her email is sdzhezhang@gmail.com

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What is this Course About?

- Computational problems
 - Specifying a desired relationship between computation inputs and outputs
- Algorithms
 - Precise steps for computing the desired output from any legal input
 - Must terminate on all inputs
- Correctness
 - Does an algorithm compute the output that has the desired relationship with the input?
- Complexity
 - How much time and space (memory) does the computation require
 - This is a function of the size of the input
 - Number of values of fixed size
 - Number of bits required to represent the input

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First Problem: Sorting

- Insertion sort
 - Iterative
 - Worst case complexity is $O(n^2)$
 - Very fast if the input is already almost sorted
 - Correctness can be shown by using a simple loop invariant
- Merge sort
 - Recursive, divide and conquer
 - Worst case complexity is $O(n \lg n)$

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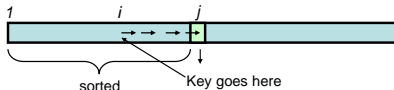
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Insertion Sort

```

InsertionSort(A, n) {
  for j = 2 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
  }
}

```



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Complexity of Insertion Sort

- What input requires the least time?
- What input requires the most time?
- Most of the time we will be concerned with worst-case behavior
- Times when you might want to use insertion sort:
 - When you know that your input is almost always going to be mostly in order
 - When you know that your input is small

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