CSC 8301 Design and Analysis of Algorithms

Lecture 3

Mathematical Analysis of Nonrecursive Algorithms

VIDEO: Sorting out Sorting

Reading: Section 2.3; review Appendix A
Exercises:
2.3: 1, 2, 3, 4, 5, 6, 10

Next time: Analysis of recursive algorithms (2.4, 2.5, App. B)

Time efficiency of nonrecursive algorithms

Steps in mathematical analysis of nonrecursive algorithms:
1. Decide on parameter $n$ indicating input size.
2. Identify algorithm’s basic operation.
3. Determine worst, average, and best case for input size $n$.
4. Set up summation for Cost reflecting algorithm’s loop structure.
5. Simplify summation using standard formulas (see Appendix A).

Examples:
1. Matrix multiplication (section 2.3)
2. Selection sort (section 3.1)
3. Insertion sort (section 5.1)
4. Mystery Algorithm

Mystery algorithm

for $i := 1$ to $n - 1$ do
    $\text{max} := i$;
    for $j := i + 1$ to $n$ do
        if $|A[j, i]| > |A[\text{max}, i]|$ then $\text{max} := j$;
        for $k := i$ to $n - 1$ do
            swap $A[i, k]$ with $A[\text{max}, k]$;
        for $j := i + 1$ to $n$ do
            for $k := n + 1$ downto $i$ do