CS 3510 - Spring 2009
Homework 1
Due: February 11

You must hand in this homework. Please work alone on this assignment. Do not use a calculator (except to check, if you want), and please show all of your work.

1. Run the extended Eucludean algorithm for $a = 697, b = 969$.

2. Problem 1.22 from [DPV]

3. Problem 1.25 from [DPV]

4. Problem 1.27 from [DPV]

5. Problem 128 from [DPV]

6. **Recurrences**

   Solve the following recurrences. You can use the Master Theorem, where applicable. Big-O notation is fine.

   (a) $T(n) = 2T(n/3) + n$.
   (b) $T(n) = 2T(n/3) + 1$.
   (c) $T(n) = 9T(n/2) + n^2$.
   (d) $T(n) = T(n/4) + 3$.
   (e) $T(n) = 3T(n/2) + 1$.
   (f) $T(n) = 2T(n-1) + 1$.

7. **Stooge Sort**

   Professor Randall thinks she has a new sorting algorithm. Here is the proposed algorithm. The input is a list $A[1 \ldots n]$ of n numbers, where n is a power of 2.

   RandallSort(A)
   1   if $length(A) = 1$,

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2          then return A
3     RandallSort(A[1 . . . n/2])
4     RandallSort(A[n/2 + 1 . . . n])
5     for i = 1 → n/2,
6          if A[i] > A[i + n/2],
7               then Swap(A[i], A[i + n/2])
8     RandallSort(A[1 . . . n/2])
9     RandallSort(A[n/2 + 1 . . . n]).


Swap(k, ℓ)
1     temp ← A(ℓ)
2     A[ℓ] ← A[k]
3     A[k] ← temp
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(a) Analyze the running time of RandallSort by stating and solving the appropriate recurrence.

(b) Does the algorithm sort correctly? If yes, argue why. If no, give an example for which the above algorithm does not sort correctly.

8. **Fixed Point**

Problem 2.17 from [DPV].