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## Homework 4 – Due Wednesday, September 26, 2007

Please refer to the general information handout for the full homework policy and options.

### Reminders

- Your solutions are due *before* the lecture. Late homework will not be accepted.
- Collaboration is permitted, but you must write the solutions *by yourself without assistance*, and be ready to explain them orally to a member of the course staff if asked. You must also identify your collaborators. Getting solutions from outside sources such as the Web or students not enrolled in the class is strictly forbidden.
- To facilitate grading, please write down your solution to each problem on a separate sheet of paper. Make sure to include all identifying information and your collaborators on each sheet. Your solutions to different problems will be graded separately, possibly by different people, and returned to you independently of each other.
- *For all problems where you are asked to design an algorithm, do not forget to prove correctness and analyze your algorithms time and space complexity.*

**Exercises** These should not be handed in, but the material they cover may appear on exams:

1. Suggest a simple change to the UNION procedure for the linked-list representation of Union-Find data structure that removes the need to keep the *tail* pointer to the last object in each list. You change should not affect the asymptotic running time of the Union procedure. (*Hint:* Instead of appending one list to another, cut one of them up and insert the other.)

### Problems to be handed in

1. (**Fastest Way to Travel**) Chapter 4, problem 18. Do not forget to prove the correctness of your algorithm, and analyze its time and space complexity.
2. (**MST**) (a) Chapter 4, problem 8; (b) Chapter 4, problem 9.
3. (**Union-Find**) Cormen Leiserson Rivest Stein “Introduction to Algorithms”, Problem 21-1. It will be posted on Angel.
4. (**Recursion-Tree Method**) Use the recursion-tree method to solve the following recurrences. Express your answer using  $\Theta$ -notation.
  - (a)  $T(n) = T(n/3) + T(2n/3) + cn$ , where  $c \geq 0$  is a constant.
  - (b)  $T(n) = T(n - a) + T(a) + cn$ , where  $a \geq 1$  and  $c \geq 0$  are constants.
  - (c)  $T(n) = 2T(n/2) + n \log n$ .

5\* (**Optional; no collaboration is allowed on this problem**) Chapter 4, problem 29.