Homework 3

CS 4104 (Spring 2014)

Assigned on Wednesday, February 26, 2014.
Submit a PDF file containing your solutions on Scholar by the beginning of class on Wednesday, March 5, 2014.

Instructions:

- You can pair up with another student to solve the homework. You are allowed to discuss possible algorithms and bounce ideas with your team-mate. **Do not discuss proofs of correctness or running time in detail with your team-mate.** Please form teams yourselves. Of course, you can ask me for help if you cannot find a team-mate. You may choose to work alone. *Each of you must write down your solution individually, and write down the name of the other member in your team. If you do not have a team-mate, please say so.*
- Apart from your team-mate, you are not allowed to consult any sources other than your textbook, the slides on the course web page, your own class notes, the TAs, and the instructor. In particular, do not use a search engine.
- Do not forget to typeset your solutions. *Every mathematical expression must be typeset as a mathematical expression, e.g., the square of n must appear as n^2 and not as "n^2".* Students can use the LaTeX version of the homework problems to start entering their solutions.
- Describe your algorithms as clearly as possible. The style used in the book is fine, as long as your description is not ambiguous. Explain your algorithm in words. A step-wise description is fine. *However, if you submit detailed pseudo-code without an explanation, we will not grade your solutions.*
- Do not make any assumptions not stated in the problem. If you do make any assumptions, state them clearly, and explain why the assumption does not decrease the generality of your solution.
- Do not describe your algorithms only for a specific example you may have worked out.
- You must also provide a clear proof that your solution is correct (or a counter-example, where applicable). Type out all the statements you need to complete your proof. *You must convince us that you can write out the complete proof. You will lose points if you work out some details of the proof in your head but do not type them out in your solution.*
- Describe an analysis of your algorithm and state and prove the running time. You will only get partial credit if your analysis is not tight, i.e., if the bound you prove for your algorithm is not the best upper bound possible.

Problem 1 (20 points) Solve exercise 2 in Chapter 4 (page 189) of your textbook. *Note:* We will discuss minimum spanning trees in the next class, but you can read the definition on page 142 of your textbook.

Problem 2 (35 points) Solve exercise 5 in Chapter 4 (pages 190-191) of your textbook. Just in case the problem statement is not completely clear, you can assume that the road is the x-axis, that each house lies directly on the road, and that the position of each house can be specified by its x-coordinate.

Problem 3 (45 points) Solve exercise 13 in Chapter 4 (pages 194-195) of your textbook. *Hint:* Try to use one of the techniques we have seen for proving the correctness of greedy algorithms. Working "backwards" from what you need to prove might help you to discover the algorithm.