

CS 5114

Homework Exercise 4

Given: February 15, 2000

Due: February 25, 2000

The point value of each problem is shown in []. Each solution must include all calculations and an explanation of why the given solution is correct. In particular, write complete sentences. A correct answer without an explanation is worth no credit. The assignment must be *submitted* to the instructor by 12:00 noon on February 25, 2000. See syllabus for late policy.

Electronic preparation of your solutions in L^AT_EX is mandatory. Here is the suggested procedure.

Retrieve this L^AT_EX source file `homework4.tex` from the 5114 Web pages and rename it `solvehw4.tex`. Delete these instructions. Enter your solutions in the locations explained by L^AT_EX comments (%). Also enter your name in the `\student` command and uncomment the line near the beginning of the file that uses the `\student` command. When you are satisfied with your solutions, print a copy and turn it in during class or no later than noon on February 25, 2000.

Electronic submission is optional. If you use electronic submission, send an email to `cs5114@courses.cs.vt.edu` with subject `Solutions to Homework Assignment 4` and with two attachments: `solvehw4.tex` and `solvehw4.ps`. Your email must be *received* by 12:00 noon on February 25, 2000.

[14] 1. CLR Problem 16-2. State the implicit optimization problem formally. Follow the dynamic programming paradigm given in class to solve the optimization problem. In particular:

- A. Carefully identify the subproblems that will be solved. How are they parameterized? How many subproblems are there? What information will your algorithm store for each subproblem?
- B. What are the base cases? How do you compute the information for the base cases?
- C. How do you compute the information for the general (non-base) case?

Once you have answered the questions in the paradigm, write your algorithm in CLR-style pseudocode. Analyze its space and time complexities. Your algorithm need only solve for the optimal value of the objective function; it does not have to “print” the paragraph as is suggested in the text of the problem.

You may be aware that T_EX uses dynamic programming to build “optimal” paragraphs and pages.

[6] 2. CLR Exercise 17.1-3. You are asked for two counterexamples, one for each approach. Show that each is indeed a counterexample.

[10] 3. CLR Exercise 17.4-2. It is best to review the notion of the “rank of a matrix” from linear algebra before starting this exercise.

[8] 4. CLR Exercise 24.1-8. First develop good, careful notation. Then use a substitution argument.

[12] 5. CLR Problem 24-1. To clarify the notion of a “second-best MST”, imagine that all the spanning trees of G are listed in nondecreasing order by total weight. Then the first tree is an MST, and the second tree is a second-best MST. Because of the possibility of ties in total weight, there may be more than one choice for the second-best MST. Your algorithm for part c need only return one.
