MA/CSSE 473 – Design and Analysis of Algorithms

Homework 13 (70 points total) Updated for Summer, 2017

When a problem is given by number, it is from the textbook. 1.1.2 means "problem 2 from section 1.1" .

Problems for enlightenment/practice/review (not to turn in, but you should think about them):

How many of them you need to do serious work on depends on you and your background. I do not want to make everyone do one of them for the sake of the (possibly) few who need it. You can hopefully figure out which ones you need to do.

Not in 3rd ed [9.1.1] (Greedy change-making not optimal) Give an instance of the change-making problem for which the greedy algorithm does not yield an optimal solution
9.1.5 (greedy bridge crossing)

Problems to write up and turn in:

1. (10) 9.1.3 (Greedy job scheduling)

2. (6) 9.1.9b [9.1.7b] (Prim example) Start with node a. Whenever you have a choice because edge weights are equal, choose the vertex that is closest to the beginning of the alphabet. Then everyone should get the same answer, making it easier for us to check your work.

3. (5) 9.1.10 [9.1.8] (Prim prior connectivity check?)

4. (10) 9.1.15 [9.1.11] (change value of an item in a min-heap)

Problem 4 previous questions and answers from Piazza:

Q: Do we assume that we already know where the element we are changing is? Or do we have to search for it from the root 1st?
TA Answer (endorsed by instructor): I interpreted the question as updating a node we already know exists. You can't really update a node's priority that you don't know exists, therefore since you know it exists, you know its position. So I assumed we knew the position. Min-heaps aren't meant to be used to search for individual elements because it is O(N).

5. (6) 9.2.1b (Kruskal example) Whenever you have a choice because edge weights are equal, choose the edge whose vertices are closest to the beginning of the alphabet. Then everyone should get the same answer, making it easier for us to check your work.

6. (8) 9.2.2 (Kruskal TF questions) Briefly explain your answers.

Problem 6 previous questions and answers from Piazza:

Q: For these questions, it says that e is a minimum-weight edge for a connected graph. What does minimum-weight edge mean? Is this in the context of Prim's algorithm? Kruskal's algorithm technically considers every edge a minimum-weight edge for some iteration.
A: It means minimal for the current iteration. The smallest-weight edge among those not already in the tree we are building that will not make a cycle if we add them. And it is Kruskal, not Prim.

7. (8) 9.4.1 (Huffman codes) (a) 4 points. When there is a choice due to a tie, place the one that appears first in the problem statement's character list "on the left" in the tree. (b) 2 points. (c) 2 points.

8. (12) 9.4.3 (Huffman TF) (a) 5 points (b) 7 points Explain your answers.

9. (5) 8.3.11a [8.3.10a] (Matrix chain multiplication) Also think about parts (b) and (c), which may appear on a later assignment or exam.