CS 3510: Advanced Algorithms/Data Structures

Spring 2019 Assignment 4

Problems due as noted.

Assignment

Problems identified by x.y(z) denote the problem “y”, in chapter “x” of the textbook, with part “z”. If “z” is not noted, then the entire problem is required.

Assignment 4a, Due Feb 21

- **4.22 (2 points)** Read this problem, and write down your ideas and questions about how to turn it into a graph path problem, such that our shortest path algorithms can be modified to solve it.
- **(5 points)** Implement the binary heap from Figure 4.16 of the text book. Test it for correctness. *Bring a printed copy of your code for this submission.*

Assignment 4b, Due Feb 23

- **4.1(a) (2 points)** Run Dijkstra, tracking the problem data in a table.
- **4.12 (2 points)** Your algorithm should be \(O(|V|^2)\) or better.
- **(5 points)** Create a runtime measuring program for the binary heap. Include the ability to measure performance of individual methods as a function of the number of items in the heap. Use powers of 2 for the sizes. *Bring a printed copy of your code for this submission.*

Assignment 4c, Due Feb 26

- **4.1(b) (2 points)** Run Dijkstra, show shortest-path tree.
- **4.14 (2 points)** By efficient, we mean no worse than Dijkstra’s algorithm.
- **(5 points)** Measure the runtime of the `makeheap()`, `deletemin()`, `insert()` and `decreasekey()` methods. For powers of 2 from \(2^4\) to at least \(2^{28}\). Record the results in a spreadsheet. *Bring a printed copy of your table for this submission.*

Assignment 4d, Due Feb 28

- **4.2(a) (2 points)** Run Bellman-Ford, tracking the problem data in a table as we did in class. Each iteration is a new array, based on the previous array. Start from node S.
- **4.2(b) (2 points)** Draw the shortest-path tree, using your table data.
- **(5 points)** Add theoretical functions to your spreadsheet of results, include at least \(\log n\), \(n\), \(n \log n\) and \(n^2\). Produce a table of these values normalized the `deletemin()` column at size \(2^{20}\). Chart this table. *Bring a printed copy of your table and your chart for this submission.*

Assignment 4e, Due Mar 2

- **4.8 (2 points)** Prove = proof, disprove = counter-example
- **4.5 (2 points)**

Assignment 4f, Due Mar 5

- **4.11 (2 points)** How can you find cycles using path algorithms in this chapter?
- **4.15 (2 points)**
- **4.19 (2 points)** Look for a modified version of Dijkstra that meets the criteria.

Assignment 4z, Due Never (optional)

- Other problems from the chapter

Submission

- For the written work, at the beginning of class, on the due dates, submit paper copies of your solutions.
- For the experimental determination, at the beginning of class on the due date, submit paper copies of the graphs.