

CS 3510: Algorithms

Assignment 4

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

- 4.22 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.
- Implement the binary heap from Figure 4.16 of the text book. Test it for correctness.

Assignment 4b

- 4.1(a) Run Dijkstra, tracking the problem data in a table.
- 4.12 Your algorithm should be $O(|V|^2)$ or better.
- 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.

Assignment 4c

- 4.1(b) Run Dijkstra, show shortest-path tree.
- 4.14 By efficient, we mean no worse than Dijkstra’s algorithm.
- 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.

Assignment 4d

- 4.2(a) 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) Draw the shortest-path tree, using your table data.
- 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.

Assignment 4e

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

Assignment 4f

- 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

- Submit your solutions by the due date and time. For written problems, your work and answers as a PDF to Canvas. For code, submit the source code to the class git repository. For tables and graphs, submit a PDF to Canvas.