

CS 323 Homework 6

Due by Sunday, March 26, 2017 8:45 PM

Submission instructions

Submit your assignment through the QTest system, using course ID: **CS323** and exam ID: **hw06**. Write all your code into the code boxes provided in QTest, and make sure that it works correctly by pressing the “Execute” button. If your program is composed of multiple classes, make the first one public and all the other ones not public (just omit the public visibility modifier for all classes except the first one). No email submissions are accepted. No late submissions are accepted. Include a collaboration statement in which you acknowledge any collaboration, help, or resource you used or consulted to complete this assignment. This section must be written even if you worked on the assignment alone.

1 Shortest Paths Algorithms (40 points)

Add the following methods to the code you developed in Homework 4.

- **(15 points)** `public boolean bellmanFord(String source)` Runs the Bellman-Ford algorithm on the current graph. The method returns `false` if a negative cycle is detected, `true` otherwise. The information necessary to extract the shortest paths gets stored in the current graph, in the same attributes that are also used by DFS and BFS.
- **(15 points)** `public boolean dijkstra(String source)` Runs Dijkstra’s algorithm on the current graph. The method returns `false` if the graph contains negative edges, `true` otherwise. The information necessary to extract the shortest paths gets stored in the current graph, in the same attributes that are also used by DFS and BFS.
- **(10 points)** In the main method of your program, write enough test cases to thoroughly test all the methods you implemented. To test Bellman-Ford and Dijkstra, you will use the `path` and `pathWeight` methods you implemented in Homework 4 (you may need to make some minor modifications to these two methods depending on how you originally implemented them).

2 Flow Networks (30 points)

- **(10 points)** Extend the Graph library that you have been working on since Homework 4 to represent a flow network. Add the necessary attributes to represent capacity and flow. Modify the `toString` methods to appropriately visualize all the information (using Graphviz).
- **(10 points)** Implement a method named `public double maxFlow()` that calculates a maximum flow with the Ford-Fulkerson algorithm. The detailed information about the found flow is stored inside the network, and should be visible using the `toString` method you modified before. The method returns the value of the maximum flow.
- **(10 points)** In the main method of your program, write enough test cases to thoroughly test all the methods you modified and/or implemented.

3 Conference Reviews (30 points)

You are the program chair of a conference where authors submit papers for review. Each paper has a specific topic, and gets reviewed by up to X reviewers. Each reviewer has a list of specialty topics, and can review up to Y papers. A paper on a certain topic can be reviewed only by a reviewer who has that topic in their list of specialties. How can we assign papers to reviewers? Write a program to model and solve this problem using a flow network.

Grading criteria

- Programs that do not compile in QTest get zero points.
- -10 points for missing collaboration statement.
- -10 points for missing comments or bad usage of comments.