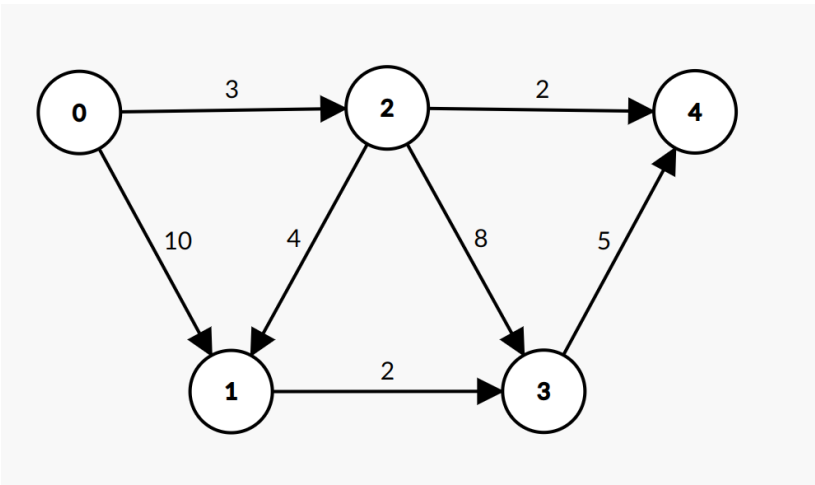
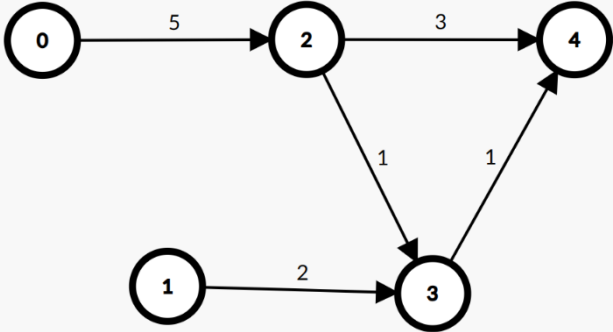


<div>CPSC 319 – Winter 2024</div> <div>Programming Assignment 4</div> <div>Dijkstra's Algorithm</div> <div>Grade: 9% (as in course outline) + 7% of bonus = 16%</div>	Released:	March 20 (Wednesday)
	Due:	Now → April 11 (Thursday) @ 11:59 PM
	# days to complete:	22 days

GOAL

In this assignment, you will write the Dijkstra's algorithm to calculate the distance and the shortest path from a source node to all the other nodes in a graph.

Example Input 1	Resulting Graph
<div>Number of nodes = 5</div> <div>Number of edges = 7</div> <div>Edge[1] = (0, 1, 10)</div> <div>Edge[2] = (0, 2, 3)</div> <div>Edge[3] = (1, 3, 2)</div> <div>Edge[4] = (2, 1, 4)</div> <div>Edge[5] = (2, 3, 8)</div> <div>Edge[6] = (2, 4, 2)</div> <div>Edge[7] = (3, 4, 5)</div> <div>Source node id = 0</div>	
Expected Output 1	
<div>The distance of the shortest path from 0 to 0 is 0, and the shortest path is 0.</div> <div>The distance of the shortest path from 0 to 1 is 7, and the shortest path is 0 -> 2 -> 1.</div> <div>The distance of the shortest path from 0 to 2 is 3, and the shortest path is 0 -> 2.</div> <div>The distance of the shortest path from 0 to 3 is 9, and the shortest path is 0 -> 2 -> 1 -> 3.</div> <div>The distance of the shortest path from 0 to 4 is 5, and the shortest path is 0 -> 2 -> 4.</div>	

Example Input 2	Resulting Graph
<p>Number of nodes = 5</p> <p>Number of edges = 5</p> <p>Edge[1] = (0, 2, 5)</p> <p>Edge[2] = (2, 3, 1)</p> <p>Edge[3] = (1, 3, 2)</p> <p>Edge[4] = (2, 4, 3)</p> <p>Edge[5] = (3, 4, 1)</p> <p>Source node id = 0</p>	 <pre> graph TD 0((0)) -- 5 --> 2((2)) 2 -- 3 --> 4((4)) 2 -- 1 --> 3((3)) 1((1)) -- 2 --> 3 3 -- 1 --> 4 </pre>
Expected Output 2	
<p>The distance of the shortest path from source to 0 is 0, and the shortest path is 0.</p> <p>There is no path from source to 1.</p> <p>The distance of the shortest path from source to 2 is 5, and the shortest path is 0 -> 2.</p> <p>The distance of the shortest path from source to 3 is 6, and the shortest path is 0 -> 2 -> 3.</p> <p>The distance of the shortest path from source to 4 is 7, and the shortest path is 0 -> 2 -> 3 -> 4.</p>	

BONUS (7%)

After implementing the main part of PA-4, build your own graph in the same way provided in PA-4 specs, according to the following scenario describing flights across Canada.

- The flight duration between Vancouver and Calgary is 1 hour, available in both directions.
- The flight duration between Vancouver and Edmonton is 2 hours, available in both directions.
- The flight duration between Vancouver and Toronto is 6 hours, available in both directions.
- The flight duration between Edmonton and Montreal is 5 hours, available in both directions.
- The flight duration between Calgary and Toronto is 4 hours, available in both directions.
- The flight duration between Toronto and Saskatoon is 3 hours, available in both directions.
- The flight duration between Toronto and Montreal is 1 hour, available in both directions.
- The flight duration between Montreal and Fredericton is 1 hour, available in both directions.

Run your code generating the results for the following questions:

A) What is the minimum duration for travel from Calgary to Fredericton? (4%)

Expected Output:

“The distance of the shortest path from Calgary to Fredericton is **<result from your code>**, and the shortest path is **<result from your code as follows:>** **<city name>** → **<city name>** (...) **<city name>**

B) Due to a snowstorm, all flights to and from Toronto are canceled. In this scenario, what is the shortest travel time from Calgary to Fredericton? (3%)

Expected Output:

“The distance of the shortest path from Calgary to Fredericton is **<result from your code>**, and the shortest path is **<result from your code as follows:>** **<city name>** → **<city name>** (...) **<city name>**

INSTRUCTIONS

Follow the instructions on the skeleton code to complete the 6 TODOs + the BONUS component.

HAND-IN

1. Cover/Grade sheet with your name and ID number only.
2. Your code.
3. Include all the above items in a zipped folder titled (PA-4-your LAST NAME-ID).zip and submit this folder electronically to D2L Dropbox with subject asgmt4-your LAST NAME-ID

LATE ASSIGNMENTS WILL NOT BE ACCEPTED

MARKING

- Source code that does not compile or produces run-time errors will receive a grade of 0%.

COLLABORATION

- The assignment must be done **individually** so you must write up the solutions *on your own* in *your own words*.
- Everything that you hand in must be your original work, except for the code copied from the textbook, lecture material (i.e., slides, notes), web, or that supplied by your TA. When someone else's code is used like this, you **must** acknowledge the source explicitly, citing the sources in a scientific way (i.e., including author(s), title, page numbers, URLs, etc.)
- Copying another student's work constitutes academic misconduct, a very serious offense that will be dealt with rigorously in all cases. Please read the sections of the University Calendar under the heading "Student Misconduct". If you are in doubt whether a certain form of aid is allowed, ask your instructor!
- Contact your TA if you have problems getting your code to work.
- Note that your code may be checked thoroughly for plagiarism by computer.

END OF THE ASSIGNMENT