Network Software Modelling Assignment 1

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This is an individual assignment worth 15% of the module. It is due 23:59 Sun 12 March (end of Week 7). Your submission must consist of 1 pdf of up to 2 pages (minimum 11 point type) plus one Python file.

The topic of this assignment is the bidirectional Dijkstra algorithm, which we have not covered in class.

You are free to discuss this assignment with other students, but you may not show your work to another student or look at another student's work. You are free to use external resources if you cite them correctly. However, the large majority of your work must be written by you, in your own words, as a direct answer to the questions of the assignment, rather than quoted or paraphrased (even with citation) from external resources.

Tasks:

1. Briefly describe Dijkstra's algorithm for solving the shortest path problem (which we have covered in class), including a statement of its time complexity.
2. Describe the *bidirectional* Dijkstra algorithm – a variant which is more efficient in practice. In order to understand it, you can research it in textbooks, MOOCs, blogs, or other external resources. State any assumptions needed for the algorithm to work.
3. With the aid of a diagram, explain how it differs from Dijkstra's original algorithm.
4. State its time complexity and explain why it is more efficient.
5. Implement both Dijkstra's algorithm and the bidirectional variant, using appropriate data structures for efficiency.
6. Test the run-time behaviour of both algorithms on randomly generated graphs of varying sizes in order to demonstrate their scaling behaviour. Include a table of data showing run-times.
7. Briefly state your conclusion concerning run-time behaviour.

Marks will be awarded for carrying out each of the above tasks succinctly and accurately; understandable results and conclusions; good-quality, wel-commented, efficient code; a well-written document with good diagrams, figures, tables as appropriate.