FIT2004: Lab questions for week 9

Objectives: This prac provides a platform for you to practise the formal concepts introduced during the lecture 8, especially shortest-path algorithms on graphs.

1. Write a program implementing the Breadth-First Search (BFS) to find the single-source shortest paths in an **unweighted and undirected** graph. Your program should accept $|V|$ (the number of vertices) as a command line argument. Constrain this value to the range $1000 \leq |V| \leq 5000$. Generate a random (unweighted and undirected) graph with $|V|$ vertices – think carefully about how such a random graph must be generated. Assume the first vertex in this random graph is the source vertex. Run the BFS algorithm on this random graph instance and print out to a file (1) the path lengths to other vertices from the source, and (2) their corresponding paths.

2. Write a program implementing Dijkstra's single-source shortest path algorithm in a weighted undirected graph. Your program should accept $|V|$ (the number of vertices) as a command line argument. Constrain this value to the range $1000 \leq |V| \leq 5000$. As before, generate a random undirected graph with $|V|$ vertices, where the first vertex in this random graph is the source vertex. For each edge in your random graph, assign a random **positive** weight between 1 and 10. Run the Dijkstra's algorithm on this random graph instance and print out to a file (1) the weighted path length (distance) of each vertex in the graph from the source, and (2) their corresponding paths.

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