Task 6. Algorithms on graphs. Path search algorithms on weighted graphs

Goal

The use of path search algorithms on weighted graphs (Dijkstra's, A* and Bellman-Ford algorithms)

Problems and methods

I. Generate a random adjacency matrix for a simple undirected weighted graph of 100 vertices and 500 edges with assigned random positive integer weights (note that the matrix should be symmetric and contain only 0s and weights as elements). Use Dijkstra's and Bellman-Ford algorithms to find shortest paths between a random starting vertex and other vertices. Measure the time required to find the paths for each algorithm. Repeat the experiment 10 times for the same starting vertex and calculate the average time required for the paths search of each algorithm. Analyse the results obtained.

II. Generate a 10x20 cell grid with 40 obstacle cells. Choose two random non-obstacle cells and find a shortest path between them using A* algorithm. Repeat the experiment 5 times with different random pair of cells. Analyse the results obtained.

III. Describe the data structures and design techniques used within the algorithms.