THE DEFERRED SOLUTIONS METHOD FOR HC FINDING

Prokopenkov V.P., Kozhyn Y.N.
National Technical University «Kharkiv Polytechnic Institute», Kharkiv

The main problem of finding the optimal Hamiltonian cycle (HC) is the inability to formulate conditions for finding the optimal solution. Therefore, a iterating over solutions scheme is the main way to solve it. For a graph of n vertices, the size of the search space is (n-1)! , and for large n, the time costs are unacceptably large. Therefore, it is necessary to speed up the process of forming and processing acceptable solutions, and when discarding solutions, do not lose the optimal solution.

The developed method of deferred solutions is designed to solve these problems, which provides:

- the rejection of the complete construction of all solutions;
- the use of a "parallel" scheme for forming solutions instead of a sequential one;
- the discarding of unpromising solutions;
- the possibility of returning to deferred solutions if necessary;
- the exclusion of the loss of the optimal solution when discarding solutions.

In the process of formation, until the solution has become a HC, it is a partial solution (PS). The search starts with the PS, which includes the starting vertex.

Each PS is built step by step. At each step, the current PS is completed by adding a vertex to it, to which you can go from its last vertex. The "parallelism" of the PS formation scheme means the simultaneous construction of a set of PS's – as many new PS's are built from the current PS as there are transition options from its last vertex to other vertices in the graph. All PS's are stored in memory if they can be completed to a complete solution. The processed PS is deleted from memory. Discarding an unpromising PS is understood as deferring of solution a possible return to it again – as a refusal at the current step to continue building the PS to a complete solution. To be able to realize the choice of a promising PS that will become the current one, each PS is characterized by its own estimate, which is related to the length of the path already built in the PS. To perform the next step, the PS that has the highest score is selected.

The execution of the scheme stops after the construction of the HC or in the absence of PS that can be completed. The disadvantage of the method is the significant memory costs for storing the PS's, but these costs are justified by reducing the search time.

Testing has shown the effectiveness of the developed method. For a non-complete graph of 20 vertices, the optimal solution was found in 0.005 minutes. On a complete graph of 20 vertices, the search time was commensurate with the search of all possible solutions.

The initial testing showed that additional analysis and refinement of the method are required, and the successful application of the method for any graph of large dimension depends on the choice of the best estimate of the PS.