

A large set of non-Hamiltonian graphs

Abstract

Katona Gyula Y.

Dept. of CIS, Ibaraki University, Hitachi, JAPAN

and

Technical University of Budapest, HUNGARY

The generation of instances to evaluate the performance of algorithms experimentally has been studied intensively from both theoretical and practical viewpoints. Among others it seems to be important to have a random generator which can generate many different kinds of non-Hamiltonian graphs. It looks impossible to have a generator which generates the complete set of the non-Hamiltonian graphs, therefore we only hope to generate a “very large” subset of it as an approximation.

An obvious approximation is the set of non-1-tough ($N1T$) graphs. Bauer et al. [1] proved that $N1T$ is NP-complete, which shows that it is “large” and complicated set. Iwama and Miyano [2] proved that the set of non-sub-2-factor graphs $NS2F$ is a much better approximation. They proved not only that $NS2F$ is NP-complete, but also that the set $NS2F - N1T$ is D^P -complete, which shows that the set $NS2F$ is “significantly” larger than $N1T$.

We prove that the set of non-1-edge-tough graphs ($N1ET$) is an even better approximation than the set $NS2F$, since $N1ET$ is NP-complete and $N1ET - NS2F$ is D^P -complete. Our proofs use similar methods to those of [2].

Open problems:

How to generate $N1ET$ graphs with fixed other properties (the number of vertices, edges, maximum degree, etc. is given)?

Find a significantly larger set of non-Hamiltonian graphs!

References

- [1] D. Bauer, S. L. Hakimi, E. Schmeichel, Recognizing tough graphs is NP-hard, *Discrete Applied Math.*, **28** (1990) 191-195.
- [2] K. Iwama, E. Miyano, Better approximations of non-Hamiltonian graphs, *Discrete Applied Math.* **81** (1998) 239-261.