A large set of non–Hamiltonian graphs
Abstract

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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.