On Reconfiguration Graph of Independent Sets under Token Sliding

David Avis **Duc A. Hoang**

Graduate School of Informatics, Kyoto University
arXiv:2203.16861

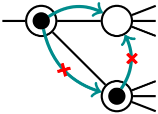
AFSA 2022 First General Meeting

May 28, 2022

TS-Reconfiguration Graph of Independent Sets

Given $G = (V, E)$ and a positive integer k.

- Each vertex of G contains at most *one unlabeled* token.
- *Token Sliding* (TS) involves moving a token from one vertex to one of its *unoccupied adjacent* vertices.



We consider $\mathsf{TS}_k(G)$ and $\mathsf{TS}(G)$.

- **Nodes:**
  - $\mathsf{TS}_k(G)$: independent sets of G of *size* k.
  - $\mathsf{TS}(G)$: independent sets of G of *arbitrary size*.
- **Edges:** defined under *Token Sliding*.

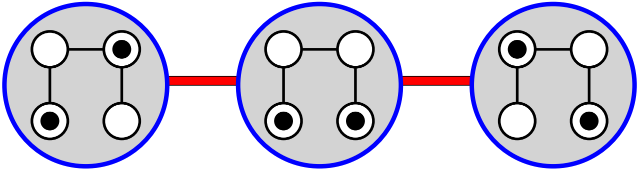


Figure: $\mathsf{TS}_2(P_4)$

$\mathsf{TS}_k(G)$ From Algorithmic Viewpoint **Very Well-Studied**

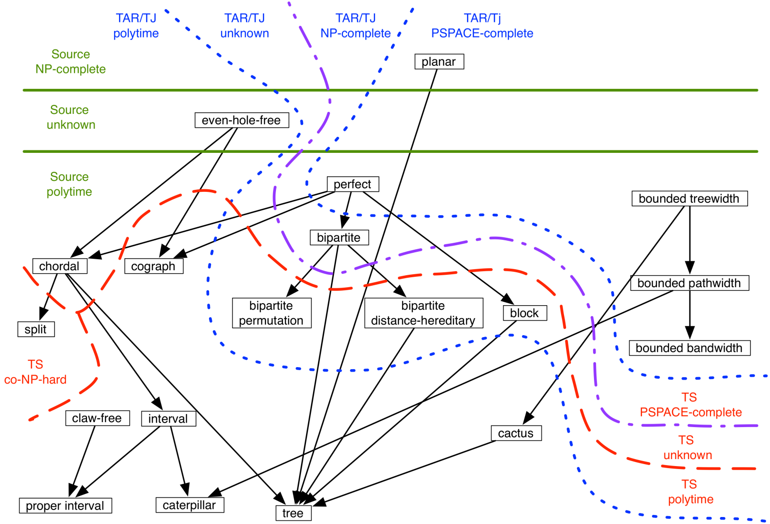


Figure: Computational complexity of ***Reachability*** *between two given nodes* in $\mathsf{TS}_k(G)$ and other related reconfiguration graphs *for different input graphs G* © Nishimura [Nishimura 2018]

$\mathsf{TS}_k(G)$ From Graph-Theoretic Viewpoint This Poster

We consider *two main questions*

(Q1) *Is G a TS_k-reconfiguration graph ($k \geq 2$)*, i.e., does there exist a graph H such that $G \simeq \mathsf{TS}_k(H)$?

(Q2) *If G satisfies some property $\mathcal{P}$, does $\mathsf{TS}(G)/\mathsf{TS}_k(G)$ also satisfy $\mathcal{P}$, and vice versa?*

Our Results [Avis and Hoang 2022]

- *We answered (Q1) for different graphs G*, including complete graphs, paths, cycles, complete bipartite graphs, and connected split graphs.
- *We answered (Q2) for different properties $\mathcal{P}$*, including s-partite, planar, (non-)acyclic, Eulerian, and the clique's size.

References

Avis, D. and D. A. Hoang (2022). "On Reconfiguration Graph of Independent Sets under Token Sliding". In: *arXiv preprint*. arXiv: 2203.16861.

Nishimura, N. (2018). "Introduction to Reconfiguration". In: *Algorithms* 11.4, p. 52. DOI: 10.3390/a11040052.