

Path-liftable digraph homomorphisms and non-liftable indices

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Let ϕ be a digraph homomorphism from a digraph G to a digraph H . A walk a_1, \dots, a_k in G is called a lifting along ϕ of a walk e_1, \dots, e_k in H if $e_i = \phi(a_i)$ for all $i \in [1, k]$. We call ϕ a path-liftable homomorphism if every walk in H has a lifting in G . If ϕ is not path-liftable, the length of a shortest walk in H without any lifting, denoted by $\delta(\phi)$, is called the non-liftable index of ϕ . Let $\delta(n)$ be the largest non-liftable index among all non-path-liftable homomorphisms from an n -vertex digraph. We prove that $\delta(n) = 2^n - 1$. We show that it is NP-complete to decide whether or not ϕ is path-liftable and, on the additional condition that G and H are strongly connected and have the same spectral radius, there is an algorithm to determine whether or not ϕ is path-liftable in $O(|V_G|^3)$ time.

This is a joint work with Yaokun Wu.
