Patterned self-Assembly Tile set Synthesis

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1 Definitions

Abstract Tile Assembly Model (aTAM). Let Σ be the set of *states*, also referred to as a *tile set*. A *tile* $t = (\sigma, p)$ is a unit square where $\sigma \in \Sigma$ and p is its position and $p \in \mathbb{Z}^2$. An *assembly* A is a set of tiles where for every pair of tiles $t_1 = (\sigma_1, p)$ and $t_2 = (\sigma_2, p')$, $p \neq p'$. A *glue strength function* s is defined as $s : \Sigma \times \Sigma \to \mathbb{N}$. A *tile assembly system* is a 4-tuple $\mathcal{T} = (\Sigma, S, s, \tau)$ where Σ is the tile set, S is the seed assembly, s is the glue strength function and τ is the temperature.

K-Colored Pattern. Given the fixed dimensions m and n, a mapping from $[m] \times [n] \subseteq \mathbb{Z}^2$ onto $[k]$ defines a *k-colored pattern*. The k-colored pattern will be extended by adding tiles to the south and west borders to create an L shape seed assembly for our tile assembly system.

Patterned self-assembly tile set synthesis (PATS). Given a k-colored pattern $c : [m] \times [n] \to [k]$, find a tile assembly system $\mathcal{T} = (\Sigma, S, s, \tau = 2)$ where all tiles in Σ have glue strength 1 and there exists a tile coloring $tc : \Sigma \to [k]$ such that each terminal assembly A satisfies $tc(A(x, y)) = c(x, y)$ for all $(x, y) \in [m] \times [n]$.