Local Search Methods for Set T-Colouring

Marco Chiarandini
Department of Mathematics and Computer Science,
University of Southern Denmark,
Odense Campusvej 55, DK-5230 Odense M, Denmark
marco@imada.sdu.dk

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Given a graph $G(V, E)$, a set of non-negative integers $R = \{r(v) : \forall v \in V\}$, and a collection of sets of non-negative integers $\mathcal{T} = \{T_v, T_{uv} : v \in V \text{and } uv \in E\}$, a *set T-colouring* assigns a set of integers $C(v)$ to each vertex v of G so that (i) at any vertex v the size of $C(v)$ is equal to $r(v)$, (ii) the distance between any two elements of $C(v)$ is never in the set T_v, and (iii) for any two neighbouring vertices u and v the distance between an element of $C(u)$ and an element of $C(v)$ is never in the set T_{uv}.

Called Γ the set of integers $\bigcup_{v \in V} C(v)$, the set T-colouring problem consists in determining the *T-order* (or T-chromatic number), that is, the minimal number of integers in Γ, and/or the *T-span*, that is, the minimal difference between the largest and the smallest integers in Γ, such that a set T-colouring exists. Very few theoretical results are known on these two graph characteristics.

This generalisation of the vertex colouring problem is used to model the assignment of frequencies to radio transmitters in the design of mobile phone networks. In the practical contexts exact solution methods are inefficient because of the large size of the involved data and hence heuristic methods are preferred. Among them the best performance reported in the literature are achieved by Local Search (LS) methods. Their configuration is however not trivial and necessitate of empirical analyses.

However understanding which is their best configuration is deemed a difficult task because these methods generates algorithms that are stochastic in nature and necessitate of correct

In the talk we will present the results of a large experimental study conducted with proper statistical methods. Focusing on determining the T-span we will describe different solution approaches and the configurations of LS algorithms that have been tested. Some of these configurations were known, others are new. The results concern two classes of random graphs, uniform and geometric, and constraints uniformly assigned. Besides determining the best algorithms, we will also report on the observed differences in performance due to graphs features, and the observed relation between T-span and T-order.